DRAFT CLEANUP ACTION PLAN

Boeing Renton Facility
Renton, Washington

Submitted to:
The Boeing Company, Seattle, WA

Submitted by:
AMEC Environment & Infrastructure, Inc., Seattle, WA

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Project 8888

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ACRONYMS & ABBREVIATIONS

Agreed Order	Agreed Order No. DE 97HZ-N233
AMEC	AMEC Environment & Infrastructure, Inc. (formerly AMEC Geomatrix, Inc./Geomatrix Consultants, Inc.)
AOC	Area of Concern
ARAR	Applicable or relevant and appropriate requirements
bgs	below ground surface
Boeing	Boeing Company
BTEX	benzene, toluene, ethylbenzene, and xylene
cfm	cubic feet per minute
CFR	Code of Federal Regulations
City	City of Renton
COC	constituent of concern
CPOC	conditional point of compliance
CS_2	carbon disulfide
CSU	container storage unit
CULs	cleanup levels
1,1-DCE	1,1-dichloroethene
cis-1,2-DCE	*cis*-1,2-dichloroethene
DCAP	Draft Cleanup Action Plan
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
Facility	Boeing Renton Facility
FS	feasibility study
FSWP	FS Work Plan
GAC	granular-activated carbon
Geomatrix	Geomatrix Consultants, Inc. (presently known as AMEC Geomatrix, Inc.)
HAZWOPER	Hazardous Waste Operations and Emergency Response
HI	hazard index
HQ	hazard quotient
I-405	Interstate 405
µg/kg	microgram per kilogram
µg/L	microgram per liter
MA	monitored attenuation
MEK	methyl ethyl ketone
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	monitored natural attenuation
MTCA	Model Toxics Control Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NGVD 29	National Geodetic Vertical Datum of 1929
NPV	net present value
ORC	oxygen-releasing compound
OSHA	Occupational Safety and Health Administration
PCE	tetrachloroethene
PCL	preliminary cleanup level

ACRONYMS & ABBREVIATIONS
(Continued)

PDB	polyethylene diffusion bag
PEL	Permissible Exposure Limit
POC	point of compliance
PQL	practical quantitation limit
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RI	remedial investigation
scfm	standard cubic feet per minute
SIM	selected ion monitoring
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TCE	trichloroethene
TEA	terminal electron acceptor
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TPH-D	TPH-diesel
TPH-G	TPH-gasoline
TPH-Jet	TPH-Jet Fuel A
TPH-MO	TPH-motor oil
U.S.C.	United States Code
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons
WAC	Washington Administrative Code
Weston	Roy F. Weston, Inc.
WISHA	Washington Industrial Safety and Health Act

DRAFT CLEANUP ACTION PLAN
Boeing Renton Facility
Renton, Washington

EXECUTIVE SUMMARY

The Boeing Company (Boeing) Renton Facility (Facility) is located in the City of Renton, Washington. The facility consists of about 180 acres of land owned by Boeing and an additional 18 acres leased by Boeing from the City of Renton (the City). Airplane manufacturing and operations have occurred at the property and the neighboring Renton Municipal Airport off and on since 1941. Boeing purchased the property from the Air Force in 1962, and has been manufacturing aircraft at the facility since 1955. Boeing has been working with the Washington State Department of Ecology (Ecology) to address historic releases of hazardous substances at the Facility under Agreed Order No. DE 97HZ-N233 (Agreed Order).

This Cleanup Action Plan (DCAP) has been prepared in accordance with Washington Administrative Code (WAC) 173-340-380 to present the proposed final cleanup actions, the cleanup standards that are expected to be achieved, and the approach and schedule for implementing these actions at 12 separate solid waste management units (SWMUs) and areas of concern (AOCs) at the Facility. Upon approval of the FS and the Final Draft Cleanup Action Plan (DCAP) (AMEC, 2010) a detailed remediation design for each AOC/SWMU and a comprehensive compliance monitoring program for the entire Facility will be developed as a part of an Engineering Design Report (EDR). The cleanup actions for each AOC or SWMU will be implemented after the EDR is approved.

Table ES-1 identifies the constituents of concern (COCs) and proposed cleanup approach for each of the SWMUs and AOCs discussed below.

SWMU-168

SWMU-168 consists of the area around a former underground storage tank (UST) on property leased from the City at the Renton Municipal Airport. COCs consist of methylene chloride in soil and vinyl chloride (VC) in groundwater. Three remedial alternatives were evaluated in the Draft Final Feasibility Study (FS) for SWMU-168: (1) monitored natural attenuation (MNA); (2) soil vapor extraction (SVE) and monitored attenuation (MA); and (3) enhanced bioremediation and MA. Soil and groundwater samples collected at SWMU-168 in May 2008 did not contain detectable levels of COCs, and therefore further active measures to reduce COC concentrations may not be necessary. Therefore, Alternative 1, MNA with institutional controls, is the proposed cleanup action for SWMU-168.

SWMU-172/174

SWMU-172/174 are the locations of former wastewater USTs on property leased from the City on the eastern side of the Renton Municipal Airport. COCs consist of chlorinated solvents, solvent degradation products, benzene, and metals in soil, and chlorinated solvents, solvent degradation products, benzene, one semivolatile organic compound (SVOC), and metals in groundwater. Three cleanup alternatives were evaluated in the FS for SWMU-172/174: (1) source area excavation, enhanced bioremediation, and MA; (2) SVE, enhanced bioremediation, and MA; and (3) MNA. The proposed cleanup action for SWMU-172/174 consists of SVE, enhanced bioremediation, MA, and institutional controls. The cost for this alternative, while higher than other alternatives, provides greater benefits commensurate with the greater cost.

Building 4-78/79 SWMU/AOC Group

The Building 4-78/79 SWMU/AOC Group is located adjacent to the Cedar River Trail Park on the east side of the Cedar River Waterway, in the west-central portion of the Facility. COCs consist of trichloroethene (TCE), TCE degradation products, carbon disulfide (CS_2), tetrachloroethene (PCE), and fuel constituents in soil, and TCE, TCE degradation products, and fuel constituents in groundwater. Three cleanup alternatives were evaluated in the FS: (1) source area excavation, enhanced bioremediation, MA, and MNA; (2) SVE, enhanced bioremediation, MA, and MNA; and (3) source area excavation and MNA. The proposed cleanup action for the Building 4-78/79 SWMU/AOC Group consists of SVE, enhanced bioremediation, MA, MNA, and institutional controls. This alternative would provide a more extensive and rapid remediation than the other alternatives considered, and the costs for this alternative are not considered disproportionate.

Former Fuel Farm AOC Group

The Former Fuel Farm consisted of three USTs near the south end of Renton Municipal Airport that were used to store Jet A Fuel. COCs for this AOC group are fuel, fuel constituents, and benzene in soil, and fuel and fuel constituents in groundwater. Three cleanup alternatives were evaluated during the FS: (1) existing biosparging/bioventing and MA; (2) upgraded biosparging/bioventing and MA; and (3) MNA. Alternative 3, MNA, is the proposed cleanup action for the Former Fuel Farm since it would provide the greatest benefit at the lowest cost.

AOC-001 and AOC-002

AOC-001 and AOC-002 were originally associated with former USTs located approximately 350 feet southeast of Lake Washington in the northern portion of the Facility. COCs for AOC-001 and AOC-002 consist of TCE, degradation products of TCE, and gasoline in soil,

and benzene, chlorinated solvents, solvent degradation products, and naphthalene in groundwater. Two cleanup alternatives were evaluated in the FS: (1) enhanced bioremediation and MA; and (2) MNA. The proposed cleanup action for AOC-001/002 is enhanced bioremediation and MA. The remediation costs for this alternative are not considered disproportionate, and this alternative would provide a more rapid restoration time frame than the other alternative considered.

AOC-003

AOC-003 represents a former UST used to store methyl ethyl ketone (MEK) and toluene at the north side of the Facility between Buildings 4-20 and 4-81. COCs include TCE in soil and tetrachloroethene (PCE), TCE, and TCE degradation compounds in groundwater. Two cleanup alternatives were evaluated during the FS for AOC-003: (1) MNA, and (2) enhanced bioremediation and MA. The proposed cleanup action for AOC-003 includes enhanced bioremediation and MA. Remediation costs for this alternative are not considered disproportionate, and this alternative would provide more rapid remediation than the other alternative considered.

AOC-004

AOC-004 was a former 250-gallon steel UST used to store gasoline and likely contained leaded gasoline prior to the mid-1970s. COCs are fuel, fuel constituents, and acetone in soil, and gasoline, benzene, and lead in groundwater. Two cleanup alternatives were addressed in the FS for AOC-004: (1) MNA, and (2) enhanced bioremediation and MA. Enhanced bioremediation and MA is the proposed cleanup action for AOC-004. Limited quantities of affected soil would also be removed. The remediation costs for this alternative are not considered disproportionate, and this alternative would provide more rapid remediation than the other alternative considered.

AOC-034/035

AOC-034/035 is the location of former USTs located next to the south side of Building 4-41. COCs for this area are TCE degradation products in both soil and groundwater. Two cleanup alternatives were evaluated in the FS for AOC-034/035: (1) MNA and (2) enhanced bioremediation and MA. MNA is the proposed cleanup action for AOC-034/035. Enhanced bioremediation would not offer significant added benefit commensurate with the increased cost.

AOC-060

AOC-060 consists of a former vapor degreaser secondary containment sump located inside Building 4-42. COCs are TCE and TCE degradation products in groundwater. Three cleanup alternatives were evaluated in the FS: (1) MNA; (2) enhanced bioremediation and MA; and (3) air sparging, SVE, and MA. MNA was selected as the preferred alternative for AOC-060 because it would provide the greatest benefit at the lowest cost. The City of Renton has approved an off-site CPOC for this AOC located in the Cedar River Trail Park.

AOC-090

AOC-090 is located near the southwest corner of former Building 4-64. Elevated concentrations of selected volatile organic compounds (VOCs) were encountered at AOC-090 during excavation for underground utilities in July 1999. COCs for AOC-090 are several VOCs, several metals, several SVOCs, and fuel constituents in soil, and VOCs, including chlorinated solvents and benzene, and fuel constituents in groundwater. Three cleanup alternatives were evaluated in the FS: (1) MA; (2) enhanced bioremediation and MA; and (3) SVE and MA. Enhanced bioremediation and MA would provide the greatest benefit at the lowest cost for AOC-090 and is the proposed cleanup action. Separate off-site CPOCs have been proposed for the shallow and intermediate groundwater zones due to different flow paths in the two zones. The City of Renton has agreed to allow the off-site CPOCs for this AOC along a public road and in the Cedar River Trail Park.

AOC-092

AOC-092 is located along the east side of Building 4-20. Soil impacted with petroleum hydrocarbons was discovered at this location during trenching activities for a new fire protection water line. COCs are gasoline and benzene in soil and groundwater. Two cleanup alternatives were evaluated for AOC-092 in the FS: (1) MNA; and (2) source area excavation, enhanced bioremediation, and MA. Source area excavation, enhanced bioremediation, and MA is the proposed cleanup action for AOC-092. The remediation costs for this alternative are not considered disproportionate, and this alternative would provide more rapid remediation than the other alternatives considered.

AOC-093

AOC-093 is an area of soil located north of Building 4-20, near the shore of Lake Washington, containing fuel products. AOC-093 was identified from a single push probe in January 2003 while delineating affected groundwater for AOC-001/002. COCs consist of gasoline in both soil and groundwater. Two cleanup alternatives were evaluated in the FS: (1) source area excavation and MNA; and (2) source area excavation, enhanced bioremediation, and MNA. Analytical results from the most recent soil sampling show that the concentration of soil COCs

at AOC-093 is below the cleanup levels presented in this CAP. Boeing proposes addressing any residual groundwater issues at this AOC through MNA.

TABLE ES-1

SUMMARY OF PROPOSED CLEANUP ACTIONS
Boeing Renton Facility
Renton, Washington

SWMU/ AOC	Constituents of Concern		Proposed cleanup action
	Soil	Groundwater	
SWMU-168	Methylene chloride	Vinyl chloride	MNA and institutional controls
SWMU-172/174	Chlorinated solvents, solvent degradation products, benzene, and metals	Chlorinated solvents, solvent degradation products, one SVOC, and metals	SVE, enhanced bioremediation, MA, and institutional controls
Building 4-79/79 SWMU/AOC Group	TCE, TCE degradation products, and fuel constituents	TCE, TCE degradation products, and fuel constituents	SVE, enhanced bioremediation, MA, MNA, and institutional controls
Former Fuel Farm	Fuel and fuel constituents	Fuel and fuel constituents	MNA and institutional controls
AOC-001 and AOC-002	TCE, TCE degradation products, and gasoline	benzene, chlorinated solvents, solvent degradation products, and naphthalene	Enhanced bioremediation, MA, and institutional controls
AOC-003	TCE	PCE, TCE, and TCE degradation compounds	Enhanced bioremediation, MA, and institutional controls
AOC-004	Fuel, fuel constituents, and acetone	Gasoline, benzene, 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 and TCE degradation products	MNA and institutional controls
AOC-090	VOCs, metals, SVOCs, and fuel constituents	VOCs, fuel, and fuel constituents	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

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Boeing Renton Facility
Renton, Washington

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. Boeing has entered into Agreed Order No. DE 97HZ-N233 (Agreed Order) with Ecology to address former releases at the Facility. The Agreed Order was issued under the Revised Code of Washington (RCW) 70.105D.050(1) and Washington Administrative Code (WAC) 173 303-646(3)(a), and became effective on October 10, 1997.

Work that has been completed at this 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 Draft Final Feasibility Study Report (FS Report) (Geomatrix, 2008) was conditionally approved by Ecology in a letter to Boeing dated June 30, 2008 (Ecology, 2008). Ecology requested that Boeing prepare a Draft Cleanup Action Plan (DCAP) meeting the requirements of WAC 173-340-360, WAC 173-340-400 (1) through (7), WAC 173-340-410, WAC 173-303-646, and WAC 173-340-380.

The DCAP is being submitted to Ecology in accordance with the Agreed Order, the requirements of the Model Toxics Control Act (MTCA), and the requirements cited by Ecology in the letter approving the FS Report.

1.1. PURPOSE

The purpose of the DCAP in the MTCA process is to present the results of the RI/FS work, including a summary and rationale for selection of the final proposed cleanup actions. This document is meant to present to the public the proposed final cleanup actions, the cleanup standards that are expected to be achieved, and the approach and schedule for implementing these actions at 12 separate solid waste management units (SWMUs) and areas of concern (AOCs) at the Facility. This DCAP has been prepared in accordance with WAC 173-340-380 to identify the proposed cleanup action and to specify cleanup standards and other requirements for the cleanup action. As proposed, the cleanup action will meet the threshold requirements of WAC 173-340-360 to protect human health and the environment, comply with

cleanup standards, comply with applicable state and federal laws, and provide for compliance monitoring.

1.2. REPORT ORGANIZATION

This DCAP is organized into introductory sections (Sections 1 through 3) that present an overview of the entire Facility and the applicable cleanup standards and primary sections (Sections 4 through 15) that present the proposed cleanup action plan for each of the 12 separate SWMUs or AOCs. Each of the primary sections discusses the remedial alternatives considered for that SWMU or AOC, presents the rationale for selecting the proposed remedial action, and discusses how the proposed action achieves the MTCA selection criteria. The soil and groundwater monitoring activities conducted for each SWMU or AOC will be performed in accordance with the Quality Assurance Project Plan included as Appendix E. SWMU-179 and AOC-094 are not discussed in this document because it was demonstrated in the FS Report that no further action is required for either of these two units (Geomatrix, 2008).

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, including 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 and leases the remaining 18 acres 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 from the 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 (NGVD 1929).

2.2. LAND USE

The Facility layout and the location of each of the individual SWMUs and AOCs addressed in this DCAP are shown on Figure 2. Boeing is currently consolidating its commercial airplane operations at the Renton Facility. Consolidation of operations has created opportunities for Boeing to reoccupy or surplus its nonessential properties and buildings, while allowing it to continue to manufacture airplanes at the Facility. 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. Although this designation allows changes in the use of the Facility property, it 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 asphalt- or concrete-paved surfacing, and it 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 uses, 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. Figure 3 shows the City of Renton zoning designations for the Boeing Renton facility and the surrounding areas. These zoning designations are established under the City of Renton Comprehensive Plan (as amended on December 8, 2008).

The Facility and the areas adjacent to each of the SWMUs and AOCs addressed in this DCAP are currently used only for industrial purposes related to airplane manufacturing, and are expected to remain in industrial use for the foreseeable future. Based on a review of the current land use and use characteristics on and adjacent to the Facility, it is Boeing's understanding that the changed Urban Center-North land use designation meets Ecology's criteria for being "zoned for industrial use."

Small areas west and south of Renton Municipal Airport are zoned for mixed use commercial and commercial/residential. These parcels are within 0.25 mile of the properties leased by Boeing. Additional small parcels are located within 0.25 mile of the Facility along Park Avenue North. These commercial properties are located near Boeing's office buildings. Additional small parcels are also located within 1 mile of the Facility boundary to the south and east.

The closest residential-zoned properties are located southeast of the Facility, south of North 6th Street and east of the Facility, east of Logan Avenue North. Residential properties are also located within 0.25 mile west and south of the Renton Municipal Airport. Property located east of Interstate 405 (I-405) (within 0.5 mile of the Facility boundary) is also primarily zoned residential.

Public use areas near the Facility include land reserved for municipal and/or recreational purposes. The largest public use area near the Facility is the Renton Municipal Airport. In addition, Cedar River Trail Park is adjacent to the Facility along the east side of the Cedar River Waterway, and extends north to Lake Washington. Cedar River Park and Liberty Park are at the intersection of I-405 and the Maple Valley Highway, approximately 0.7 mile south-southeast of the Facility boundary. Coulon 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.

3.0 CLEANUP ACTION OBJECTIVES AND CLEANUP STANDARDS

This section outlines cleanup level objectives, presents the cleanup standards for soil and groundwater, and presents evaluation criteria for cleanup alternatives.

3.1 CLEANUP ACTION OBJECTIVES

The overall objective for Facility cleanup is to protect human health and the environment from potential impacts related to constituents of concern (COCs) present at the Facility. This must be accomplished by addressing the COCs specific to each SWMU and AOC, addressing the relevant migration pathways, and addressing the potential exposure pathways. The relevant migration and exposure pathways are described below, along with the overall cleanup action objectives for the Facility. Additional cleanup objectives will be presented as appropriate in the sections describing the planned cleanup action for each SWMU and AOC.

3.1.1 Facility Migration and Exposure Pathways of Concern

Migration pathways that may result in exposure of human or ecological receptors to site COCs must be addressed by the cleanup action. Based on the conceptual site model described in the Feasibility Study Work Plan (FSWP) (Geomatrix, 2004b), the following migration pathways are of concern for AOCs and SWMUs at the Facility:

- Leaching of contaminants from affected on-site soil to on-site groundwater; and
- Migration of contaminant-affected groundwater from the site to either Lake Washington or the Cedar River Waterway.

The following exposure pathways are of concern for AOCs and SWMUs at the Facility:

- Exposure of temporary construction workers to contaminant-affected soil from direct ingestion, dermal contact, particulate inhalation, or inhalation of volatiles released from affected soil;
- Exposure of temporary construction workers to contaminant-affected groundwater from dermal contact or inhalation of volatile compounds released from affected groundwater;
- Exposure of potential residential users of publicly supplied potable water drawn from the Cedar River Waterway or Lake Washington due to ingestion, dermal contact, or inhalation of contaminants present in groundwater entering either Lake Washington or the Cedar River Waterway from the Facility;
- Exposure of people harvesting fish from portions of the Cedar River Waterway or Lake Washington that are affected by groundwater entering the waterway or the lake from the Facility;

- Exposure of recreational users of the Cedar River Trail Park, Cedar River Waterway, and Lake Washington due to direct dermal contact or ingestion of contaminants present in surface water; and

- Exposure of small aquatic mammals, benthos, fish, piscivorous birds, and/or raptors through ingestion of affected surface water, dermal contact with affected surface water, or ingestion of affected fish or affected aquatic biota.

The above migration and exposure pathways apply to each of the SWMUs and AOCs included in this DCAP, as appropriate.

3.1.2 Facility Cleanup Objectives

Cleanup objectives have been established that are applicable to all AOCs and SWMUs at the Facility. The cleanup action selected 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 soil and groundwater constituents 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'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, ongoing environmental monitoring programs will be reevaluated by Boeing to account for the planned change in use. Ecology approval is needed for reevaluation 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; and

- 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 included in this DCAP. Additional objectives specific to each SWMU or AOC may be established as appropriate in the sections of this DCAP that address the individual SWMUs and AOCs.

If there is a change of land use at some point in the future, site conditions will be reevaluated, including review of cleanup standards appropriate for future land uses, and additional cleanup actions will be implemented and/or appropriate enforceable protective covenants will be placed as necessary to ensure protection of human health and the environment. Additional cleanup actions and covenants will depend on the land use and potential exposure pathways that could reasonably be expected to occur.

3.2 CLEANUP STANDARDS

Preliminary cleanup standards were developed in the FS for each of the 12 SWMUs and AOCs (sites) addressed in this DCAP. 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 DCAP. The cleanup levels for each site are presented in this section. The other elements of the cleanup standard for each of the 12 sites, namely the POC and applicable regulatory requirements, are discussed in the individual sections of this DCAP addressing each of the 12 sites. As noted in Section 6 of the approved FSWP, it is expected that conditional POCs (CPOCs) will be established for remedial alternatives and that some alternatives may include off-site CPOCs.

Cleanup levels for individual hazardous substances must be established in accordance with MTCA regulations. Groundwater cleanup levels for the Facility must be protective of surface waters that are potential potable water sources and that support aquatic life. For those sites at which multiple COCs are present, the groundwater cleanup levels at the POC must be adjusted downward as appropriate to ensure that the total combined excess cancer risk potential (calculated in accordance with MTCA methods) for carcinogenic substances would not exceed one in one hundred thousand (1×10^{-5}) and that the hazard index (HI) calculated in accordance with MTCA methods would not exceed 1. In accordance with the MTCA rules, the HI is conservatively calculated by summing hazard quotients (HQs) for individual COCs. The

groundwater cleanup levels applicable at the POCs established in this DCAP are less than state and federal maximum contaminant levels defined in the drinking water regulations. The MTCA Method C soil cleanup levels for each of the sites must be protective of industrial workers and groundwater.

3.2.1 Cleanup Levels

Facility cleanup levels (CULs) for each SWMU or AOC were established in the FS. Groundwater beneath each of the SWMUs and AOCs present at the Facility discharges either to the Cedar River Waterway or to Lake Washington. Therefore, groundwater cleanup levels must be protective of surface water. Protection of surface water was accomplished by ensuring that groundwater cleanup levels do not exceed applicable or relevant and appropriate requirements (ARARs) protective of surface water and by conducting groundwater modeling to conservatively establish concentrations at the proposed POCs that would naturally attenuate to protective levels before discharge to surface water. The groundwater cleanup levels presented in this DCAP were also established in accordance with the MTCA regulations considering practical quantitation limits (PQLs) and total risk criteria. Soil cleanup levels were established to ensure protection of industrial workers and groundwater.

3.2.1.1 Soil Cleanup Levels

Since the Facility is under industrial land use, most soil cleanup levels for specific COCs will be established in accordance with MTCA Method C requirements, as described in the FSWP. The MTCA Method C soil cleanup levels must be protective of human health and the environment and protective of groundwater. Cleanup levels for total petroleum hydrocarbons (TPH) are based on MTCA Method A levels for industrial properties. If it is determined to be appropriate in the future, Boeing may choose to work with Ecology to establish site-specific TPH cleanup levels based on extractable petroleum hydrocarbons (EPH) and volatile petroleum hydrocarbons (VPH) data, as described in the MTCA regulations at WAC 173-340-700(8).

The soil cleanup levels for the COCs at each SWMU or AOC are summarized in Table 1. The soil cleanup levels in Table 1 are either (1) Industrial MTCA Method A cleanup levels for TPH or (2) standard or modified MTCA Method C cleanup levels developed in accordance with WAC 173-340-745, as discussed in detail in the FS. The modified MTCA Method C soil cleanup levels for each site are protective of groundwater at the CPOC established for the respective site and were developed to specifically apply to the designated SWMUs or AOCs. The groundwater cleanup levels listed in Table 2 were used to establish soil cleanup levels protective of groundwater. Modified MTCA Method C soil cleanup levels were established for those constituents for which site-specific groundwater cleanup levels were established for the designated SWMUs and AOCs; natural attenuation modeling and soil partitioning calculations

were used to establish the Modified MTCA Method C soil cleanup levels, as described in the FS. The modeling is presented in Appendix A. Standard MTCA Method C soil cleanup levels protective of groundwater were established for those constituents for which non-site-specific groundwater cleanup levels were established, as described in the FS. Calculations presented in the FS demonstrate that the cumulative excess cancer risk and HI for the soil cleanup levels comply with the MTCA thresholds of 1.0 for HI and 10^{-5} for the total cancer risk potential.

3.2.1.2 Groundwater Cleanup Levels

Cleanup levels for groundwater have been established for each SWMU and AOC addressed in this DCAP. The groundwater cleanup levels, which are applicable at the CPOC for each SWMU and AOC, were established as described in the FS. Groundwater cleanup levels for each COC at each SWMU and AOC are presented in Table 2. For petroleum hydrocarbons, the MTCA Method A cleanup levels have been selected. As described in the FS, the cleanup levels listed in Table 2 meet MTCA regulatory requirements, including the limits for a cumulative cancer risk of 10^{-5} and an HI of 1.

Both Lake Washington and the Cedar River Waterway have been classified as potential sources for public water supply. Therefore, the groundwater cleanup levels were established to be protective of both human health and ecological receptors within the surface water bodies. Table 2 lists the groundwater COCs and the corresponding groundwater cleanup levels for each of the SWMUs/AOCs addressed in this DCAP.

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 proposed in the FS. The process used to establish the proposed CPOCs was documented in the FS. The CPOCs are specific to each SWMU and AOC addressed in this DCAP. Specific CPOCs are described in the sections of this DCAP that address each SWMU and AOC. Off-site CPOCs must be established for three SWMUs and AOCs, Former Fuel Farm, AOC-060, and AOC-090. As specified in the MTCA regulations, approvals are needed from off-site property owners prior to formally establishing off-site CPOCs. Approval of off-site CPOCs is discussed in Appendix C, City of Renton Conditional Point of Compliance Approval and Access Agreement .

3.2.3 Applicable or Relevant and Appropriate Regulations

The proposed cleanup actions for all AOCs and SWMUs will comply with MTCA (Chapter 173-340 WAC) and all ARARs, including state and federal laws, in accordance with WAC 173-340-350, WAC 173-340-710, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a COC, remedial action, location, or other circumstance at the Facility and that are

applicable to the Facility under law. "Relevant and appropriate" requirements are regulatory requirements or regulatory guidance that do not apply to the Facility under law but have been determined to apply by Ecology in accordance with WAC 173-340-710(3). ARARs are often identified as chemical-specific, location-specific, or remedial action-specific. A number of regulations include requirements in more than one of these three categories.

Corrective actions under RCRA are ongoing and require compliance with the Washington Dangerous Waste Regulations (WAC 173-303) and federal RCRA regulations (Code of Federal Regulations [CFR] Title 40, Parts 240-299). Any cleanup action taken must comply with other applicable laws and regulations (United States Code [U.S.C.] Title 42, Chapter 6901 et seq.). The applicable requirements under the Dangerous Waste and RCRA regulations pertain primarily to management of remediation. Corrective action requirements under RCRA and the Dangerous Waste regulations are addressed under the MTCA regulations, which include very specific and extensive requirements for the DCAP. Specific ARARs are listed in the sections below, and Table 3 summarizes the state and local ARARs applicable to each SMWU or AOC.

3.2.3.1 State and Local Requirements

The following state and local ARARs have been considered in selecting the cleanup actions:

- MTCA (WAC 173-340),
- Dangerous Waste Regulations (WAC 173-303),
- Clean Air Act/Puget Sound Clean Air Agency regulations (WAC 173-400)
- Natural Background Soil Metals Concentrations in Washington State (Ecology, 1994),
- State Environmental Policy Act (RCW 43.21C and WAC 197-11),
- State of Washington Worker Safety Regulations (WAC 296-24),
- State of Washington well drilling regulations (WAC 173-160 and 173-162),
- State of Washington Underground Injection Control Regulations (WAC 173-218),
- State of Washington solid waste disposal regulations (WAC 173-304, -350, -351), and
- State of Washington Shoreline Management Act (RCW 90.58).

3.2.3.2 Federal Requirements

The following federal ARARs have been considered in selecting the proposed cleanup actions:

- RCRA regulations (40 CFR Parts 240-299),
- Clean Water Act (33 U.S.C. 1251 et seq.) Section 304 National Recommended Water Quality Criteria,
- Clean Air Act (42 U.S.C. 7401 et seq.),
- National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61),
- Waste transportation regulations (49 CFR Parts 100 and 177)
- Federal worker safety regulations.

3.3 COMPARATIVE EVALUATION OF REMEDIAL ALTERNATIVES

Remedial alternatives for each SWMU and AOC were evaluated in the FS based on the criteria specified in the agreed order and the MTCA regulations. The evaluation criteria used in the FS included the following:

- Protectiveness and Risk Reduction,
- Permanence,
- Cost,
- Long-Term Effectiveness,
- Management of Short-Term Risks,
- Technical and Administrative Implementability,
- Public Concern, and
- Reasonable Restoration Time Frame.

Each of these criteria and the methods used for comparative evaluation of remedial alternatives are described in detail in the FS (Geomatrix, 2008).

3.4 MTCA REQUIREMENTS FOR CLEANUP ACTIONS

Cleanup actions under MTCA must meet the requirements specified in WAC 173-340-360. The following bullets summarize these requirements.

- **Overall Protection of Human Health and the Environment –** The proposed cleanup alternative must protect human health and the environment. The proposed cleanup action for each of the AOCs/SWMUs protects human health and the environment by minimizing human contact with contaminated media, and preventing ecological exposure. Each proposed cleanup action includes measures

to remove, treat in situ, or isolate hazardous materials and prevent exposure to humans or ecological receptors. Where applicable, the proposed cleanup action includes institutional and engineering controls, protocols, and monitoring to limit exposure to temporary construction workers in exposed areas of affected soil and groundwater and to industrial workers inside buildings. Each proposed cleanup action includes a rigorous monitoring program to verify that surface water quality in the Cedar River Waterway and Lake Washington is protected.

- **Compliance with Cleanup Standards –** The proposed cleanup alternative must comply with cleanup standards. The cleanup levels in Section 3.2.1 were developed in the FS and conditionally approved by Ecology. These cleanup levels comply with applicable MTCA criteria. Each proposed cleanup action is designed to attain the cleanup levels at a POC or CPOC defined for each SWMU/AOC.

- **Compliance with Applicable State and Federal Laws –** The proposed cleanup alternative for each SWMU/AOC will meet dangerous waste, water discharge, air emission, and solid waste requirements, as well as other applicable state and federal laws.

- **Permanent Solutions –** Each proposed cleanup action has been designed to reduce the toxicity, mobility, or volume of hazardous substances and include permanent destruction of hazardous substances.

- **Reasonable Restoration Time Frame –** Conservative fate and transport groundwater modeling presented in Appendix A indicates that the proposed cleanup alternative for each SWMU/AOC would restore each site within a reasonable time frame.

- **Consideration of Public Concerns –** The public will have an opportunity to review the DCAP and the Draft Final FS Report prior to finalization of both documents, and so the proposed cleanup alternatives will allow for consideration of public concerns.

- **Compliance Monitoring –** Each proposed cleanup action includes rigorous monitoring in accordance with the requirements of WAC-173-340-410 and will include protection, performance, and confirmation monitoring. Since groundwater is the preferential pathway for possible exposure to COCs at the Facility, and since each proposed cleanup action includes institutional controls to limit exposure to soils potentially containing COCs, groundwater monitoring will be the primary method of compliance monitoring. Each proposed cleanup action includes a CPOC established downgradient of the source area, and upgradient of potential surface water discharge points.

The preferred cleanup alternative for each SWMU/AOC presented in Sections 4 through 14 meets the minimal MTCA threshold requirements, as well as other requirements.

3.5 MODIFICATIONS AND CHANGES TO CLEANUP ACTIONS

Proposed cleanup actions at each area are based primarily on soil and groundwater data collected between 1999 and 2009. During this time, natural and enhanced degradation of

contaminants have been demonstrated to significantly reduce contaminant concentrations in groundwater over time. Cleanup actions specified in this DCAP were prepared using the most recently available soil and groundwater data and based on the evaluation of cleanup technologies proven to be effective at the current time. Modifications of cleanup actions, including the change of cleanup remedies, expansion (or reduction) of cleanup actions, and change to the length of time, duration, or frequency of groundwater monitoring, may be appropriate as cleanup proceeds. For example, Boeing has been conducting groundwater monitoring at several of the SWMUs and AOCs for more than 10 years, resulting in a significant body of data describing contaminant trends and behavior. It is anticipated that the number of groundwater wells within the groundwater monitoring network and/or the frequency of monitoring will be reduced from that indicated for the program included in this DCAP based on a review of monitoring data as implementation of the cleanup remedies proceeds. It is expected that quarterly monitoring will be decreased to a semiannual or annual basis as appropriate to achieve cleanup objectives. Before any such changes will be adopted, a revised groundwater monitoring plan will be presented to Ecology for their review and approval.

4.0 PROPOSED CLEANUP ACTION: SWMU-168

This section describes the proposed cleanup action for SWMU-168.

4.1. BACKGROUND

SWMU-168 (referred to as "the site" in this section) is located near the northeast corner of Building 5-50 on leased property at the Renton Municipal Airport and consists of the area around a former underground storage tank (UST) designated URE-31 (for underground tank Renton, number 31) (see Figures 4 and 5). 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.

4.1.1 Investigation History

Soil and groundwater samples were collected during the RI at this SWMU in 1999 using push probes (Weston, 2001). Due to the length of time between collection of the soil and groundwater samples during the RI and the approval of the Draft Final FS Report, Boeing decided to collect another round of samples prior to development of the DCAP. Five additional push probes were completed in April 2008 during the Pre-CAP investigation (AMEC, 2008). Both soil and groundwater samples were collected from these push probes.

4.1.2. Implemented Interim Actions

The UST URE-31 was removed in 1985, and there was no documented soil removal at the time the tank was removed. There have been no other subsequent interim actions at SWMU-168 (Weston, 2001).

4.1.3 Constituents of Concern

Figures 4 and 5 show the nature and extent of COCs for soil and groundwater based on the RI. COCs are those chemicals whose concentrations exceeded the soil or groundwater cleanup levels specified in the conditionally approved FS report.

As listed in Tables 1 and 2, the COCs for this SWMU are:

- Soil: Methylene chloride.
- Groundwater: Vinyl chloride (VC).

The FS report indicated that confirmation sampling would be completed prior to preparation of the DCAP. During the Pre-CAP field investigation performed in April 2008, methylene chloride concentrations were less than the detection limit in the confirmation samples collected from a

depth of approximately 2 to 4 feet below ground surface (bgs) (AMEC, 2008). In June 2009, an additional push probe (PP202) was completed in the vicinity of PP002 and PP166 (Figure 4), and the concentration of methylene chloride in a soil sample collected from 5.5 to 6.5 feet bgs was less than the detection limit. Results from the Pre-CAP investigation and sampling conducted in June 2009 suggest that methylene chloride in soil has attenuated since the RI samples were collected.

A groundwater sample collected from PP167 at 14 feet bgs during the 1999 RI contained vinyl chloride at a concentration greater than the preliminary cleanup level (PCL) established in the RI Report (see Figures 4 and 5); this push probe defines the source area for this SWMU. As part of the preferred cleanup alternative, a source area groundwater monitoring well will be installed adjacent to PP167. Groundwater samples will be collected from this well along with samples from the CPOC wells (Section 4.4).

4.2. IDENTIFICATION OF CLEANUP ALTERNATIVES

The SWMU-168 area is leased from the City of Renton, and the nearby buildings will continue to be used to support airplane manufacturing activities for the main plant area across the Cedar River Waterway for the foreseeable future.

Based on the screening evaluation, MTCA minimum threshold requirements, and the site considerations discussed above, three remedial alternatives addressing groundwater COCs were developed in the FS for SWMU-168:

- Cleanup Alternative 1: Monitored Natural Attenuation (MNA);
- Cleanup Alternative 2: Soil Vapor Extraction and Monitored Attenuation;
- Cleanup Alternative 3: Enhanced Bioremediation and Monitored Attenuation.

4.2.1 Cleanup Alternative 1: Monitored Natural Attenuation

Alternative 1 consists of two primary elements: institutional controls and MNA. Cleanup Alternative 1 would use institutional controls and MNA to address the site COCs.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to ensure it is fully protective of human health and the environment. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.

- **Monitored Natural Attenuation –** MNA would be used to attain the groundwater cleanup levels at a CPOC established upgradient from the Cedar River Waterway, as shown on Figures 4 and 5. Fate and transport groundwater modeling presented in Appendix A indicates that natural attenuation would attain the cleanup level for the groundwater COC (VC) at the CPOC, given sufficient time. A long-term groundwater monitoring program using the network shown in Figure 6 would be instituted to monitor the effectiveness of MNA.

4.2.2. Cleanup Alternative 2: Soil Vapor Extraction and Monitored Natural Attenuation

Cleanup Alternative 2 consists of three primary elements: institutional controls, soil vapor extraction (SVE), and MNA. Alternative 2 uses institutional controls, SVE, and MNA to address the soil and groundwater COCs. This alternative uses SVE to address residual soil contamination. The remaining elements of this alternative are the same as described above for Cleanup Alternative 1.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Alternative 2 would be the same as those described above for Cleanup Alternative 1.

- **Soil Vapor Extraction –** The well would be installed near PP001 (Figure 6). SVE is compatible with the current site use and would be effective at addressing the affected soil at this SWMU. VOCs removed from the soil would be collected and treated using potassium permanganate and granular-activated carbon (GAC) beds operated in series to control emissions. Subsequent to the completion of SVE system operation, soil confirmation sampling would be performed to confirm that the unsaturated zone soil at this SWMU had met the soil cleanup level for methylene chloride.

- **Monitored Natural Attenuation –** Monitored natural attenuation for this alternative is intended to be a final “polishing” mechanism, following the soil vapor extraction, to ensure that cleanup levels for all COCs are met at the CPOC as shown in Figures 4 and 5. The MNA program for Cleanup Alternative 2 would be the same program as described above for Cleanup Alternative 1.

4.2.3 Cleanup Alternative 3: Enhanced Bioremediation and Monitored Attenuation

Cleanup Alternative 3 consists of three primary elements: institutional controls, enhanced biodegradation, and monitored attenuation (MA). This alternative would use enhanced bioremediation to address vinyl chloride in groundwater. The following specific elements are included in Cleanup Alternative 3.

- **Institutional Controls –** The institutional controls for Alternative 3 would be the same as those described above for Cleanup Alternative 1.

- **Enhanced Bioremediation –** The reductive dechlorination processes that are active at this site would be enhanced by addition of electron donor and nutrients, as

appropriate. An electron donor (such as molasses, lactate, or emulsified vegetable oil) would be injected into affected groundwater in the SWMU-168 source area.

- **Monitored Attenuation –** Monitored attenuation would be accomplished using a network of groundwater monitoring wells to assess the effectiveness of enhanced bioremediation and confirm that the cleanup standard is met. An on-site CPOC shown in Figures 4 and 5 would be used to ensure the cleanup standard is being attained during the bioremediation program. The monitoring program for Cleanup Alternative 3 would be the same as described for Cleanup Alternative 1.

4.3 COMPARATIVE ANALYSIS OF CLEANUP ALTERNATIVES

Table 4 provides a comparison of the cleanup alternatives from the FS report based on the criteria described in Section 3.3. These criteria were used in the FS to evaluate cleanup alternatives for SWMU-168. The estimated costs for each cleanup alternative are presented in Appendix B.

As discussed in Section 6.6 of the FS report, the original preferred cleanup alternative for SWMU-168 was Alternative 3, enhanced bioremediation and monitored attenuation. This alternative was selected because the cost was not disproportionate compared to the cost of natural attenuation monitoring (Appendix B), and provided more rapid restoration of the site. The preferred Cleanup Alternative 3 would have provided the same benefits as Alternative 2 (soil vapor extraction) with lesser negative impacts on Facility operations.

Based on the information from the Pre-CAP investigation (AMEC, 2008) and additional push probe investigations in June 2009, however, it appears that natural attenuation may have already remediated the source area for SWMU-168, since no soil COCs were detected above the reporting limit in the source area. Based on these results, Cleanup Alternative 1 (monitored natural attenuation) will be the preferred cleanup alternative for SWMU-168.

Once the DCAP has been approved, a comprehensive compliance monitoring program for the entire Facility (including SWMU-168) will be developed as a part of an Engineering Design Report.

4.4 PROPOSED CLEANUP ACTION

Cleanup Alternative 1 (MNA and institutional controls) meets the MTCA requirements for cleanup actions, as discussed in Section 3.4, and is the proposed cleanup action for SWMU-168. As shown in Figures 4 and 5, the most recent soil and groundwater data collected since the Pre-CAP field investigation show that concentrations of methylene chloride in soil have dropped below the detection limit (AMEC, 2008). Natural attenuation has already reduced the concentration of methylene chloride in soil at SWMU-168, so further cleanup action is only necessary for groundwater.

As part of the preferred cleanup action, a shallow monitoring well will be installed in the source area (near PP003/PP167, as shown in Figure 6). This well will be screened at 14 feet bgs, and groundwater samples will be analyzed for VC as part of the SWMU-168 monitoring program (Section 4.4.2). A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

4.4.1 Institutional Controls

The following institutional controls would be included to reduce the risk of human exposure to impacted soil or groundwater.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside buildings are protected and indoor air concentrations meet Permissible Exposure Limits (PELs) established by the Washington Department of Labor and Industry.

- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and Occupational Safety and Health Administration (OSHA) Hazardous Waste Operation and Emergency Response (HAZWOPER) regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and/or groundwater.

- Recovery and use of groundwater beneath the site would be restricted. This institutional control would require cooperation from the City of Renton, because the City is responsible for the property being leased by Boeing. Recovery of groundwater in this area for any purpose other than construction dewatering would be prohibited.

4.4.2 Monitored Natural Attenuation

Groundwater monitoring data collected at the Renton Facility indicate that natural processes are at work degrading and retarding the migration of COCs at other SWMUs and AOCs so it is expected that these same processes will also address the low concentrations of remaining COCs at SWMU-168.

The general objectives for long-term monitoring, if it is necessary, include:

- Demonstrate that natural attenuation is occurring according to expectations;

- Identify any potentially toxic and/or mobile transformation products;

- Verify that the plume is not expanding beyond the CPOC;

- Verify that cleanup levels are attained at the CPOC;

- Verify that there is no unacceptable impact to downgradient receptors;
- Detect new releases of COCs that could impact the effectiveness of the natural attenuation remedy;
- Demonstrate the efficacy of institutional controls put in place to protect potential receptors; and
- Verify attainment of remediation objectives.

The conceptual monitoring program for SWMU-168 is designed to achieve these objectives. If needed, a detailed MNA Validation and Long-Term Sampling Work Plan would be developed to guide the monitoring program. This work plan would identify additional monitoring wells and monitoring analytes that would be required for both characterization/validation sampling and long-term groundwater monitoring.

For the conceptual design, it was assumed that characterization/validation sampling, if necessary, would consist of quarterly monitoring of four monitoring wells for a minimum of 1 year. Four new monitoring wells (three shallow monitoring wells and one intermediate depth monitoring well) would be installed, if needed, to monitor plume migration (Figure 6). Monitoring parameters and analytes would consist of volatile organic compounds (VOCs) (contaminants and daughter products), as well as the full suite of MNA geochemical parameters [dissolved oxygen, nitrate, Fe(II), sulfate, methane, temperature, pH, specific conductance, alkalinity, oxidation/reduction potential, chloride, ethane, and total organic carbon (TOC)].

Long-term groundwater monitoring, if necessary, would follow for an estimated additional 13 to 14 years (15 total years of monitoring) and include semiannual monitoring of the four monitoring wells for VOCs (contaminants and daughter products) and a limited suite of geochemical parameters (dissolved oxygen, oxidation/reduction potential, temperature, and pH). All four wells would be sampled once every 5 years for the entire characterization/validation list of analytes.

5.0 PROPOSED CLEANUP ACTION: SWMU-172/174

This section describes the proposed cleanup action for SWMU-172/174.

5.1 BACKGROUND

SWMU-172/174 (collectively referred to in this section as the site) is located on the west side of the Cedar River Waterway, on leased property on the eastern side of the Renton Municipal Airport. Both SWMU-172 and SWMU-174 are the locations of former wastewater USTs located adjacent to Buildings 5-09 and 5-08, respectively (see Figures 7 and 8). SWMU-172 is associated with former UST URE-66, and SWMU-174 is associated with former UST URE-73. URE-66 was a 155-gallon concrete tank installed in 1963, and URE-73 was a 120-gallon concrete tank installed in 1957. Both USTs were used for the collection and temporary storage of steam-cleaning wastewater. URE-73 was deactivated in 1980; the deactivation date for URE-66 was not documented, indicating that it occurred prior to 1980. Both USTs were removed in 1987.

5.1.1. Investigation History

Soil and groundwater samples were collected during the RI in 1999 and 2000 from push probes and groundwater monitoring wells (Weston, 2001). Due to the length of time between collection of the soil and groundwater samples during the RI and the approval of the Draft Final FS Report, Boeing decided to collect another round of samples prior to development of the DCAP. Eight additional push probes were completed in April 2008 during the Pre-CAP investigation, and an additional seven groundwater samples were collected from existing groundwater monitoring wells (AMEC, 2008). Both soil and groundwater samples were collected at the push probe locations.

Groundwater samples were collected from several monitoring wells in SWMU-172/174 using polyethylene diffusion bag (PDB) samplers in February and May 2008. Ecology, however, has stated that analytical results from samples collected using PDB samplers are not comparable to analytical results from samples collected using low-flow groundwater sampling methods.

In April 2011, Boeing began renovations to Building 5-50, a large building located west of SWMU-172/-174. As part of the renovation, Boeing replaced a section of the sanitary sewer servicing Building 5-50 due to an obstruction in the existing sewer line. However, replacement of the sewer line required the abandonment of groundwater monitoring well GW082S prior to completion of the excavation. A replacement groundwater monitoring well, GW226S, was installed south of the former GW082S location as shown in Figures 7, 8, and 9.

5.1.2. Implemented Interim Actions

During the UST removal activities conducted in 1987 for both SWMUs, 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).

5.1.3. Constituents of Concern

Figures 7 and 8 show the nature and extent of COCs for soil and groundwater, respectively, based on the RI. COCs are those chemicals whose concentrations exceeded the soil or groundwater cleanup levels specified in the conditionally approved FS report.

As listed in Tables 1 and 2, the COCs for these SWMUs are:

- Soil: Tetrachloroethene (PCE), trichloroethene (TCE), vinyl chloride (VC), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), 1,1-dichloroethene (1,1-DCE), benzene, methylene chloride, and metals (copper, thallium, and zinc);

- Groundwater: PCE, TCE, benzene, other solvents, and solvent-related biodegradation products; one semivolatile organic compound (SVOC), and metals (arsenic, chromium, copper, and lead).

The FS report indicated that confirmation sampling would be completed prior to preparation of the DCAP. The confirmation samples were collected during the Pre-CAP field investigation in April and May 2008. The results of the Pre-CAP field investigation showed that concentrations of benzene and chlorinated solvents in soil are higher than those detected in RI samples collected in 1999 and 2000 (AMEC, 2008). Three soil constituents (1,1-DCE, *cis*-1,2-DCE, and VC) were detected during the Pre-CAP investigation at concentrations that exceeded the PCLs from the RI and, as a result, were added to the DCAP as COCs. These constituents are commonly found with the other chlorinated VOCs detected in this area.

Groundwater results obtained in the source areas during the Pre-CAP indicate that similar groundwater constituents were detected during the Pre-CAP investigation and the RI. Groundwater results collected along the CPOC for the Pre-CAP investigation exceeded CULs in several cases. Detected concentrations of PCE and TCE in groundwater were above the CULs at PP175 and PP176. Monitoring wells will be installed along the CPOC to determine compliance with CULs for all COCs in groundwater.

5.2 IDENTIFICATION OF CLEANUP ALTERNATIVES

SWMU-172/174 and adjacent areas are used for industrial purposes and are expected to remain under industrial use. Industrial buildings are located adjacent to the former UST locations.

Based on the screening evaluation, MTCA minimum threshold requirements, and the site considerations discussed above, the following three cleanup alternatives that could be used to address COCs on the SWMU-172/174 site were developed:

- Cleanup Alternative 1: Source Area Excavation, Enhanced Bioremediation, and MA;
- Cleanup Alternative 2: Soil Vapor Extraction, Enhanced Bioremediation, and MA;
- Cleanup Alternative 3: Monitored Natural Attenuation.

5.2.1 Cleanup Alternative 1: Source Area Excavation, Enhanced Bioremediation, and Monitored Attenuation

Cleanup Alternative 1 would involve excavating the source areas at SWMU-172/174 to remove affected soil in the vicinity of the source areas. This alternative also includes enhanced bioremediation and MA to address the groundwater plume downgradient from the source areas. This cleanup alternative includes the following specific elements.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to ensure it is fully protective of human health and the environment. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.
- **Source Area Excavation –** Excavation of source area soil in the vicinity of the two former USTs and push probes PP061 and PP062; the extent of excavation would be guided by soil verification sampling to confirm removal of affected soil exceeding cleanup levels for soil COCs to the extent practicable.
- **Enhanced Bioremediation –** The reductive dechlorination processes that are active at this site would be enhanced by further addition of electron donor and nutrients, as appropriate. An electron donor (such as sugar substrate, lactate, or emulsified vegetable oil) would be injected into the affected groundwater within the source areas.
- **Monitored Attenuation –** Monitored attenuation would be accomplished using a network of groundwater monitoring wells (as shown in Figure 9) to assess the effectiveness of enhanced bioremediation and confirm that the cleanup standard is met. Since the plume extends downgradient from the two source areas, an on-site CPOC would be used to ensure the cleanup standard is being attained during the bioremediation program.

5.2.2 Cleanup Alternative 2: Soil Vapor Extraction, Enhanced Bioremediation, and Monitored Attenuation

Alternative 2 includes SVE within the source area to remove volatile COCs from affected soil in the vicinity of the source areas and enhanced bioremediation with MA to address the groundwater plume downgradient from the source areas. Nonvolatile COCs would remain within site soils under this alternative. This cleanup alternative includes the following specific elements.

- **Institutional Controls –** The institutional controls for Cleanup Alternative 2 would be the same as those described above for Cleanup Alternative 1.

- **Soil Vapor Extraction –** An SVE system would be installed and operated in the vicinity of the two former USTs and push probes PP061 and PP062. SVE is compatible with the current site use and would be effective at addressing the affected soil. VOCs removed from the soil would be collected and treated using potassium permanganate and granular-activated carbon (GAC) beds operated in series to control emissions. Following shutdown of the SVE system, soil confirmation sampling would be performed to confirm that the unsaturated zone soil had met the soil cleanup level for volatile soil COCs.

- **Enhanced Bioremediation –** Enhanced bioremediation would be implemented as described above for Cleanup Alternative 1.

- **Monitored Attenuation –** MA for this alternative would be the same program as described above for Cleanup Alternative 1.

5.2.3 Cleanup Alternative 3: Monitored Natural Attenuation

Cleanup Alternative 3 is based on biodegradation of organic constituents by MNA and on institutional controls to limit the potential for exposure to site constituents that may remain in site soil. The cleanup standard for this alternative would be attained through permanent destruction of organic constituents by the ongoing natural processes and immobilization of the nonbiodegradable COCs. This alternative includes the following specific elements.

- **Institutional Controls –** The institutional controls for Cleanup Alternative 3 would be the same as those described above for Cleanup Alternative 1.

- **Monitored Natural Attenuation –** MNA would be used to attain the groundwater cleanup levels at a CPOC established upgradient from the Cedar River Waterway, as shown on Figures 7 and 8. Based on the highly conservative modeling approach presented in the FS and included in Appendix A, natural attenuation may not attain the cleanup levels for chlorinated COCs in groundwater prior to groundwater reaching the Cedar River Waterway.

5.3. COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 5 provides a comparison of the cleanup alternatives from the FS report based on the criteria outlined in Section 3.3. These criteria were used in the FS to evaluate cleanup alternatives for SWMU-172/174. Estimated costs for each cleanup alternative are presented in Appendix B.

As discussed in Section 7.6 of the FS report, the preferred cleanup alternative for SWMU-172 and SWMU-174 was Alternative 2: SVE, enhanced bioremediation, monitored attenuation, and institutional controls. This alternative would address the elevated COC concentrations remaining in the soil. PCE exceeds the soil cleanup level that is protective of groundwater at the CPOC. PCE and TCE concentrations in the source area groundwater also exceed the cleanup level that is protective of groundwater at the projected CPOC.

Based on the information from the Pre-CAP investigation, SVE remains an appropriate cleanup technology to address soil contaminants identified at SWMU-172/174. Because groundwater COC concentrations from push probes installed at the CPOC exceeded the CPOC groundwater cleanup level for SWMU-172 and SWMU-174, enhanced bioremediation will be required to address COC concentrations at these SWMUs. In addition, elevated PCE concentrations were measured in groundwater at PP173 . To address this issue, two additional bioremediation injection wells are proposed in the immediate area around PP173 to reduce COC concentrations upgradient of the CPOC (Figure 9). Reduction in upgradient concentrations will achieve cleanup levels at the CPOC as a result of enhanced bioremediation along groundwater flow paths. Based on the Pre-CAP investigation results, Alternative 2 (SVE, enhanced bioremediation, monitored attenuation, and institutional controls) is the proposed cleanup action for SWMU-172 and SWMU-174.

Once the DCAP has been approved, a comprehensive compliance monitoring program for the entire Facility (including SWMU-172/174) will be developed as a part of the Engineering Design Report.

5.4 PROPOSED CLEANUP ACTION

SVE, enhanced bioremediation, monitored attenuation, and institutional controls meet the MTCA requirements for cleanup actions, as discussed in Section 3.4. Therefore Alternative 2 is the proposed cleanup action for SWMU-172/174. The proposed remedy is appropriate for addressing all COCs associated with SWMU-172/174.

A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

5.4.1 Institutional Controls

The following institutional controls would be incorporated into the proposed cleanup action to reduce risks to human health and the environment.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside buildings are protected and indoor air concentrations meet PELs established by the Washington Department of Labor and Industry.

- Recovery and use of groundwater beneath the site would be restricted. This institutional control would require cooperation from the City of Renton because the City is responsible for the property being leased by Boeing. Recovery of groundwater in this area for any purpose other than construction dewatering would be prohibited.

- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and OSHA HAZWOPER regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and groundwater.

- An on-lease CPOC would be established for this alternative.

5.4.2 Soil Vapor Extraction

For this remedial alternative, soils in the two source areas affected by volatile COCs would be remediated by an SVE system. The approximate locations of the SVE wells are shown in Figure 9. The SVE system would address essentially all source area soils above the water table. The conceptual design includes three vapor extraction wells (see Figure 9). A blower with a capacity of approximately 100 cubic feet per minute (cfm) would be used to draw soil gas from the vapor extraction wells. The extracted soil gas would be treated using a permanganate oxidation bed and activated carbon adsorption. Air pollution permitting and registration requirements include application for a Puget Sound Clean Air Agency (PSCAA) Notice of Construction (NOC) and evaluation of potential emissions to ensure compliance with National Emission Standards for Hazardous Air Pollutants (NESHAPS) regulations. Field testing would be required to determine site-specific design parameters.

Verification sampling of soils within the area treated by SVE would be conducted after monitoring data indicate that the SVE system has removed recoverable VOCs. It has been assumed that this would be accomplished in 2 years. The verification samples would be compared to soil cleanup levels to confirm attainment of remediation objectives. The verification samples would also be analyzed for nonvolatile COCs to confirm previous sampling results and to confirm the delineation of soil affected by the nonvolatile COCs.

Verification sampling may not be possible in all treated areas due to access restrictions related to the site buildings and activities.

It is expected that the SVE system would substantially remove soil VOCs throughout the affected area, including the area beneath buildings. Residual concentrations of soil COCs would be addressed by institutional controls. This alternative would provide a permanent remedial solution for most of the soil affected by VOCs at this site.

5.4.3 Enhanced Bioremediation

Reductive dechlorination processes that are active at this site would be enhanced by the addition of an electron donor and nutrients to site groundwater, as appropriate. Increasing the concentration of electron donor and deficient nutrients would enhance biological activity and thereby increase the rate of biodegradation, destroying the chlorinated solvents present in groundwater. An electron donor (such as sugar substrates, lactate, or emulsified vegetable oil) would be injected into affected groundwater at multiple locations, as shown in Figure 9. Electron donor would be injected using a line of new injection wells traversing the groundwater plume (Figure 9) and/or using existing monitoring wells. New injection wells would be installed to an approximate depth of 15 feet bgs and would be screened through the entire saturated zone above the silty clay layer identified beneath the site. The electron donor injected into these wells would cover the width of the plume and move downgradient as the groundwater moves, eventually addressing the affected groundwater area. Up to 12 electron donor injection wells would be used. For cost estimating purposes, it was assumed that four injection events occurring over a 2-year period would likely be sufficient to achieve full degradation of biodegradable groundwater COCs. A different electron donor may be used during final implementation. For costing purposes, it was also estimated that 200 gallons of 2 percent emulsified vegetable oil per well (approximately 2,400 gallons total) would be injected during each event. Injection schedules and volumes will be refined during engineering design.

5.4.4 Monitored Attenuation

Monitored attenuation would be conducted to confirm the effectiveness of SVE and enhanced bioremediation and attainment of the cleanup standard. A network of groundwater monitoring wells would be required to assess the effectiveness of enhanced bioremediation and to confirm that the cleanup standard is met for groundwater. The conceptual monitoring program for SWMU-172/174 has been designed to verify that the general objectives outlined in Section 3.1.2 are achieved.

For the proposed cleanup action, a detailed MA plan would be developed to document the monitoring program. This plan would identify existing and additional monitoring wells and

analytes that would be required for both characterization/validation sampling and long-term groundwater monitoring.

An on-site CPOC would be located along the downgradient lease boundary on the west side of East Perimeter Road (Figure 9). Three new shallow monitoring wells would be installed along the CPOC (see Figure 9). Two of the shallow CPOC monitoring wells would be nested with intermediate depth wells to monitor the deeper sand unit underlying the shallow, affected zone, for a total of five new wells located along the CPOC.

For the conceptual design, it was assumed that the five new CPOC monitoring wells, plus six existing source area monitoring wells, would be included in the monitoring well network for a total of 11 monitoring wells (Figure 9). Characterization/validation sampling would consist of quarterly monitoring of the 11 monitoring wells for a minimum of 1 year. Monitoring parameters and analytes for each of these wells would include groundwater COCs and the appropriate MNA geochemical parameters [e.g., dissolved oxygen, nitrate, Fe(II), sulfate, methane, temperature, pH, specific conductance, alkalinity, oxidation/reduction potential, chloride, ethane, and TOC]. Data reporting for characterization/validation sampling would follow each quarterly sampling event, and an annual report would be prepared that evaluates and discusses the monitoring data.

Long-term groundwater monitoring would follow the initial characterization/validation sampling program. Quarterly monitoring of all 11 monitoring wells would continue until a variance is approved by Ecology. Estimated costs for the proposed cleanup action are based on the assumption that intermediate wells would be dropped from the monitoring program after 2 years of quarterly monitoring with Ecology approval followed by 13 years of semiannual monitoring. For the cost estimate, it was assumed that all 11 wells would be analyzed once every 5 years for the full list of characterization/validation analytes to monitor overall plume control (in addition to the routine analytes). For conceptual design, it was assumed that long-term groundwater monitoring results would be reported to Ecology annually. Long-term monitoring and associated remedial action would end when groundwater meets the site-specific cleanup levels, as approved by Ecology.

6.0 PROPOSED CLEANUP ACTION: BUILDING 4-78/79 SWMU/AOC GROUP

The Building 4-78/79 SWMU/AOC Group is located adjacent to the east side of the Cedar River Waterway, in the west-central portion of the Boeing-owned part of the Facility. This SWMU/AOC group includes a former dangerous waste storage area (SWMU-181), four former gasoline USTs (UREs-17, -23, -24 and -54), a former gasoline dispenser, and two former methyl ethyl ketone (MEK) USTs (UREs-18 and -25). The location for this site is shown on Figures 10 and 11.

6.1 BACKGROUND

The former USTs at the site were used to store gasoline and MEK. In addition, the fuel from these tanks was piped to a fuel dispenser located on the east side of Building 4-79. The gasoline pump dispenser island and associated piping were removed from this area as well. Buildings 4-61 and 4-73 were demolished in early 2004 and converted to parking facilities. Building 4-78 is still being used for temporary storage of hazardous wastes. Building 4-79 is still used for painting of aircraft parts to support airplane manufacturing activities conducted at the Renton Facility. These two buildings and adjacent buildings and areas are currently used for industrial purposes and are expected to remain in industrial use for the foreseeable future. A general description of the SWMU and AOCs is provided below.

- SWMU-181: Building 4-78 Former Dangerous Waste Storage Area—SWMU-181 was formerly used for the accumulation of dangerous wastes brought from other areas of the Facility. Wastes typically stored at SWMU-181 included solvents, spent petroleum products, and sludges. As documented in the final RI Report, historical data indicate that releases of VOCs, SVOCs, and TPH to groundwater have occurred from this SWMU. A new dangerous waste accumulation building was constructed over the footprint of the former dangerous waste storage area.

- AOC-013: Former URE-17—This 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 TPH.

- AOC-14: Former URE-18—This 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—This 4,000-gallon steel tank was used to store gasoline. The tank was removed in September 1985. Benzene, toluene, ethylbenzene, and xylene (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 was detected.

- AOC-026: Former URE-54—This 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. TCE, benzene, and VC were detected in groundwater samples collected in the vicinity of this AOC.

- AOC-037: Former URE-25—This 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—This 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 at the site have resulted in two separate source areas for COCs: (1) a chlorinated solvent source associated with the former dangerous waste storage area in Building 4/78 (SWMU-181); and (2) a fuel and nonchlorinated solvent source areas associated with the former USTs and fuel dispenser island, and removed piping.

The final RI Report and Appendix A of the RI report summarize the background and remedial history for this SWMU/AOC Group (Weston, 2001).

6.1.1 Investigation History

The RI Report summarized the investigation history for this SWMU/AOC. As described in the following section, many of the AOCs were addressed through tank removal and in some cases limited soil removal well before the effective date of the Agreed Order. Groundwater monitoring results from 1999 and 2000 were presented in the RI Report to establish the groundwater COCs; in the FS it was assumed that the soil COCs were the same as the groundwater COCs. Due to the length of time between collection of the groundwater samples during the RI and the approval of the Draft Final FS Report, and the lack of recent soil data for the site, Boeing decided to collect another round of samples prior to development of the DCAP. Twelve additional push probes were completed in April 2008 during the Pre-CAP investigation, and an additional seven groundwater samples were collected from existing groundwater monitoring wells (Figures 10 and 11; AMEC, 2008). Both soil and groundwater samples were collected at the push probe locations. 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 (Figures 10 and 11).

These data suggest that former Building 4-78, especially the north side of the building where solvent for recycling and/or off-site disposal was stored prior to 1991, is the primary source of chlorinated VOCs at this SWMU. The highest concentrations of primary VOCs are found directly north of the former building (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) show much lower concentrations that may be the result of vapor transport from the source area.

6.1.2 Implemented Interim Actions

Previous site cleanup actions in this area have been related to removal of structures or USTs, and implementation of an interim action. The following paragraphs summarize the site cleanup actions at the SWMU and AOCs that comprise this group.

- SWMU-181: Former Dangerous Waste Storage Area—This SWMU became inactive in December 1989. The original container storage pad and canopy were removed in 1993 and replaced by Building 4-78, which was placed into operation as a container storage unit (CSU). The CSU was initially operated as a permitted dangerous waste storage facility. A closure plan for the 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. The CSU is currently used to store containers for less than 90 days and is no longer permitted.

- AOC-13: Building 4-62 Former UST URE-17—This gasoline storage UST 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: Building 4-61 Former UST URE-18—This former UST 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: Building 4-61 Former UST URE-24—This gasoline storage UST was removed in September 1985, and approximately 50 gallons of gasoline was reportedly recovered from the excavation.

- AOC-26: Building 4-61 Former UST URE-54—This gasoline storage UST 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 was extracted from the excavation.

- AOC-037: Building 4-79 Former UST URE-25—This UST, which stored MEK, was removed in September 1987 in accordance with Subtitle I of the Solid Waste Disposal Act. No soil was documented to have been removed during the excavation. Soil verification samples collected in 1993 were below RCRA Subpart S action limits. TCE, benzene, and VC were detected in groundwater in the vicinity of this AOC.

- AOC-054: Building 4-78 Former UST URE-23—This 10,000-gallon steel tank was used to store gasoline. During removal of URE-23 in April 1989, gasoline was observed in the soil and groundwater samples. Approximately 200 cubic yards of soil was excavated. Soil and groundwater sampling revealed detectable concentrations of BTEX, TPH, and VOCs.

All of these units are located within the capture zone for the interim action groundwater hydraulic containment system that was installed at this site in 1991. The hydraulic containment system consists of two extraction wells, an air stripper, and a monitoring well network. The groundwater hydraulic containment system was shut down in November 2003 to allow site hydrogeologic conditions to recover to static conditions and support evaluation of potential remedial alternatives.

6.1.3 Constituents of Concern

As listed in Tables 1 and 2, the COCs for this SWMU/AOC group are:

- Soil: TCE and related solvent breakdown products, TPH in the gasoline range (TPH-G), benzene, PCE, and carbon disulfide (CS_2);
- Groundwater: TCE and related solvent breakdown products, TPH-G, and benzene.

PCE and carbon disulfide were detected in soil samples collected during the Pre-CAP investigation, and the concentrations exceeded calculated cleanup levels (Table 1). These constituents were not considered COCs in the FS, however, the proposed remedy will address PCE and carbon disulfide along with other COCs for this area.

6.2 IDENTIFICATION OF CLEANUP ALTERNATIVES

The Building 4-78/79 SWMU/AOC Group is located on the western portion of the Renton Facility. Former Building 4-61, which was demolished in 2003-2004, was located between the Building 4-78/79 SWMU/AOC group and the Boeing property line. Nishiwaki Lane and the Cedar River Trail Park lie between the Boeing property line and the Cedar River Waterway. All property adjacent to the Building 4-78/79 SWMU/AOC Group is owned by Boeing and used for industrial purposes. The site is expected to remain under industrial use for the foreseeable future. Industrial buildings are located adjacent to some of the former UST locations.

Cleanup alternatives considered for this site must be compatible with the two different types of source area and groundwater plume; remediation approaches considered for one plume must have no adverse effects on the other plume. Remediation approaches considered for groundwater plumes must accommodate the existing buildings and site activities.

Based on the screening evaluation, MTCA minimum threshold requirements, and the site considerations discussed above, the following three cleanup alternatives that could be used to address COCs on the SWMU-172/174 site were developed:

- Cleanup Alternative 1 – Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation, and Monitored Natural Attenuation;

- Cleanup Alternative 2 – Soil Vapor Extraction, Enhanced Bioremediation, Monitored Attenuation, and Monitored Natural Attenuation;

- Cleanup Alternative 3 – Source Area Excavation and Monitored Natural Attenuation.

6.2.1 Cleanup Alternative 1 - Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation, and Monitored Natural Attenuation

Cleanup Alternative 1 for the Building 4-78/79 SWMU/AOC group includes excavation of the presumed TPH/benzene soil source area to remove affected soil, enhanced bioremediation with MA to address the chlorinated solvents in the solvent plume, and monitored natural attenuation to address TPH-G and benzene in the benzene plume. The following specific elements are included in this alternative.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to ensure it is fully protective of human health and the environment. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.

- **Source Area Excavation –** Excavation of the TPH/benzene source area soil that likely exists in the vicinity of the former USTs where releases were identified during tank removal (URE-17, -18, -23, -24, and -54) and in the area where the underground lines supplying fuel to the dispenser island were located, as shown in Figures 10 and 11. Soil verification sampling would be performed to confirm removal of affected soil exceeding soil cleanup levels for TPH-G and benzene.

- **Enhanced Bioremediation –** Enhanced bioremediation for chlorinated VOCs in the solvent plume by adding electron donor and nutrients within the chlorinated VOC source area shown on Figures 10 and 11.

- **Monitored Attenuation –** Monitored attenuation would be accomplished using a network of groundwater monitoring wells to assess the effectiveness of enhanced bioremediation and confirm that the cleanup standard is met. Since the plume extends downgradient from the two source areas, an on-site CPOC would be used to verify that the cleanup standard is being attained during the bioremediation program.

- **Monitored Natural Attenuation –** MNA would be used to attain the groundwater cleanup levels at a CPOC established upgradient from the Cedar River Waterway, as shown on Figures 10 and 11. Fate and transport groundwater modeling presented in Appendix A indicates that natural attenuation may attain the cleanup levels for the nonchlorinated groundwater COCs (TPH-G and benzene) at the CPOC.

6.2.2 Cleanup Alternative 2 – Soil Vapor Extraction, Enhanced Bioremediation, Monitored Attenuation, and Monitored Natural Attenuation

Cleanup Alternative 2 is similar to Cleanup Alternative 1, except that source area soils would not be excavated near the nonchlorinated source areas near the former USTs and dispenser lines, and an SVE system would be included to enhance degradation of COCs in both areas. The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Cleanup Alternative 2 would be the same as those described above for Cleanup Alternative 1.
- **Soil Vapor Extraction –** SVE would be used to address the COC-affected soils in the source areas for both the benzene and solvent plumes. VOCs removed with the soil gas would be collected and treated prior to discharge of soil gas to the atmosphere. Soil verification sampling would be conducted within the source areas to confirm attainment of soil cleanup levels for TPH-G, benzene, and the other soil COCs.
- **Monitored Attenuation –** Monitored attenuation for this alternative will be the same as described for Cleanup Alternative 1.
- **Monitored Natural Attenuation –** MNA for this alternative will be the same as described for Cleanup Alternative 1.

6.2.3 Cleanup Alternative 3 – Source Area Excavation and Monitored Natural Attenuation

Cleanup Alternative 3 is similar to Cleanup Alternative 1, except it does not include enhanced bioremediation. The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Cleanup Alternative 3 would be the same as those described above for Cleanup Alternative 1.
- **Source Area Excavation –** Excavation of the TPH/benzene source area soil that likely exists in the vicinity of the former USTs and dispenser piping would be conducted as described above for Cleanup Alternative 1.
- **Monitored Natural Attenuation –** MNA for this alternative would be the same as described for Cleanup Alternative 1.

6.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 6 provides a comparison of the cleanup alternatives from the FS report based on the criteria described in Section 3.3. These criteria were used in the FS to evaluate cleanup alternatives for the Building 4-78/79 SWMU/AOC Group. Estimated costs for each cleanup alternative are presented in Appendix B.

As discussed in Section 9.6 of the FS report, the preferred cleanup alternative for the Building 4-78/79 SWMU/AOC Group is Alternative 2 (SVE, enhanced bioremediation, MA, and MNA). The SVE system would remove COCs from soil within both the solvent and TPH source areas, and would result in the permanent destruction of the constituents. Enhanced bioremediation would promote rapid degradation of solvents in the solvent plume, and natural attenuation would degrade the benzene plume. The site would remain capped by the existing tarmac, pavement, and buildings, which would prevent runoff and limit infiltration of surface water. A rigorous groundwater monitoring program would ensure that the cleanup standards are attained at an on-site CPOC. The institutional controls included in the alternative have been implemented by Boeing and proven effective; Boeing would continue to maintain overall responsibility for this site and ensure that the institutional controls are properly enforced.

Based on the information from the Pre-CAP investigation and sample analytical results from 2009, high VOC concentrations were observed in soil and groundwater near the north end of SWMU-181. Elevated COCs in this area may be due to high COC concentrations beneath Building 4-78. Furthermore, Pre-CAP investigation and the June 2009 investigation results indicate that soil vapor extraction would be more effective if wells were placed at the northern end of SWMU-181 (see Figure 12), rather than on the eastern side shown in Figure 9-3 of the FS (Geomatrix, 2008). The higher concentrations of various COCs in soil samples collected at PP178, PP179, PP185, and PP188 merit the use of soil vapor extraction in these wells instead of the locations at the southern and eastern sides of SWMU-181.

Enhanced bioremediation is currently planned for the east side of SWMU-181. This approach would be effective at reducing the residual COC concentrations in groundwater to the east of SWMU-181, although this area may be suitable for MNA alone. At some future time, additional injection wells may be needed on the west side of SWMU-181 and/or near the area of the former fuel piping network once SVE has sufficiently reduced the soil concentrations (which continue to act as a source to groundwater). Additional details of the remedial design will be addressed in the Engineering Design Report and the construction plans and specifications.

6.4 PROPOSED CLEANUP ACTION

Cleanup Alternative 2 (SVE, enhanced bioremediation, monitored attenuation, monitored natural attenuation, and institutional controls) has been selected as the proposed cleanup action, and meets the MTCA requirements for cleanup actions, as discussed in Section 3.4.

A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

6.4.1 Institutional Controls

The following institutional controls would be incorporated into the proposed cleanup action to reduce risk to human health and the environment.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside buildings are protected and indoor air concentrations meet PELs established by the Washington Department of Labor and Industry.

- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and OSHA HAZWOPER regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and groundwater; and

6.4.2 Soil Vapor Extraction

Affected soils in the two source areas would be remediated by SVE. The approximate locations of the SVE extraction wells are shown in Figure 12. These wells would be located to fully address the source areas. The SVE system is considered a suitable element of the proposed cleanup alternative and would address contamination in vadose zone soil above the water table. The conceptual design includes 15 vapor extraction wells distributed throughout the two source areas, with two SVE wells proposed in the area of PP178 and PP201 to address COC concentrations north of Building 4-78.

A blower (approximately 320 cfm) would be used to draw soil gas from the vapor extraction wells. A vapor-phase adsorption system (consisting of potassium permanganate and activated carbon beds operated in series) would be used to control emissions from the SVE system. Air pollution permitting and registration requirements include application for a PSCAA NOC and evaluation of potential emissions to ensure compliance with NESHAPS regulations. Field testing would also be required prior to final design to determine site-specific design parameters for implementation of SVE at the site.

Verification sampling of soils within the source areas treated by SVE would be conducted following shutdown of the SVE system. It has been assumed that this would be accomplished in 5 years. Twelve push-probe borings would be placed randomly within the two source areas, with soil samples collected at depths of 1 foot, 5 feet, and 10 feet. Each soil sample would be analyzed for the soil COCs. Verification sampling may not be possible in all treated areas due to access restrictions created by buildings and site activities.

It is expected that the SVE system would effectively remove volatile COCs and attain soil cleanup levels for most of the soil throughout the two source areas, including the area beneath

buildings. As previously discussed, SVE may not be effective in reaching and removing COCs in fine-grained soils, particularly under buildings. The proposed cleanup action would provide a permanent remedial solution for most affected soil at this site while supporting ongoing industrial activity at the Facility.

6.4.3 Enhanced Bioremediation

Enhanced bioremediation has been included in the proposed cleanup action to address the solvent plume downgradient from Building 4-78. The reductive dechlorination processes that are active at this site would be enhanced by addition of an electron donor and nutrients to the solvent plume groundwater, as appropriate. Increasing the concentration of electron donor and any nutrients that may be deficient would enhance biological activity. The rate of biodegradation would increase, thus destroying the chlorinated solvents present in groundwater. An electron donor (such as sugar substrates, lactate, or emulsified vegetable oil) would be injected just upgradient of groundwater affected by solvents using a line of injection wells located west of Building 4-78 just upgradient of the solvent plume source area (Figure 12). A mobile system consisting of tank, mixers, and pumps would be used to inject electron donor and nutrients as needed into each injection well. Electron donor injected into these wells would cover the width of the plume and move downgradient as groundwater moves, covering the groundwater area.

Based on this conceptual design, a total of eight injection wells would be installed. For costing purposes, it was assumed that four injection events over a 2-year period would be sufficient to achieve full degradation of groundwater COCs. It was estimated that about 250 gallons of 2% emulsified vegetable oil per well (2,000 gallons total) would be injected during each event. For actual implementation, an alternate electron donor may be used, and volume estimates and injection intervals will be refined during the engineering design process.

6.4.4 Monitored Attenuation and Monitored Natural Attenuation

A network of groundwater monitoring wells would be required at the CPOC to assess the effectiveness of the proposed cleanup action. The monitoring program has been designed to verify that the general objectives outlined in Section 3.1.2 are achieved. An on-site CPOC would be established downgradient of the benzene and solvent source areas, and upgradient of the Cedar River Waterway, as shown on Figure 12.

MNA would be implemented to address the benzene plume in groundwater. Results of the highly conservative modeling presented in Appendix A indicate that natural attenuation would attain the cleanup levels for both TPH-G and benzene prior to groundwater reaching the CPOC.

Because of the similar mechanisms between enhanced bioremediation and natural attenuation, the conceptual design for the MA groundwater monitoring program has been developed to address recent U.S. Environmental Protection Agency (EPA) guidance for monitored natural attenuation programs, and the same monitoring program would be used to assess natural attenuation of the benzene plume

For the conceptual design, it was assumed that characterization/validation sampling would consist of quarterly monitoring of 16 monitoring wells for a minimum of 1 year. Eight new monitoring wells would be required (in addition to eight existing wells) to monitor plume migration. The wells would include nested monitoring wells with shallow wells (approximately 15 feet bgs), intermediate wells completed just above the underlying silt layer (about 25 feet bgs), and deep wells completed just below the silt layer (approximately 35 feet bgs). Monitoring parameters and analytes for each of these wells would include TPH-G, benzene, TCE, *cis*-1,2-DCE, VC, and the full suite of MNA geochemical parameters for TPH and chlorinated solvents in groundwater [dissolved oxygen, nitrate, Fe(II), sulfate, chloride, methane, ethene, temperature, pH, specific conductance, alkalinity, oxidation/reduction potential, and TOC]. Data reporting for characterization/validation sampling would follow each quarterly sampling event and an annual report would be prepared evaluating and discussing the monitoring data.

Long-term groundwater monitoring would follow the initial characterization/validation sampling program. Quarterly monitoring of all 16 monitoring wells would continue until a variance is approved by Ecology. Estimated costs for the proposed cleanup action are based on the assumption that intermediate and deep wells would be dropped from the monitoring program after 2 years of quarterly monitoring with Ecology approval, followed by 13 years of semiannual monitoring. For the estimate, it was assumed that all 16 wells would be analyzed once every 5 years for the full list of characterization/validation analytes to monitor overall plume control (in addition to routine analytes). For conceptual design, it was assumed that long-term groundwater monitoring results would be reported to Ecology annually. Long-term monitoring and associated remedial action would end when groundwater meets the site-specific cleanup levels, as approved by Ecology.

7.0 PROPOSED CLEANUP ACTION: FORMER FUEL FARM

The Former Fuel Farm consisted of three USTs used to store Jet A Fuel (URE-033, URE-034, URE-035), located near the south end of Renton Municipal Airport, about 200 feet southeast of Building 5-02 (see Figures 13 and 14). This section describes the proposed cleanup action for the Former Fuel Farm (referred to in this section as the site).

7.1. BACKGROUND

The former Jet A Fuel USTs were installed in 1956 and 1957 and removed during closure activities at the Former Fuel Farm in 1993. The residual petroleum hydrocarbons remaining in soil associated with the three former fuel storage tanks were identified in the Agreed Order as AOC-046, -047, and -048, respectively. URE-033, URE-034, and URE-035 were steel tanks used to store Jet A Fuel. URE-033 and –034 had capacities of 50,000 gallons; URE-035 had a capacity of 12,000 gallons.

Since closure, the Former Fuel Farm site, which is owned by the City of Renton, has been used for employee parking. Boeing leases a portion of the site and adjacent areas from the City. The nearby Boeing-leased buildings and areas are currently used for industrial purposes and are expected to remain in industrial use for the foreseeable future.

7.1.1. Investigation History

Soil sampling performed in 1994 assessed the lateral and vertical extent of TPH-impacted soil near this area. The total volume of soil above MTCA Method A cleanup level was estimated to be approximately 4,400 cubic yards (5,200 tons). Evaluation of chromatograms from Former Fuel Farm soil samples suggests the presence of Jet A Fuel petroleum products and not TPH-G or TPH in the diesel range (TPH-D) (Weston, 1994). The Former Fuel Farm was investigated during the RI in 1999 to 2000, and Section 5.8 of the final RI Report presents site characterization results for these units (Weston, 2001).

The current performance monitoring program for the Former Fuel Farm AOC group consists primarily of biannual groundwater sampling and periodic inspection of the equipment and operational systems. Biannual soil sampling in the Former Fuel Farm source area at fixed push-probe locations was temporarily discontinued in June 2003 with Ecology approval. Soil and groundwater monitoring requirements are discussed in this section.

In June 2009 three soil samples were collected from the source area. As shown on Figure 13, sample results indicate that soil concentrations have attenuated to less than the MTCA Method A cleanup level for TPH-Diesel Range Organics of 2,000 milligrams per kilogram (mg/kg). Two additional downgradient groundwater monitoring wells were installed in

December 2003 to augment the two previously existing groundwater monitoring wells at this site.

During the Pre-CAP investigation (AMEC, 2008), two additional groundwater monitoring wells were installed at the Former Fuel Farm to address Ecology concerns about potential migration of COCs at the site. These wells were sampled in May 2008, and the sample results indicated that groundwater at these wells has not been impacted by the residual soil contamination at the Former Fuel Farm. The current groundwater monitoring program includes semiannual sampling of the six groundwater monitoring wells at the site.

During the Pre-CAP investigation, the air sparge/bioventing system at the Former Fuel Farm was active during groundwater elevation measurements. As a result, the groundwater elevations measured during the investigation were not indicative of groundwater flow under quiescent conditions. In order to accurately quantify groundwater flow directions, Ecology agreed with the recommendation that the system should be shut down for 1 month before collecting an additional round of groundwater elevation measurements. Figure 15 shows groundwater contours for elevation data collected in November 2008 after a 1 month shutdown. Groundwater flow directions across the Former Fuel Farm AOC Group are generally to the north or northwest.

In 2011, after the DCAP (AMEC, 2010) had been distributed for public comment, Boeing became aware of the City's plans to expand an existing building in the Former Fuel Farm area. To ensure that this expansion would not impact cleanup plans and visa versa, Boeing conducted additional investigations of both soil and groundwater in this area. A draft report describing this work was provided to Ecology during the summer of 2011, and Boeing, Ecology, and city staff met at the site in September 2011 to discuss both the expansion and the proposed site cleanup. During this meeting there was consensus that the interim action of the site (described immediately below) had been successful in meeting soil cleanup goals and that the expansion by the City could occur as planned. Furthermore, it was agreed that the selected remedy for the Former Fuel Farm, as described in the draft of this document and as described in Section 7.4, was still needed to address groundwater concerns. As of the fourth quarter of 2011, groundwater cleanup levels had not yet been met. During additional investigations conducted in 2011, photoionization detector readings taken below the water table during push probe borings were high at several locations. Further characterization will be conducted at these depths. The final version of the 2011 Former Fuel Farm Investigation report is provided herein as Appendix D.

7.1.2. Implemented Interim Actions

Previous site cleanup actions in this area have been related to removal of USTs and operation of the 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. TPH-affected soil and groundwater were observed during removal of the tanks. An ongoing interim action at the Former Fuel Farm AOC group was initiated in May 1995 following closure and removal of URE-033 through URE-035. The interim remedial system, which consists of a network of bioventing and biosparging wells, continues to address the residual hydrocarbons remaining in the soil and groundwater at the site. The cleanup objective for the interim action is for residual impacted soil to be reduced to the MTCA Interim TPH Policy Standards (Ecology, 1997) or prevailing MTCA provisions.

7.1.3. Constituents of Concern

Figures 13 and 14 show the nature and extent of COCs for soil and groundwater, respectively, based on the RI and subsequent investigations. As listed in Tables 1 and 2, the COCs for this AOC group are:

- Soil: TPH-Jet Fuel, TPH-D, benzene, and 2-methylnapthalene;
- Groundwater: TPH-Jet Fuel and TPH-D.

During previous investigations, TPH-affected soil extended beyond the lease boundary line to the north, under an adjacent property also owned by the City of Renton (Weston, 1994). TPH-affected soil also extended from the western portion of the Former Fuel Farm toward the northwest. This second area of affected soil remains on the Boeing leased property. Push probe sampling completed in June 2003 indicated a similar extent of TPH-affected soils (Geomatrix, 2003), as shown in Figure 13. Four groundwater monitoring wells have been installed near the source areas, and no TPH-affected soil was observed based on field observations during installation of these wells (Geomatrix, 2004a) and during subsequent monitoring (AMEC, 2008) (Figure 14).

Regular groundwater monitoring conducted at the site has not detected TPH-Jet fuel components dissolved in groundwater samples collected from monitoring wells located around the Former Fuel Farm. Groundwater samples collected from previous push probes within the source areas contained dissolved TPH-Jet fuel above cleanup levels, but none of the samples collected from the groundwater monitoring wells have contained detectable concentrations of TPH-Jet fuel.

7.2. IDENTIFICATION OF CLEANUP ALTERNATIVES

The area of the Former Fuel Farm is owned by the City of Renton and a portion is leased to Boeing. During removal of the USTs, the excavation was extended to approximately the northern lease boundary line near the northeast corner of the Former Fuel Farm.

There is no apparent plume of dissolved TPH-Jet fuel extending from the Former Fuel Farm towards the Cedar River. The lack of a dissolved TPH-Jet fuel plume could be attributable to extensive biodegradation of the mobile and more soluble jet fuel components. The bioremediation interim action is expected to have enhanced aerobic biodegradation of these components in the subsurface and has helped to curtail migration of a dissolved-phase plume from the site.

The affected soil is located below tarmac or pavement. The piping and wellheads of the in situ bioremediation sparge wells and venting wells extend beneath the area of the Former Fuel Farm. Various utilities, including storm drains, sanitary sewers, and other utilities, are located below the paved surface of the Former Fuel Farm site.

Based on the screening evaluation, MTCA minimum threshold requirements, and the site considerations discussed above, the following three cleanup alternatives that could be used to address COCs on the Former Fuel Farm site were developed:

- Cleanup Alternative 1: Existing Biosparging/Bioventing and Monitored Attenuation;
- Cleanup Alternative 2: Upgraded Biosparging/Bioventing and Monitored Attenuation;
- Cleanup Alternative 3: Monitored Natural Attenuation.

7.2.1. Cleanup Alternative 1: Existing Biosparging/Bioventing and Monitored Attenuation

The existing biosparging/bioventing system has operated since May 1995, and although TPH-affected soil still exists in the source area, there is no dissolved-phase plume in groundwater at this site. The existing interim action has likely enhanced ongoing aerobic biodegradation at this AOC group. Therefore, for Cleanup Alternative 1, the existing biosparging/bioventing system would remain in operation. Monitored attenuation would be used to confirm the continued effectiveness of the biosparge/bioventing system.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to ensure it is fully protective of human health and the environment and

enforced on city-owned property through cooperative agreement. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.

- **Continued Biosparging/bioventing Operation –** Continued operation of the existing bioremediation sparge and vent well network would promote aerobic bioremediation of TPH-Jet fuel and related components (including benzene and 2-methylnaphthalene) in the source area soils.

- **Monitored Attenuation –** Groundwater monitoring would be conducted to verify that dissolved TPH-Jet fuel concentrations remain below the cleanup level at the CPOC shown in Figures 13 and 14. Six existing groundwater monitoring wells and five new groundwater wells (four shallow, one intermediate in depth) would be used to monitor attenuation.

7.2.2. Cleanup Alternative 2: Upgraded Biosparging/Bioventing and Monitored Attenuation

The existing biosparging/bioventing system at the Former Fuel Farm AOC group has operated since May 1995, and although TPH-affected soil still exists in the source area, there is no dissolved-phase plume at this site. However, past sampling results within the source areas indicate the presence of a distinct zone of TPH-Jet-fuel-affected soil that still contains high concentrations of TPH-Jet fuel despite operation of the existing system for nearly 10 years.

Review of the biosparge well boring logs and cross-sections A-A' and B-B' (as shown in Figure 2-2 of Weston, 1994) shows that the biosparge wells were installed to a depth of approximately 35 feet. A distinct layer of silt throughout the site is apparent on the cross-sections at an approximate depth of 12 to 25 feet bgs. This layer was apparently breached during installation of the original USTs during the 1950s. As shown by the cross-sections, this layer dips to the northwest. It is possible that air injected below the silt layer rises until it encounters the base of the layer, rises with the contour of the silt layer, bypasses the silt layer and soils above it, and rises within the area of the former tank excavation. This process may prevent the existing bioremediation system from reaching all of the TPH-Jet fuel source areas.

New biosparge wells are proposed under this alternative to correct this possible deficiency. No changes in overall system operation would be expected, because these new wells would supplement rather than replace the current system.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls for this alternative would be similar to those proposed for Cleanup Alternative 1.

- **Upgraded Biosparging/Bioventing –** Enhanced aerobic bioremediation of TPH-Jet fuel and related components (including benzene and 2-methylnaphthalene) in the source area soils would be promoted by continuing to operate the existing bioremediation sparge and vent well network and installation of 13 new biosparge wells screened just above the silt layer. These wells would be installed near existing pipe runs to minimize the additional trenching required. The new wells would focus on the remaining TPH-Jet-fuel-affected soils northeast and northwest of the former USTs.

- **Monitored Attenuation –** Groundwater monitoring would be conducted following the same MA program described above for Cleanup Alternative 1.

7.2.3. Cleanup Alternative 3: Monitored Natural Attenuation

Although the existing bioremediation system appears to be useful in encouraging aerobic degradation of TPH-affected soils and groundwater, after nearly 10 years of operation the original design has likely reached a point of diminishing returns because of the limitations discussed in the previous section. Data suggest that the current bioremediation system could be shut off, and natural processes would continue to biodegrade TPH-Jet-fuel-affected soils and groundwater without the assistance provided by the interim measure. Soil samples collected in June 2009 support this conclusion and indicate that COC concentrations have attenuated to less than cleanup levels in source area soils, eliminating the need for additional soil samples as part of the final remedy. No free-phase light nonaqueous-phase liquid has been identified in groundwater monitoring wells at the Former Fuel Farm. Moreover, results of modeling presented in Appendix A indicate that groundwater cleanup levels for all COCs would be met before groundwater reaches the CPOC for the Former Fuel Farm, and no additional soil removal or soil sampling is needed.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls for this alternative would be similar to those proposed for Cleanup Alternative 1.

- **Monitored Natural Attenuation –** MNA would be used to attain the groundwater cleanup levels at a CPOC established downgradient from the source area, as shown on Figures 13 and 14. Modeling presented in Appendix A indicates that natural attenuation would continue to achieve the cleanup levels for TPH-Jet fuel and TPH-D at the CPOC.

7.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 7 provides a comparison of the cleanup alternatives from the FS report based on the criteria described in Section 3.3. These criteria were used in the FS to evaluate cleanup alternatives for the Former Fuel Farm AOC Group. Cost estimates for each cleanup alternative are presented in Appendix B.

As discussed in Section 10.6 of the FS report, the preferred cleanup alternative for the Former Fuel Farm is Alternative 3 (monitored natural attenuation). The bioremediation sparge and venting system would be shut off, and a rigorous groundwater monitoring program would be implemented to verify that the cleanup standards are maintained at an on-site and off-site CPOC. The institutional controls included in the alternative have been implemented by Boeing and proven effective. Boeing would continue to maintain overall responsibility for this site, and the institutional controls would be properly enforced cooperatively by Boeing and the City of Renton.

Once the DCAP has been approved, a comprehensive compliance monitoring program for the entire Facility (including the Former Fuel Farm AOC Group) will be developed as a part of the Engineering Design Report.

7.4 PROPOSED CLEANUP ACTION

Cleanup Alternative 3 (monitored natural attenuation and institutional controls) has been selected as the proposed cleanup action, and meets the MTCA requirements for cleanup actions as discussed in Section 3.4. Natural attenuation of TPH-Jet fuel in the source area soils and groundwater would permanently destroy soil and groundwater COCs. Given that other risks from the TPH-Jet fuel in soils can be managed through institutional controls and that the soils are confined by the existing pavement or tarmac, no additional active measures are necessary to remediate soils at this site. A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

7.4.1 Institutional Controls

The following institutional controls would be incorporated into the proposed cleanup action to reduce risk to human health and the environment.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside adjacent Boeing buildings are protected and indoor air concentrations meet PELs established by the Washington Department of Labor and Industry.

- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and OSHA HAZWOPER regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and groundwater. These procedures will be enforced cooperatively by Boeing and the City.

- An on-lease and off-lease CPOC would be established for this alternative.

- Recovery and use of groundwater beneath the site would be restricted. This institutional control would require cooperation from the City of Renton, because the City is responsible for the property being leased by Boeing. Recovery of groundwater in this area for any purpose other than construction dewatering would be prohibited.

7.4.2 Monitored Natural Attenuation

A network of groundwater monitoring wells, as illustrated in Figure 16, would be required at the CPOC to assess the effectiveness of the proposed cleanup action. An on-site and off-site CPOC would be established downgradient of the Former Fuel Farm with the concurrence of the landowner, the City of Renton. The monitoring program has been designed to verify that the general objectives outlined in Section 3.1.2 are achieved.

A detailed MNA design would be developed to guide the process. This work plan would identify additional monitoring wells and monitoring analytes required for long-term groundwater monitoring. For this conceptual design, it was assumed that characterization/validation sampling would consist of quarterly monitoring of new wells and semiannual monitoring of existing wells for a minimum of 1 year. Five new monitoring wells (four shallow and one intermediate) would be required (in addition to the six existing wells) to monitor potential plume migration. Monitoring parameters and analytes would consist of TPH-Jet fuel, TPH-D, BTEX, and appropriate MNA geochemical parameters [dissolved oxygen, nitrate, Fe(II), sulfate, methane, temperature, pH, specific conductance, alkalinity, oxidation/reduction potential, chloride, ethane, and TOC]. Reporting for characterization/validation sampling would follow each quarterly event.

Long-term groundwater monitoring would follow the initial characterization/validation sampling program. Quarterly monitoring of all new wells and semiannual monitoring of existing wells would continue until a variance is approved by Ecology. Estimated costs for the proposed cleanup action are based on the assumption that intermediate wells would be dropped from the monitoring program after 2 years of quarterly monitoring with Ecology approval followed by 13 years of semiannual monitoring. For the estimate, it was assumed that all 11 monitoring wells would be analyzed once every 5 years for the full list of characterization/validation analytes to monitor overall plume control (in addition to the routine analytes). For conceptual design, it was assumed that long-term monitoring results would be reported to Ecology annually. Long-term monitoring and associated remedial action would end when groundwater meets the site-specific cleanup levels, as approved by Ecology.

8.0 PROPOSED CLEANUP ACTION: AOC-001/002

AOC-001/002 are located near the northwest corner of Building 4-81 in the northern portion of the Facility, as shown in Figure 17. This section describes the proposed cleanup action for this area.

8.1 BACKGROUND

AOC-001 and AOC-002, two areas of concern, were originally associated with former USTs URE-01 and URE-02, respectively. The Lake Washington shoreline is approximately 350 feet northwest of the former location of these USTs. Both USTs were installed in 1980 for storage of MEK and toluene. Each steel tank had a capacity of 500 gallons, and 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 investigation 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. The RI and the FSWP grouped AOC-003 with AOC-001/002 because of their proximal locations and similar COCs. However, AOC-003 is several hundred feet upgradient of AOC-001/002, and the current data suggest that there is no commingling of contaminants from these areas. For these reasons, this DCAP deals with AOC-001/002 and AOC-003 as separate entities.

8.1.1 Investigation History

This area was investigated in several phases of RI and post-RI investigation to further delineate the nature and extent of affected soil and groundwater. Additional investigation was completed at this area in April and May 2008 to evaluate current VOC concentrations in soil and groundwater at the secondary source area. Three shallow injection wells (GW213S, GW214S, and GW215S) were installed in April 2008 as part of the Pre-CAP Investigation (AMEC, 2008). These wells would be used to inject electron donor within the target shallow zone. Soil samples were collected at each injection well location.

8.1.2 Implemented Interim Actions

Two interim actions have been conducted for AOC-001/002. The first was implemented in 1986 when the USTs in the source areas were removed. The second was conducted in 2005. Each interim action is described briefly below.

8.1.2.1 AOC-001/002 Interim Action, 1986

Both USTs at AOC-001/002 were removed in July 1986. A total of 130 cubic yards of soil was removed from the URE-01 and URE-02 excavation 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.

8.1.2.2 AOC-001/002 Interim Action, 2005

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. The interim measure included:

- Installation and sampling of nine direct-push boreholes for collection of soil and groundwater samples to more thoroughly delineate the extent of affected soil near the source area;
- 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 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 site COCs in groundwater;
- 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 from the site. Confirmation data also indicated that soil affected with petroleum hydrocarbons was removed from the source area. Groundwater monitoring data collected subsequent to the interim action indicate that biodegradation is active and that concentrations of chlorinated VOCs are decreasing.

In June 2007, a second dose of sugar substrate donor material (1,600 gallons) was injected into the system to promote reductive dechlorination of site COCs in groundwater (Geomatrix, 2007).

8.1.3 Constituents of Concern

Figures 17, 18 (sheet 1 of 2), and 18 (sheet 2 of 2) show the nature and extent of COCs for soil and groundwater, based on the RI and subsequent investigations. As listed in Tables 1 and 2, the COCs for this area are:

- Soil: TCE, degradation products of TCE, and TPH-G;
- Groundwater: benzene, chlorinated solvents, solvent degradation products, and one SVOC (naphthalene).

Two source areas have previously been identified at AOC-001/002. 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 the former URE-01 and URE-02 (Figures 17 and 18 [sheet 1 of 2]). Affected soil was removed from the primary source area as part of the 2005 interim measure. In general, the primary source area had higher COC concentrations than the secondary source area. Both source areas are affected by chlorinated VOCs; the primary source area is also affected by TPH-G at concentrations exceeding cleanup levels.

Affected groundwater extends downgradient from the area identified as the primary soil source area (Figure 18 [sheet 1 of 2], and Figure 18 [sheet 2of 2]). Groundwater samples collected from direct-push boreholes during the Supplemental RI and reported in the FSWP (Geomatrix, 2004b) and in a more recent investigation (Geomatrix, 2004c) contained dissolved chlorinated VOCs at concentrations exceeding cleanup levels defined in the FSWP. Groundwater quality data indicate that affected groundwater associated with AOC-001/002 is present near the excavated source area (i.e., within about 250 feet of the primary source area) and in an area near PP081 and PP098.

Groundwater samples collected below the lower permeability peaty silt layer underlying this site and downgradient from the primary source area did not exceed groundwater cleanup levels for any of the COCs. The results of the downgradient groundwater sampling indicate that groundwater beneath the silty peat layer has not been affected by COCs (Figure 18 [sheet 1 of 2], and Figure 18 [sheet 2of 2]).

8.2 IDENTIFICATION OF CLEANUP ALTERNATIVES

Remedial alternatives have been identified and developed for AOC-001/002. The alternatives specifically address site conditions, the site remedial objectives, and the soil and groundwater cleanup levels for AOC-001/002. Development of these alternatives is based on present site conditions, considering the previously implemented interim actions.

The Facility property line lies to the north of AOC-001/002, with either Lake Washington or Washington Department of Natural Resources (DNR) land north of the property line. All on-site property adjacent to AOC-001/002 is owned by Boeing and used solely for industrial purposes. The primary source area is generally accessible and is not near any aboveground structures. The secondary source area is adjacent to substantial underground utilities, including a stormwater diversion structure and a stormwater wet vault. AOC-001 and AOC-002 are located within the tow path used for moving partially completed aircraft from Building 4-81 to other portions of the Facility. This tow path is a significant site activity that will affect access to AOC-001/002 for remedial construction. Use of the area as a tow path will also affect the design of any remediation system.

Based on the screening evaluation, MTCA minimum threshold requirements for cleanup (WAC 173-340-360), and the site considerations discussed above, two cleanup alternatives were developed for this site:

- Alternative 1: Enhanced Bioremediation and Monitored Attenuation;
- Alternative 2: Monitored Natural Attenuation.

8.2.1 Cleanup Alternative 1 – Enhanced Bioremediation and Monitored Attenuation

Cleanup Alternative 1 for AOC-001/002 includes enhanced bioremediation to actively degrade the chlorinated VOCs present in site groundwater and source area soils. As noted previously, affected soil within the primary source area was removed as an interim measure; enhanced bioremediation within the primary source area was also implemented as an interim measure.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to ensure it is fully protective of human health and the environment. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.
- **Containment by Capping –** The area around AOC-001/002 is essentially capped by the existing 12- to 18-inch-thick tarmac which limits recharge, limits the potential for soil COCs to leach into groundwater, and limits the potential for direct exposure of human or ecological receptors to soil or groundwater COCs.
- **Enhanced Bioremediation –** The reductive dechlorination processes that are active at this site would be enhanced by further addition of electron donor and nutrients, as appropriate. An electron donor (such as sugar substrates, lactate, or

emulsified vegetable oil) would be injected into affected groundwater along the upgradient edge of the plume in both source areas.

- **Monitored Attenuation –** Monitored attenuation would be accomplished using a network of groundwater monitoring wells shown on Figure 19 to assess the effectiveness of enhanced bioremediation and confirm that the cleanup standard is met. Since the plume extends downgradient from the two source areas, an on-site CPOC would be used to ensure the cleanup standard is being attained during the bioremediation program. It is expected that enhanced bioremediation would attain the standard POC in the future, after biodegradation processes have proceeded to completion.

8.2.2 Cleanup Alternative 2 – Monitored Natural Attenuation

Cleanup Alternative 2 incorporates MNA rather than enhanced bioremediation to destroy site COCs within affected groundwater. All other elements of this alternative are the same as described above for Cleanup Alternative 1 (i.e., containment by concrete tarmac that would effectively cap the affected area, groundwater monitoring, and institutional controls).

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Cleanup Alternative 2 would be the same as those described above for Cleanup Alternative 1.

- **Containment by Capping –** The area around AOC-001/002 is already essentially capped by the existing 12 to 18 inches thick tarmac, as discussed above for Cleanup Alternative 1.

- **Monitored Natural Attenuation –** MNA would be used to attain the groundwater cleanup levels at a CPOC established upgradient from the Lake Washington shoreline, as shown on Figure 19. Fate and transport groundwater modeling presented in Appendix A indicates that natural attenuation may attain the cleanup levels for TCE, *cis*-1,2-DCE, and VC in groundwater at the CPOC given sufficient time to achieve them.

8.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 8 provides a comparison of the cleanup alternatives from the FS report based on the criteria described in Section 3.3. These criteria were used in the FS to evaluate cleanup alternatives for AOC-001/002. Estimated costs for each alternative are presented in Appendix B.

As discussed in Section 11.6 of the FS report, the proposed cleanup action for AOC-001/002 is Cleanup Alternative 1, enhanced bioremediation and monitored attenuation. This alternative was selected because it would provide a more rapid restoration time frame. However, it would also have a greater impact on Facility operations. The previously implemented interim measure has removed much of the affected soil exceeding the soil cleanup levels. The

existing concrete tarmac cover would limit infiltration of surface water into and through affected soils. Enhanced bioremediation would rapidly and permanently destroy constituents present in groundwater. The MA program would verify that the cleanup standard is attained. The proven institutional controls would continue to be implemented to protect worker health and safety.

8.4 PROPOSED CLEANUP ACTION

Cleanup Alternative 1 has been selected as the proposed cleanup action for this site. Enhanced bioremediation, monitored attenuation, and institutional controls meet the MTCA requirements for cleanup actions, as discussed in Section 3.4.

Results of the Pre-CAP field investigation show that soil and groundwater COC concentrations in the secondary source area have decreased significantly since last sampled during the RI. The low concentrations of chlorinated VOCs observed in soil and groundwater during the Pre-CAP investigation indicate that the secondary source at AOC-001/002 may not require aggressive treatment using enhanced bioremediation and could possibly be addressed by MNA alone. This issue will be revisited in the Engineering Design Report during final design of the cleanup action.

A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

8.4.1 Containment by Capping

The area around AOC-001/002 is essentially capped by the existing tarmac. Due to the heavy industrial use of this area, the concrete tarmac is 12 to 18 inches thick. The tarmac is also sloped to promote runoff, which is collected in existing storm sewers. This tarmac functions as a cap and would limit the potential for soil COCs to leach into groundwater and limit the potential for direct exposure of human or ecological receptors to soil or groundwater COCs. By significantly limiting recharge into the AOC-001/002 area, the tarmac reduces groundwater flow velocities and increases the travel time for groundwater to reach Lake Washington. The increased travel time would improve conditions for biodegradation of groundwater constituents. The existing concrete tarmac cover over AOC-001/002 would improve the performance of this cleanup alternative.

8.4.2 Enhanced Bioremediation

Enhanced bioremediation and MA would be used to address affected groundwater and any remaining affected soil within the saturated zone at AOC-001/002. For the conceptual design, it was assumed that a mobile system consisting of tank, mixers, and pumps would be used to inject electron donor and nutrients as needed into the three new injection wells located at the secondary source area and into the two injection pipe risers located in the primary source

area. Electron donor injected into these wells and risers would cover the constituent source areas and move downgradient with groundwater, eventually covering the affected groundwater area and saturated soils within the two source areas.

It is anticipated that up to six injection events over a 3-year period would be sufficient to achieve full degradation of groundwater COCs within the secondary source area. An estimated 600 pounds of sodium lactate would be injected for each event, to be divided equally among the three injection wells. During 2008, Boeing installed the three new injection wells (GW213S, GW214S, and GW215S) in the secondary source area as a part of the Pre-CAP investigation. Only low levels of VOCs were detected, with no detections of vinyl chloride (Figure 18 (sheet 1 of 2)). Additional groundwater monitoring will be performed to determine the need for substrate injections in this area.

As noted previously, electron donor was placed into the primary source area as part of the interim measure. A second injection event for the primary source area was completed in 2007 (Geomatrix, 2007). Based on previous investigations, one additional injection event using the same volume of electron donor and injection methods described in the work plan (Geomatrix, 2007) would likely be needed to fully attain the cleanup standard for this site. For cost estimating purposes, it was assumed that a combined total of 11,000 gallons of emulsified vegetable oil would be injected into IPR1 and IPR2. Other substrates may be used as appropriate, and volume estimates will be refined during remedial design.

8.4.3 Institutional Controls

The following institutional controls would be implemented to protect human health and the environment.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside buildings are protected and indoor air concentrations meet PELs established by the Washington Department of Labor and Industry.

- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and OSHA HAZWOPER regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and groundwater.

8.4.4 Monitored Attenuation

Fate and transport modeling presented in Appendix A indicates that biodegradation would be effective in attaining cleanup levels at the on-site CPOC shown on Figure 19. The CPOC for AOC-001/002 is located 60 feet southwest of Lake Washington (Figure 19). Monitored

attenuation would be accomplished using the network of groundwater monitoring wells shown on Figure 19 to assess the effectiveness of the cleanup action. As shown on Figure 19, one new shallow monitoring well will be installed near PP133 to assess groundwater quality in the area between the primary source area and the CPOC and one new shallow monitoring well will be installed along the CPOC. It is expected that enhanced bioremediation would attain the standard POC in the future, after biodegradation processes have proceeded to completion. The monitoring program for AOC-001/002 would be designed to verify that the general objectives outlined in Section 3.1.2 are achieved. A detailed MA monitoring plan would be developed to identify existing and additional monitoring wells and analytes that would be required for both characterization/validation sampling and long-term groundwater monitoring.

For this conceptual program, it was assumed that characterization/validation sampling would consist of quarterly monitoring of nine existing monitoring wells for a minimum of 1 year after implementation of Alternative 1. The monitoring network would include shallow wells and deep wells completed just below the silt/peat layer. Monitoring parameters and analytes for each of these wells would include all groundwater COCs for AOC-001/002. Analyses during the first 1 to 2 years of quarterly monitoring would include the full suite of MNA geochemical parameters for chlorinated solvent plumes [dissolved oxygen, nitrate, Fe(II), sulfate, methane, temperature, pH, specific conductance, alkalinity, oxidation/reduction potential, and TOC]. Quarterly sampling would be conducted for 2 years, data reporting for characterization/validation sampling would follow each quarterly sampling event, and an annual report would be prepared evaluating and discussing the monitoring data.

Long-term groundwater monitoring would follow the initial characterization/validation sampling program. Quarterly monitoring of all 11 monitoring wells would continue until a variance is approved by Ecology. Estimated costs for the proposed cleanup action are based on the assumption that 2 years of quarterly monitoring will be followed by 13 years of semiannual monitoring with Ecology approval. For the estimate, it was assumed that all 11 wells would be analyzed once every 5 years for the full list of characterization/validation analytes to monitor overall plume control (in addition to the routine analytes). For conceptual design, it was assumed that long-term monitoring results would be reported to Ecology annually. Long-term monitoring and associated remedial action would end when groundwater meets the site-specific cleanup levels, as approved by Ecology.

9.0 PROPOSED CLEANUP ACTION: AOC-003

AOC-003 is located at the north side of the Facility between Buildings 4-20 and 4-81. AOC-003 represents the former UST URE-03 that was located just west of Building 4-81, as shown on Figure 20. This section describes the proposed cleanup action for this area.

9.1 BACKGROUND

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. The RI and the FSWP grouped AOC-003 with AOC-001/002 because of their proximal locations and similar COCs. However, AOC-003 is several hundred feet upgradient of AOC-001/002, and the current data suggest that there is no commingling of contaminants from these areas. For these reasons, this DCAP deals with AOC-001/002 and AOC-003 as separate entities.

9.1.1 Investigation History

Following the removal of this UST 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.

9.1.2 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.

9.1.3 Constituents of Concern

Figure 20 shows the nature and extent of COCs for soil and groundwater based on the RI and subsequent investigations. As listed in Tables 1 and 2, the COCs for this area are:

- Soil: TCE;
- Groundwater: PCE, TCE, *cis*-1,2-DCE, and VC.

Soil contains TCE, but observed concentrations are below the cleanup level. PCE and VC were detected at concentrations exceeding their respective groundwater CULs in groundwater samples collected at PP016 in May 1999. More recent groundwater monitoring has identified degradation products VC and *cis*-1,2-DCE in groundwater samples from the downgradient well GW-188S, but at concentrations only marginally higher than the respective CULs. The

presence of these degradation products indicates that biodegradation is actively occurring at AOC-003.

9.2 IDENTIFICATION OF CLEANUP ALTERNATIVES

Cleanup alternatives have been identified and developed for AOC-003. The alternatives specifically address site conditions, the site remedial objectives, and the soil and groundwater cleanup levels for AOC-003. Development of these alternatives is based on present site conditions, considering the previously implemented interim action.

AOC-003 is located in an area that serves dual purposes. Most of the time, this site is used as an employee parking area for the Facility. However, parking within this area is closed in the late afternoon and evening so that the area can be used as a tow path for commercial airplanes. Airplanes manufactured at the site are moved along this tow path to reach other areas of the Facility or, upon their completion, are moved to the Renton Airport where they depart the site. Maintaining an open tow path is critical to the operation of the Renton Facility, and this requirement could limit or constrain remedial alternatives.

Based on the screening evaluation, MTCA minimum threshold requirements for cleanup (WAC 173-350-360), and the site considerations discussed above, the following two remedial alternatives addressing groundwater COCs were developed for AOC-003:

- Cleanup Alternative 1: Monitored Natural Attenuation;
- Cleanup Alternative 2: Enhanced Bioremediation and Monitored Attenuation.

An alternative incorporating SVE was also initially considered for this AOC but was eliminated because of the limited available vadose zone, making SVE inappropriate for the site. The depth to groundwater for this AOC is typically between 1.5 and 3 feet bgs.

9.2.1 Cleanup Alternative 1 – Monitored Natural Attenuation

Cleanup Alternative 1 for AOC-003 includes institutional controls and MNA. The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to ensure it is fully protective of human health and the environment. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.

- **Monitored Natural Attenuation –** MNA would be used to attain the groundwater cleanup levels at a CPOC established upgradient from the Lake Washington shoreline, as shown on Figure 21. Fate and transport groundwater modeling presented in Appendix A indicates that natural attenuation may attain the cleanup levels for the groundwater COCs (PCE, TCE, *cis*-1,2-DCE, and VC) at the CPOC given sufficient time to achieve them.

9.2.2 Cleanup Alternative 2 – Enhanced Bioremediation and Monitored Attenuation

Alternative 2 for AOC-003 includes enhanced bioremediation through introduction of electron donor to further promote the natural biodegradation that is occurring at the site and MA, instead of MNA, along with institutional controls, as described above for Cleanup Alternative 1.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Cleanup Alternative 2 would be the same as those described above for Cleanup Alternative 1.

- **Enhanced Bioremediation –** The reductive dechlorination processes that are active at this site would be enhanced by further addition of electron donor and nutrients, as appropriate. An electron donor (such as emulsified vegetable oil, sodium lactate, or some other similar substrate) would be injected into an injection zone surrounding the source area.

- **Monitored Attenuation –** Monitored attenuation would be accomplished using a network of groundwater monitoring wells to assess the effectiveness of enhanced bioremediation and confirm that the cleanup standard is met. Since the plume extends downgradient from the source area, an on-site CPOC would be used to verify that the cleanup standard is being attained during the bioremediation program.

9.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 9 provides a comparison of the cleanup alternatives from the FS report based on the criteria described in Section 3.3. These criteria were used in the FS to evaluate cleanup alternatives for AOC-003. Estimated costs for each of the cleanup alternatives are presented in Appendix B.

As discussed in Section 12.6 of the FS report, the proposed cleanup action for AOC-003 is Cleanup Alternative 2, enhanced bioremediation and monitored attenuation. This alternative was selected because it is the most permanent potential remedy, and although it does not provide additional benefits over Cleanup Alternative 1, it may achieve these benefits quicker and does not have a disproportionate cost. Under the proposed cleanup action, affected soils would remain capped by maintained pavement or tarmac, which would prevent potential runoff and infiltration of rainfall. Groundwater in the area is not used for any purpose, and potable water is readily available from the Renton public water system. The institutional controls

included in Cleanup Alternative 2 have been implemented and proven by Boeing, who would continue to maintain overall responsibility for this site and ensure that the institutional controls are properly enforced.

9.4 PROPOSED CLEANUP ACTION

Cleanup Alternative 2 has been selected as the proposed cleanup action for AOC-003. Enhanced bioremediation, monitored attenuation, and institutional controls meet the MTCA requirements for cleanup actions, as discussed in Section 3.4. Therefore this alternative will be the proposed cleanup action for AOC-003.

A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

9.4.1 Institutional Controls

The following institutional controls are included to reduce the risk of human exposure to impacted soil or groundwater.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside buildings are protected and indoor air concentrations meet PELs established by the Washington Department of Labor and Industry.
- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and OSHA HAZWOPER regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and groundwater.

9.4.2 Enhanced Bioremediation

Electron donor would be introduced to the subsurface to enhance ongoing biodegradation. The electron donor could be emulsified vegetable oil, sodium lactate, or some other similar substrate, applied using dedicated injection wells or using direct-push methods. The conceptual design assumes a series of four injection wells in an injection zone surrounding the source area (Figure 21). The injection wells, constructed of 2-inch-diameter polyvinyl chloride, are assumed to be screened in the impacted aquifer between 5 and 15 feet bgs. For the conceptual design, it was assumed that a total of 1,000 gallons of 2 percent emulsified vegetable oil would be injected into the four injection wells in approximately equal portions. It was also assumed that three applications (at 1-year intervals) would be required to effectively treat the aquifer, resulting in a total injection of 3,000 gallons of 2 percent emulsified vegetable oil. For costing of this approach, it was assumed that pilot testing is not needed, as enhanced bioremediation using emulsified vegetable has been performed successfully at the Facility as

an interim measure. Prior to installation of the injection wells, groundwater will be evaluated utilizing the proposed monitoring well network to determine if enhanced bioremediation is necessary. If contaminant concentrations are found to meet cleanup levels, monitored natural attenuation may be found to be the preferred cleanup approach. The final design will be determined in an Engineering Design Report.

9.4.3 Monitored Attenuation

Monitored attenuation for this cleanup approach is intended to be a final "polishing" mechanism, following the active enhanced bioremediation, to confirm that cleanup levels for all COCs are met at the CPOC. The conceptual monitoring program has been designed to verify that the general objectives outlined in Section 3.1.2 are achieved. MA would commence after the first enhanced bioremediation injection event, and would consist of long-term groundwater monitoring. Three new monitoring wells (one shallow source area well, one shallow CPOC well, and one intermediate depth CPOC well) and one existing well (GW188S) would be used to monitor the source area and plume migration. GW188S may be converted to an injection well if monitoring results indicate that substrate injections are needed in this area. Characterization/validation sampling would consist of quarterly monitoring of the four monitoring wells for a minimum of 1 year. Monitoring parameters and analytes would consist of VOCs (contaminants and daughter products), as well as the full suite of MNA geochemical parameters [dissolved oxygen, nitrate, Fe(II), sulfate, methane, temperature, pH, specific conductance, alkalinity, oxidation/reduction potential, chloride, ethane, and TOC]. It is assumed that reporting for characterization/validation sampling would follow each quarterly event.

Long-term groundwater monitoring would follow for an estimated additional 13 to 14 years (15 total years of monitoring) and include semiannual monitoring of four wells for VOCs (contaminants and daughter products) and a limited suite of geochemical parameters (dissolved oxygen, oxidation/reduction potential, temperature, and pH). All four wells would be analyzed once every 5 years for the entire characterization/validation list of analytes. The frequency of sampling and the duration of the groundwater monitoring program would be based on the results of performance monitoring, and may be adjusted as appropriate. It is assumed that monitoring would continue for a total of 15 years, and that annual reporting would be required for the duration. Long-term groundwater monitoring and associated remedial actions would end when site-specific groundwater cleanup levels have been achieved.

10.0 PROPOSED CLEANUP ACTION: 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 22). This section describes the proposed cleanup action for this area.

10.1 BACKGROUND

The former UST at AOC-004 was used for the storage of 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.

10.1.1 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. Due to the length of time between collection of the soil and groundwater samples during the RI and the approval of the Draft Final FS report, Boeing decided to collect another round of soil samples prior to development of the DCAP. The soil samples were collected from two additional push probes during the April 2008 Pre-CAP investigation (AMEC, 2008).

During the Pre-CAP investigation it was noted that Boeing had completed excavations in the area immediately surrounding AOC-004. These excavations were completed around the footings of seismic upgrade structures for the adjacent Building 4-21. These structures may limit the possibility of future excavation in the area of AOC-004.

10.1.2 Implemented Interim Actions

The 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 if gasoline-impacted soil was removed from the excavation.

10.1.3 Constituents of Concern

Figure 22 shows the nature and extent of COCs for soil and groundwater based on the RI and subsequent investigations. As listed in Tables 1 and 2, the COCs for this area are:

- Soil: TPH-G, benzene, toluene, ethylbenzene, and acetone;
- Groundwater: TPH-G, benzene, and lead.

Results from the Pre-CAP investigation show that the source area soils still contain TPH-G and fuel-related COCs well above the soil cleanup levels. The source of the aromatic VOCs

and TPH-G in the shallow soil can be attributed to a past release from the former UST. The acetone detected in the soil sample was considered a nontarget analyte for this AOC (Weston, 2001). Because the Pre-CAP COC concentration data for the soil are higher than the data collected during the RI, groundwater contamination levels may be different from the RI results of a decade ago.

10.2 IDENTIFICATION OF CLEANUP ALTERNATIVES

Information available when the former UST URE-04 was excavated and removed in 1986 did not indicate if gasoline-impacted soil was removed from the excavation. The UST was located within approximately 10 feet of Building 4-21. Analytical data from the RI indicate that TPH-G and associated compounds were present in site soils and groundwater at concentrations exceeding the respective cleanup levels. Soil sample results from the RI indicate that elevated TPH-G concentrations occur close to the former UST location and Building 4-21. Furthermore, the RI results indicate that the vertical extent of these constituents is less than 10 feet bgs (Weston, 2001). Due to the proximity of remaining affected soil to the foundation and footings of Building 4-21 as well as the newer footings for the seismic upgrade, any soil excavation would need to be limited as it may threaten the building.

Based on the screening evaluation, MTCA minimum threshold requirements for cleanup (WAC 173-350-360), and the site considerations discussed above, the following two remedial alternatives addressing groundwater COCs were developed for AOC-004:

- Cleanup Alternative 1 – Monitored Natural Attenuation;
- Cleanup Alternative 2 – Enhanced Bioremediation and Monitored Attenuation.

10.2.1 Cleanup Alternative 1 – Monitored Natural Attenuation

Cleanup Alternative 1 would consist of the following primary elements: institutional controls, MNA, and excavation and disposal of limited quantities of affected soil. The source area soil sample contained TPH-G at a concentration of 12,000 to 16,000 mg/kg, which exceeds the residual saturation screening level for weathered gasoline of 1,000 mg/kg and is also greater than the MTCA Method A cleanup level for TPH-G. Therefore, additional action, such as excavation of soils affected by TPH-G, would be included as a conservative measure under this alternative.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to ensure it is fully protective of human health and the environment. In general, the institutional controls that would be incorporated into this remedial

alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.

- **Monitored Natural Attenuation –** Since source area soils exceeded cleanup levels for TPH-G, limited excavation of affected soil would be performed in the source area. However, no excavation below the water table would be performed. After excavation was completed, MNA would be used to attain the groundwater cleanup levels at a CPOC established downgradient from the source area, as shown on Figure 23. Using data obtained during RI activities and assuming no new releases have occurred in the vicinity of AOC-004, fate and transport groundwater modeling presented in Appendix A indicates that natural attenuation would achieve cleanup levels at the CPOC for TPH-G, benzene, and the other fuel components.

10.2.2 Cleanup Alternative 2 – Enhanced Bioremediation and Monitored Attenuation

Alternative 2 would consist of institutional controls, enhanced bioremediation, and MA.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Alternative 2 would be the same as those described above for Cleanup Alternative 1.

- **Enhanced Bioremediation –**Enhanced bioremediation for AOC-004 would consist of injecting a terminal electron acceptor (TEA), such as an oxygen-releasing compound (ORC), ammonium nitrate, or calcium nitrate, into the source area groundwater to promote degradation of petroleum compounds.

- **Monitored Attenuation –** As with Cleanup Alternative 1, limited excavation of soil would be performed in the AOC-004 source area. Monitored attenuation would be accomplished using a small network of groundwater monitoring wells to assess the effectiveness of enhanced bioremediation and confirm that the cleanup standard is met. An on-site CPOC would be used to verify that the cleanup standard is being attained during the bioremediation program.

10.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 10 provides a comparison of the cleanup alternatives from the FS report based on the criteria described in Section 3.3. These criteria were used in the FS to evaluate cleanup alternatives for AOC-004. Estimated costs for each of the alternatives are presented in Appendix B.

As discussed in Section 13.6 of the FS report, the proposed cleanup action for AOC-004 is Cleanup Alternative 2, enhanced bioremediation and monitored attenuation. Cleanup Alternative 2, as the most permanent potential remedy, does not provide additional benefits over Cleanup Alternative 1. However, it may achieve these benefits quicker and does not have a disproportionate cost. The institutional controls included in Cleanup Alternative 2 have

been implemented and proven by Boeing, who would continue to maintain overall responsibility for this site and ensure that the institutional controls are properly enforced.

10.4 PROPOSED CLEANUP ACTION

Cleanup Alternative 2 is selected as the proposed cleanup action for this site. Enhanced bioremediation, monitored attenuation, and institutional controls meet the MTCA requirements for cleanup actions, as discussed in Section 3.4. Therefore this alternative will be the proposed cleanup action for AOC-004.

A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

10.4.1 Institutional Controls

The following institutional controls are included to reduce the risk of human exposure to impacted soil or groundwater.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside buildings are protected and indoor air concentrations meet PELs established by the Washington Department of Labor and Industry.

- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and OSHA HAZWOPER regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and groundwater.

10.4.2 Enhanced Bioremediation

Enhanced bioremediation for AOC-004 would consist of injecting a TEA, such as ORC, ammonium nitrate, or calcium nitrate, into the source area groundwater to promote degradation of petroleum compounds. For conservative estimation of remediation costs, it was assumed that approximately 300 pounds of ORC would be injected directly into the subsurface at nine points located in the immediate vicinity of the source area at depths of approximately 4 feet to 14 feet bgs. If a nitrate were selected as the TEA, an equivalent dosage would be determined and injected in the same general manner as assumed for the ORC.

10.4.3 Monitored Attenuation

Since shallow soil at AOC-004 exceeded MTCA Method A cleanup levels for TPH-G, limited excavation of affected soil would be performed in the source area. Monitored attenuation for this alternative is intended to be a final “polishing” mechanism, following excavation and the

active enhanced bioremediation, to confirm that cleanup levels for all COCs are met at the CPOC. MA would follow enhanced bioremediation and consist of the long-term groundwater monitoring program for one existing well (GW174) and three new wells, as illustrated on Figure 23.

The conceptual monitoring program has been designed to verify that the general objectives outlined in Section 3.1.2 are achieved. Characterization/validation sampling would consist of quarterly monitoring of three monitoring wells for a minimum of 1 year. The monitoring network would consist of existing well GW174, one shallow well located within the source area, with two additional shallow wells located along the CPOC (Figure 23). Monitoring parameters and analytes would consist of acetone, benzene, ethylbenzene, toluene, TPH-G, as well as the full suite of MNA geochemical parameters for hydrocarbon sites [dissolved oxygen, nitrate, Fe(II), sulfate, methane, temperature, pH, specific conductance, alkalinity, and oxidation/reduction potential]. Reporting would follow each quarterly event.

Long-term groundwater monitoring would be conducted semiannually for acetone, benzene, ethylbenzene, toluene, TPH-G, and a limited suite of geochemical parameters (dissolved oxygen, oxidation/reduction potential, temperature, and pH). All three monitoring wells would be analyzed once every 5 years for the entire list of analytes. It is assumed that monitoring would continue following active remediation for an estimated total of 15 years of monitoring, and that annual reporting would be required for the duration. Long-term groundwater monitoring and associated remedial actions would end when site-specific groundwater cleanup levels have been achieved.

11.0 PROPOSED CLEANUP ACTION: AOC-034/035

AOC-034/035 is located next to the south side of Building 4-41, as shown in Figures 24 and 25. This section describes the proposed cleanup action for this area.

11.1 BACKGROUND

AOC-034/035 is the location of former underground storage tanks URE-07 and URE-08. Both USTs 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.

11.1.1 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. Additional investigation was completed at this area in April and May 2008 to further evaluate groundwater flow direction and current groundwater conditions. Three shallow monitoring wells (GW216S, GW217S, and GW218S) were installed in April 2008 as part of the Pre-CAP investigation (AMEC, 2008).

11.1.2 Constituents of Concern

Figures 24 and 25 show the nature and extent of COCs for soil and groundwater based on the RI and subsequent investigations. As listed in Tables 1 and 2, the COCs for this area are:

- Soil: *cis*-1,2-DCE and VC;
- Groundwater: *cis*-1,2-DCE and VC.

The source area, including the underground tanks and impacted soil, have been removed. Analytical results from the Pre-CAP investigation are generally consistent with the findings from the RI and indicate a historic release of chlorinated solvent that is naturally biodegrading. Pre-CAP investigation results indicate that natural attenuation is active and is essentially attaining CULs at the CPOC.

11.2 IDENTIFICATION OF CLEANUP ALTERNATIVES

Cleanup alternatives have been identified and developed for AOC-034/035. The alternatives specifically address site conditions, the site remedial objectives, and the soil and groundwater cleanup levels for AOC-034/035. Development of these alternatives is based on present site conditions, considering the previously implemented interim actions.

Based on the screening evaluation, MTCA minimum threshold requirements for cleanup (WAC 173-350-360), and the site considerations discussed above, two cleanup alternatives were developed for AOC-034/035:

- Cleanup Alternative 1: Monitored Natural Attenuation;
- Cleanup Alternative 2: Enhanced Bioremediation and Monitored Attenuation.

11.2.1 Cleanup Alternative 1 – Monitored Natural Attenuation

Cleanup Alternative 1 for AOC-034/035 includes institutional controls and MNA.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to protect human health and the environment. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.
- **Monitored Natural Attenuation –** MNA would be used to attain the groundwater cleanup levels at a CPOC established upgradient from the Lake Washington shoreline and Cedar River Waterway, as shown on Figure 26. Fate and transport groundwater modeling presented in Appendix A indicates that natural attenuation may attain the cleanup levels for the groundwater COCs (*cis*-1,2-DCE and VC) at the CPOC given sufficient time to achieve them.

11.2.2 Cleanup Alternative 2 – Enhanced Bioremediation and Monitored Attenuation

Cleanup Alternative 2 for AOCs-034/035 includes institutional controls, enhanced bioremediation, and MA.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls incorporated into this alternative would be the same as described above for Cleanup Alternative 1.
- **Enhanced Bioremediation –** The reductive dechlorination processes that are active at this site would be enhanced by further addition of electron donor and nutrients, as appropriate. An electron donor (such as emulsified vegetable oil, sodium lactate, or other similar substrate) would be injected into an injection zone surrounding the source area.
- **Monitored Attenuation –** Monitored attenuation would be accomplished using a network of groundwater monitoring wells to assess the effectiveness of enhanced bioremediation and confirm that the cleanup standard is met. A CPOC located

downgradient of the source area would be used to ensure the cleanup standard is being attained during the bioremediation program.

11.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 11 provides a comparison of the cleanup alternatives from the FS report based on the criteria outlined in Section 3.3. These criteria were used in the FS to select cleanup alternatives for AOC-034/035. Estimated costs for each of the alternatives are presented in Appendix B.

As discussed in the Pre-CAP investigation report, Cleanup Alternative 1, Monitored Natural Attenuation, is the proposed cleanup action for AOC-034/035. COC concentrations in the source area well are slightly reduced from levels observed during the RI sampling event in 1999; additionally, concentrations of COCs in samples from the CPOC well are essentially at the CULs. It appears that natural attenuation is protective of surface water at this area. Based on these results, enhanced bioremediation would not offer significant added benefit; therefore, enhanced bioremediation is not necessary for this area. The MNA program would achieve cleanup standards. The proven institutional controls would continue to be implemented to protect worker health and safety.

11.4 PROPOSED CLEANUP ACTION

Cleanup Alternative 1 has been selected as the proposed cleanup action for this site. MNA and institutional controls meet the MTCA requirements for cleanup actions, as discussed in Section 3.4.

A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

11.4.1 Institutional Controls

The following institutional controls are included to reduce the risk of human exposure to impacted soil or groundwater.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside buildings are protected and indoor air concentrations meet PELs established by the Washington Department of Labor and Industry.
- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and OSHA HAZWOPER regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and groundwater.

11.4.2 Monitored Natural Attenuation

Based on the fate and transport groundwater modeling presented in Appendix A, concentrations of all COCs fall rapidly with increased distance from the source, and cleanup levels would be met at the CPOC. The proposed cleanup action for AOC-034/035 also requires a monitoring plan designed to verify that the general objectives outlined in Section 3.1.2 are achieved.

For the conceptual design, characterization/validation sampling would consist of quarterly monitoring of four monitoring wells for a minimum of 1 year. The monitoring network would consist of wells to be monitored for groundwater quality and wells to be monitored for water level only. One new shallow monitoring well and three existing wells (GW216s, GW217S, and GW218S, Figure 26) would be monitored for both water quality and water level. Three additional existing monitoring wells (GW001S, GW004S, and GW005S) would be monitored for water level only, which will provide a network of seven wells for assessing groundwater flow directions. Water quality monitoring parameters and analytes would consist of VOCs (contaminants and daughter products), as well as the full suite of MNA geochemical parameters [dissolved oxygen, nitrate, Fe(II), sulfate, methane, temperature, pH, specific conductance, alkalinity, oxidation/reduction potential, chloride, ethane, and TOC]. Reporting for characterization/ validation sampling and groundwater flow directions would follow each quarterly event.

Long-term groundwater monitoring would follow for an estimated additional 13 to 14 years (15 total years of monitoring) and include semiannual monitoring of four shallow wells for VOCs (contaminants and daughter products) and a limited suite of geochemical parameters (dissolved oxygen, oxidation/reduction potential, temperature, and pH). All four wells would be analyzed once every 5 years for the entire characterization/validation list of analytes, and annual reporting would be required for long-term groundwater monitoring. Long-term groundwater monitoring and associated remedial actions would end when site-specific groundwater cleanup levels have been achieved.

12.0 PROPOSED CLEANUP ACTION: AOC-060

AOC-060 is located in Building 4-42, as shown in Figure 27. This section describes the proposed cleanup action for this area.

12.1 BACKGROUND

AOC-060 consists of a former vapor degreaser secondary containment sump. The former vapor degreaser was used primarily for cleaning metal parts with 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.

12.1.1 Investigation History

During the RI, more than a dozen monitoring wells were installed in the vicinity of AOC-060, and quarterly sampling and analysis of monitoring wells for COCs occurred for almost 10 years. The focus of the RI investigation was groundwater; no data were presented in the RI indicating concentrations of COCs present in soil above cleanup levels.

12.1.2 Constituents of Concern

Figure 27 shows the nature and extent of COCs in groundwater based on the RI and subsequent investigations. As listed in Tables 1 and 2, the COCs for this area are:

- Soil: None;
- Groundwater: TCE, *cis*-1,2-DCE, and VC.

The source of VOCs at this AOC was probably releases of TCE from the former vapor degreaser and/or its associated sumps. Subsequent to the release, degradation of the TCE has occurred to form *cis*-1,2-DCE and VC. The presence of these breakdown products indicates that biodegradation is active in this area. As groundwater flows through the affected saturated zone soil near the former degreaser, any adsorbed VOCs may dissolve into the groundwater. 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.

12.2 IDENTIFICATION OF CLEANUP ALTERNATIVES

Cleanup alternatives have been identified and developed for AOC-060. The alternatives specifically address site conditions, the site remedial objectives, and the groundwater cleanup levels for AOC-060. Development of these alternatives is based on present site conditions.

Building 4-42 is currently used as offices and associated work space supporting airplane manufacturing facilities. As a part of the manufacturing complex, Building 4-42 is currently considered industrial and is expected to remain so for the foreseeable future.

Based on the screening evaluation, MTCA minimum threshold requirements for cleanup (WAC 173-340-360), and the site considerations discussed above, three cleanup alternatives were developed for this site:

- Cleanup Alternative 1: Monitored Natural Attenuation;
- Cleanup Alternative 2: Enhanced Bioremediation and Monitored Attenuation;
- Cleanup Alternative 3: Air Sparging, Soil Vapor Extraction, and Monitored Attenuation.

12.2.1 Cleanup Alternative 1 – Monitored Natural Attenuation

Cleanup Alternative 1 for AOC-060 utilizes MNA to destroy site COCs within affected groundwater.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to protect human health and the environment. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.
- **Monitored Natural Attenuation –** MNA would be used to attain the groundwater cleanup levels at an off-site CPOC established upgradient from the Cedar River Waterway shoreline, as shown on Figure 28. The City of Renton has approved placement of the off-site CPOC in the Cedar River Trail Park, as noted in the City of Renton Access Agreement included in Appendix C. Fate and transport groundwater modeling presented in Appendix A indicates that natural attenuation may attain the cleanup levels for the groundwater COCs (TCE, *cis*-1,2-DCE, and VC) at the CPOC given sufficient time to achieve them.

12.2.2 Cleanup Alternative 2 – Enhanced Bioremediation and Monitored Attenuation

Cleanup Alternative 2 incorporates enhanced bioremediation to destroy site COCs within affected groundwater. All other elements of this alternative are basically the same as described above for Cleanup Alternative 1 (i.e., groundwater monitoring, and institutional controls).

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Alternative 2 would be the same as those described above for Cleanup Alternative 1.

- **Enhanced Bioremediation –** The reductive dechlorination processes that are active at this site would be enhanced by further addition of electron donor and nutrients, as appropriate. A growth substrate (such as emulsified vegetable oil, sodium lactate, or another similar carbohydrate substrate) would be injected into affected groundwater at an injection zone located between Building 4-42 and the utility corridor to the west of the building.

- **Monitored Attenuation –** Monitored attenuation would be accomplished using a network of groundwater monitoring wells to assess the effectiveness of enhanced bioremediation and confirm that the cleanup standard is met. The monitoring program would be the same as the MNA monitoring program under Cleanup Alternative 1.

12.2.3 Cleanup Alternative 3 – Air Sparging, Soil Vapor Extraction, and Monitored Attenuation

Cleanup Alternative 3 incorporates air sparging and vapor extraction to destroy site COCs within affected groundwater. All other elements of this alternative are basically the same as described above for Cleanup Alternative 1 (i.e., groundwater monitoring and institutional controls).

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Cleanup Alternative 3 would be the same as those described above for Cleanup Alternative 1.

- **Air Sparging –** Air sparging wells, designed to strip VOCs from groundwater, would be connected to a compressor and air distribution system designed to continually feed about 5 standard cubic feet per minute (scfm) of air to each sparging well. VOC-laden air from the sparging wells would be collected by the SVE system discussed below.

- **Soil Vapor Extraction –** Extraction wells would be screened above the water table to collect VOC-laden air from the sparging system and the limited vadose zone at the site. The vapor extraction wells would be connected to a vacuum blower system. The air stream would be routed for treatment through a combination GAC and permanganate unit in order to remove VOCs, including VC, prior to discharge to the atmosphere.

- **Monitored Attenuation –** The monitoring program for Cleanup Alternative 3 would be the same as described above for Cleanup Alternative 1.

12.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 12 provides a comparison of the cleanup alternatives from the FS report based on the criteria outlined in Section 3.3. These criteria were used in the FS to select cleanup alternatives for AOC-060. Estimated costs for each cleanup alternative are presented in Appendix B.

As discussed in Section 15.6 of the FS report, Cleanup Alternative 1, Monitored Natural Attenuation, provides the greatest benefit at the lowest cost; therefore, Alternative 1 is the proposed cleanup action for the AOC-060 site. Cleanup Alternative 3, as the most permanent potential remedy, does not provide additional benefits that are commensurate with its disproportionate cost. Ample evidence was collected during the RI to demonstrate that natural biodegradation of organic soil and groundwater COCs is active at this site. Groundwater samples collected downgradient from the source areas and upgradient from the Cedar River Waterway show that groundwater COC concentrations are declining with time, and COCs have not migrated to the waterway.

12.4 PROPOSED CLEANUP ACTION

Cleanup Alternative 1 has been selected as the proposed cleanup action for this site. Monitored natural attenuation and institutional controls meet the MTCA requirements for cleanup actions, as discussed in Section 3.4. A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

12.4.1 Institutional Controls

The following institutional controls are included to reduce the risk of human exposure to impacted soil or groundwater.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside buildings are protected and indoor air concentrations meet PELs established by the Washington Department of Labor and Industry.
- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and OSHA HAZWOPER regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and groundwater.

It is assumed that an off-site CPOC would be established for this alternative with permission granted by the off-site landowner (the City of Renton). As indicated in Appendix C, the City has approved cleanup actions proposed for the Facility.

12.4.2 Monitored Natural Attenuation

Groundwater monitoring data collected over the last 12 years in the vicinity of AOC-060 indicate that natural processes are at work degrading and retarding the migration of COCs. The current groundwater monitoring program includes 13 monitoring wells that are monitored semiannually for VOCs. Historical trend analysis of COCs in groundwater (Geomatrix, 2006) shows that concentrations of COCs in samples from many wells have dropped substantially since monitoring began in 1995. Based on these data, no off-site wells had detectable concentrations of *cis*-1,2-DCE or TCE, and only one off-site well (GW150S) had a detectable concentration of VC. The highest detections of TCE and VC remain in on-site wells. Samples from the monitoring wells closest to the river (Wells GW159S and GW160S) were below detection limits for all COCs. The trend in decreasing concentration over time also suggests that the remaining source materials have a minimal extent, much reduced concentrations, or both.

Fate and transport groundwater modeling presented in Appendix A indicates that the site-specific groundwater cleanup levels for all COCs applicable at the CPOC shown on Figure 28 would be met.

The conceptual monitoring program for AOC-060 would be designed to verify that the general objectives outlined in Section 3.1.2 are achieved. For the conceptual design, the monitoring network would consist of three new monitoring wells and six existing wells (Figure 28). One new intermediate monitoring well would be completed at the CPOC to monitor groundwater quality in the intermediate saturated zone. Characterization/validation sampling would consist of continued semiannual sampling of existing wells, and quarterly monitoring of new monitoring wells, for a minimum of 1 year. Monitoring parameters and analytes would consist of TCE, *cis*-1,2-DCE, VC, and the appropriate MNA geochemical parameters for chlorinated solvent plumes [dissolved oxygen, nitrate, Fe(II), sulfate, methane, temperature, pH, specific conductance, alkalinity, oxidation/reduction potential, chloride, ethane, and TOC]. Reporting for characterization/validation sampling would follow each quarterly event.

Long-term groundwater monitoring would follow for an estimated additional 13 to 14 years (15 total years of monitoring) and include semiannual monitoring of nine shallow and intermediate depth wells for VOCs (contaminants and daughter products) and a limited suite of geochemical parameters (dissolved oxygen, oxidation/reduction potential, temperature, and pH). All nine wells would be analyzed once every 5 years for the entire characterization/validation list of analytes. Long-term groundwater sampling frequency and the duration of the groundwater monitoring program would be based on the results of performance monitoring and may be adjusted as appropriate. Annual reporting would be required for long-term groundwater monitoring. Long-term groundwater monitoring and

associated remedial actions would end when site-specific groundwater cleanup levels have been achieved.

13.0 PROPOSED CLEANUP ACTION: AOC-090

AOC-090 is located near the southwest corner of former Building 4-64. The location is shown on Figures 29 and 30. This section describes the proposed cleanup action for this area.

13.1 BACKGROUND

During the installation of an underground fire protection water line and fire hydrant in July 1999, approximately 40 cubic yards of soil was excavated to a depth of approximately 6 feet bgs. Laboratory analysis of soil samples collected from the stockpiled soil indicated elevated concentrations of selected VOCs (TCE and carbon tetrachloride) as well as TPH-G, TPH-D, and TPH in the motor oil range (TPH-MO). The source of the elevated concentrations is unknown. AOC-090 was subsequently investigated as part of the RI.

The former adjacent building (Building 4-64) was used by Boeing for aircraft preflight checks until it and Building 4-65 (the Gate D-30 Guard House) were demolished in early 2004 to prepare the site for construction of a new parking area.

13.1.1 Investigation History

This area was investigated in several phases of RI and post-RI investigation to further delineate the nature and extent of affected soil and groundwater. The results of this work indicated that VC was present at elevated concentrations in groundwater near the western Facility boundary with the Cedar River Trail Park, and elevated VOC and TPH levels were present in soil and groundwater near Building 4-64.

13.1.2 Implemented Interim Actions

Remedial actions completed in the area include the excavation of 40 cubic yards of soil initially removed in 1999 during installation of the fire protection water line. Additionally, Building 4-64 and the Gate D-30 Guard House were demolished in 2004 to prepare the site for construction of a new parking area. Coincident with the building demolition, an interim action was conducted at AOC-090 to remove TPH- and VOC-affected soil exceeding cleanup levels in the source area to the extent practicable. 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. Throughout the excavation, soil was excavated to the water table at a depth of approximately 7 feet bgs. Soils requiring different off-site disposal means (i.e., solvent- versus TPH-affected soils) were segregated during excavation.

Following soil removal, 16.68 tons of molasses were 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, indicates substantial degradation of TCE in groundwater and a substantial rise in concentration of the final, nontoxic biodegradation products (methane, ethane, and ethene) (Geomatrix, 2006).

13.1.3 Constituents of Concern

Figures 29 and 30 show the nature and extent of COCs in soil and groundwater, respectively, based on the RI and subsequent investigations. As listed in Tables 1 and 2, the COCs for AOC-090 are:

- Soil: VOCs including chlorinated solvents and benzene, several metals, several SVOCs, and TPH;
- Groundwater: VOCs, including chlorinated solvents and benzene, and TPH.

During the interim action in 2004, nearly all of the affected soil above the water table was removed. Some affected soil was left in place due to constraints on access resulting from underground utilities. Groundwater data indicate that shallow groundwater is affected beneath the Cedar River Trail Park both north and south of AOC-090, with the most highly affected water beneath the source area. Data for the intermediate unit generally show localized areas affected by VC at levels less than one part per billion. The source area well (Well GW189S) shows that significant concentrations of site COCs remain in the shallow saturated zone.

13.2 IDENTIFICATION OF CLEANUP ALTERNATIVES

Remedial alternatives have been identified and developed for AOC-090. The alternatives specifically address site conditions, the site remedial objectives, and the soil and groundwater cleanup levels for AOC-090. Development of these alternatives is based on present site conditions, considering the previously implemented interim actions.

AOC-090 is located at the western edge of the Renton Facility directly north of North 6th Street. The area was paved in early fall 2004, and the parking area was put to use. As a part of the manufacturing complex, the parking area is considered industrial and is expected to remain industrial for the foreseeable future. Because the AOC is located within 50 feet of the property line of the Cedar River Trail Park and directly north of North 6th Street, access is limited. Several buried utilities corridors run through the AOC, along North 6th Street, and along the property boundary. The pipeline and road are active and are not owned by Boeing. Removal of additional affected soil is not a practical option, as it would require removal and

replacement of the gas pipeline. Other public utilities are also within the North 6th Street right-of-way.

Based on the screening evaluation, MTCA minimum threshold requirements for cleanup (WAC 173-340-360), and the site considerations discussed above, three cleanup alternatives were developed for this site:

- Cleanup Alternative 1: Monitored Attenuation;
- Cleanup Alternative 2: Enhanced Bioremediation and Monitored Attenuation;
- Cleanup Alternative 3: Soil Vapor Extraction and Monitored Attenuation.

13.2.1 Cleanup Alternative 1 – Monitored Attenuation

Cleanup Alternative 1 for AOC-090 is MA. This alternative is predicated by the interim source removal action conducted at the site in 2004, the enhanced bioremediation process established by the addition of molasses to the excavation backfill, and the presence of degradation products in water samples from downgradient wells, thus confirming that natural biodegradation is occurring at the site.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to ensure it is fully protective of human health and the environment. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.
- **Monitored Attenuation –** Monitored attenuation would be accomplished using a network of groundwater monitoring wells (Figure 31) to assess the effectiveness of enhanced bioremediation and confirm that the cleanup standard is met. Due to the different flow paths for the shallow and intermediate depth groundwater, different CPOCs have been established for the two depth zones. Additionally, two CPOCs have been established for the shallow zone due to the flow divide created by the sheet pile wall in the Cedar River Trail Park (Figure 31). The CPOCs would be used to verify that the cleanup standard is being attained. Natural biodegradation processes have been further enhanced by the addition of organic carbon source during the 2004 interim remedial action. It is expected that ongoing natural biodegradation would continue to reduce the contaminant mass, resulting in cleanup levels being achieved at the CPOC within 15 years.

13.2.2 Cleanup Alternative 2 – Enhanced Bioremediation and Monitored Attenuation

Cleanup Alternative 2 incorporates enhanced bioremediation to destroy site COCs within affected groundwater. All other elements of this alternative are the same as described above for Alternative 1.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Cleanup Alternative 2 would be the same as those described above for Cleanup Alternative 1.
- **Enhanced Bioremediation –** The reductive dehalogenation processes that are active at this site would be enhanced by further addition of electron donor and nutrients, as appropriate. An electron donor (such as sugar substrates, lactate, or emulsified vegetable oil) would be injected into affected groundwater beneath the source area in both the shallow and intermediate depth zones.
- **Monitored Attenuation –** The monitored attenuation approach for Cleanup Alternative 2 would be the same as that described above for Cleanup Alternative 1.

13.2.3 Cleanup Alternative 3 – Soil Vapor Extraction and Monitored Attenuation

Cleanup Alternative 3 incorporates soil vapor extraction to destroy site COCs. All other elements of this alternative are the same as described above for Cleanup Alternative 1.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Cleanup Alternative 2 would be the same as those described above for Cleanup Alternative 1.
- **Soil Vapor Extraction –** SVE would be used to address the COC-affected soils in the source area. VOCs removed with the soil gas would be collected and treated prior to discharge of soil gas to the atmosphere.
- **Monitored Attenuation –** The monitored attenuation approach for Cleanup Alternative 2 would be the same as that described above for Cleanup Alternative 1.

13.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 13 provides a comparison of the cleanup alternatives from the FS report based on the criteria outlined in Section 3.3. These criteria were used in the FS to evaluate cleanup alternatives for AOC-090. Estimated costs for each of the cleanup alternatives are presented in Appendix B.

As discussed in Section 16.6 of the FS report, the proposed cleanup action for AOC-090 is Cleanup Alternative 2, enhanced bioremediation and monitored attenuation. This alternative was selected because it would provide the greatest benefit at an intermediate cost.

Groundwater monitoring data show a substantial decrease in TCE concentrations within the source area and a substantial increase in the concentration of nontoxic degradation end products. Based on these data, the molasses has successfully enhanced biodegradation in the source area.

COCs are present in samples collected at the CPOC at concentrations slightly exceeding the site-specific cleanup levels. Since most source area soils were removed in 2004 and biodegradation has been enhanced, it is expected that COC concentrations will continue to degrade and that the site-specific cleanup levels will be attained at the CPOCs in the future.

The MA program would confirm that the cleanup standard is attained at the on-site and off-site CPOCs shown on Figure 31. Given that (1) impacted soils have been removed to the extent practicable, (2) the risks from the VOCs and TPH in soils can be managed through institutional controls (discussed below), and (3) the remaining soils are either confined by the recently placed parking lot asphalt cover or are inaccessible due to the gas pipeline, no additional active measures are necessary to remediate soils.

13.4 PROPOSED CLEANUP ACTION

Alternative 2 has been selected as the proposed cleanup action for this site. Enhanced bioremediation, monitored attenuation, and institutional controls meet the MTCA requirements for cleanup actions, as discussed in Section 3.4.

A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

13.4.1 Institutional Controls

The following institutional controls are included to reduce the risk of human exposure to impacted soil or groundwater.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside buildings are protected and indoor air concentrations meet PELs established by the Washington Department of Labor and Industry.

- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and OSHA HAZWOPER regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and groundwater.

It is assumed that off-site CPOCs would be established for this alternative with permission granted by the off-site landowner, the City of Renton. As indicated in Appendix C, the City has approved cleanup actions proposed for the Facility.

13.4.2 Enhanced Bioremediation

Enhanced bioremediation for AOC-090 would consist providing additional electron donor substrate to enhance the existing microbial activity. Additional electron donor would be injected into the shallow and intermediate depth zones beneath the source area. The conceptual design employs the existing perforated drainpipe and access ports (designated IPR3 and IPR4 on Figure 31) installed during the interim action along the southern extent of the excavation area, parallel to the gas line on North 6th Street. This drainpipe would be supplemented by installation of nine new injection wells, as shown on Figure 31. The pipe and new injection wells would be used for injection of organic carbon substrate, such as sodium lactate, emulsified vegetable oil, or sucrose.

For cost estimation purposes, it was assumed that the initial injection would consist of 1,000 gallons of electron donor injected into the intermediate depth zone using injection wells, 4,000 gallons into the shallow depth zone using injection wells, and 1,000 gallons injected into the vadose/shallow zones using the drainpipe. It was assumed that the electron donor would be 2 percent emulsified vegetable oil (potable water would be used to dilute the concentrated product). It was also assumed that three applications (at 1-year intervals) would be required to effectively treat affected groundwater at this site; a total injection volume of 2,000 gallons was assumed for subsequent annual injections. The final design will be determined in an Engineering Design Report. Monitored attenuation would be implemented simultaneously with substrate injection and would continue after the final injection, as described below.

13.4.3 Monitored Attenuation

Monitored attenuation for this alternative is intended to be a final “polishing” mechanism, following the active enhanced bioremediation, to ensure that cleanup levels for all COCs are met at the CPOCs. The conceptual monitoring program for AOC-090 is designed to verify that the general objectives outlined in Section 3.1.2 are achieved.

A detailed MA Validation and Long-Term Sampling Work Plan would be developed to guide the monitoring program. This work plan would identify monitoring wells and monitoring analytes that would be required for both characterization/validation sampling and long-term groundwater monitoring. Due to the very low site-specific cleanup levels that apply to intermediate zone groundwater at the CPOC, it will be necessary to use an analytical method based on selected ion monitoring (SIM) to detect site COCs at appropriate concentrations.

These specialized analytical methods would be used for monitoring only the intermediate zone groundwater.

For conceptual design, it was assumed that characterization/validation sampling would consist of semiannual and/or quarterly monitoring of 11 monitoring wells, as illustrated in Figure 31. Only the deeper wells would be monitored for the well pairs located along the intermediate zone CPOC. Monitoring parameters and analytes would consist of VOCs (contaminants and daughter products), as well as appropriate MA geochemical parameters [dissolved oxygen, nitrate, Fe(II), sulfate, methane, temperature, pH, specific conductance, alkalinity, oxidation/reduction potential, chloride, ethane, and TOC]. Shallow CPOC wells (GW178S and GW208S) and GW189S would be monitored for TPH-D, TPH-G and TPH-MO. Reporting for characterization/validation sampling would follow each quarterly event.

Long-term groundwater monitoring would follow for an estimated additional 13 to 14 years (15 total years of monitoring) and would include semiannual monitoring of the eight shallow wells and three intermediate wells for VOCs (contaminants and daughter products) and a limited suite of geochemical parameters (dissolved oxygen, oxidation/reduction potential, temperature, and pH). Monitoring of shallow CPOC wells (GW178S and GW208S) and GW189S would include the analysis of TPH-D, TPH-G, and TPH-MO. All 13 wells would be analyzed once every 5 years for the entire characterization/validation list of analytes applicable to the respective wells as noted above. Annual reporting would be required for long-term groundwater monitoring. For cost estimation, it was assumed that quarterly monitoring would be performed for 2 years followed by 13 years of semiannual monitoring. Long-term groundwater sampling frequency and the duration of the groundwater monitoring program would be based on results of performance monitoring, and may be adjusted as appropriate. Long-term groundwater monitoring and associated remedial actions would end when site-specific groundwater cleanup levels have been achieved.

14.0 PROPOSED CLEANUP ACTION: AOC-092

AOC-092 is located along the east side of Building 4-20, as shown in Figure 32. This section describes the proposed cleanup action for this area.

14.1 BACKGROUND

Soil impacted with petroleum hydrocarbons was discovered at this location during trenching activities for a new fire protection water line. No gasoline-impacted soil was removed at the time of the original fire water line excavation from this area due to structural concerns regarding the building foundation (Boeing, 2001).

14.1.1 Investigation History

After impacted soil was discovered preliminary sampling was conducted in 2001, then subsequent investigation of AOC-092 was performed in November 2005 during Facility improvements in the adjacent Building 4-20. The concrete slab floor inside Building 4-20 was removed and replaced. The portion of the floor inside Building 4-20 that was removed was located northwest of AOC-092. In order to determine whether the affected soil related to the AOC-092 release extended underneath Building 4-20 in the area of slab removal, soil and groundwater samples were collected via direct push borings from six locations in the area of the removed slab.

14.1.2 Constituents of Concern

Figure 32 shows the nature and extent of COCs for soil and groundwater based on the investigation conducted at AOC-092. As listed in Tables 1 and 2, the COCs for this area are:

- Soil: benzene and TPH-G;
- Groundwater: benzene and TPH-G.

TPH-G was originally detected in a sample from the fire line excavation at 22,000 mg/kg. This represents the source area at AOC-092. Soil concentrations were lower at subsequent step out locations and suggest that the affected soil exceeding the soil cleanup standard at this location may have been removed during installation of the fire water line, and that the affected soil had a limited extent. Groundwater and soil samples collected in 2001 from boring PP073 contained TPH-G concentrations of 8.7 milligrams per liter (mg/L) and 150 mg/L, respectively, indicating potential contamination upgradient of the source area. Existing groundwater data show that a benzene plume extends under Building 4-20 downgradient of the source area.

14.2 IDENTIFICATION OF CLEANUP ALTERNATIVES

Remedial alternatives have been identified and developed for AOC-092. The alternatives specifically address site conditions, the site remedial objectives, and the soil and groundwater cleanup levels for AOC-092. Development of these alternatives is based on present site conditions, considering the previously implemented interim actions.

This area was historically and is currently used for temporary outdoor storage of airplane parts and as a tow-path for partially completed aircraft. This area is currently used for industrial purposes, and is expected to remain in industrial use for the foreseeable future. The source area is located directly adjacent to Building 4-20. Remedial alternatives must take into account proximity to the building and must be constrained so as not to interfere with ongoing industrial activity.

Based on the screening evaluation, MTCA minimum threshold requirements for cleanup (WAC 173-340-360), and the site considerations discussed above, two cleanup alternatives were developed for this site:

- Cleanup Alternative 1: Monitored Natural Attenuation;
- Cleanup Alternative 2: Source Area Excavation, Enhanced Bioremediation, and Monitored Attenuation.

The alternatives evaluated for this site are described below.

14.2.1 Cleanup Alternative 1 – Monitored Natural Attenuation

Cleanup Alternative 1 for AOC-092 includes monitored natural attenuation as the cleanup remedy for the site.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to ensure it is fully protective of human health and the environment. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.
- **Monitored Natural Attenuation –** MNA would be used to attain the groundwater cleanup levels at a CPOC established approximately 80 feet downgradient of the source area. Fate and transport groundwater modeling presented in Appendix A indicates that natural attenuation may be currently attaining the cleanup levels for the groundwater COCs at the CPOC.

14.2.2 Cleanup Alternative 2 – Source Area Excavation, Enhanced Bioremediation, and Monitored Attenuation

Cleanup Alternative 2 incorporates source area excavation and enhanced bioremediation to destroy site COCs.

The following specific elements are included in this cleanup alternative.

- **Institutional Controls –** The institutional controls for Cleanup Alternative 2 would be the same as those described above for Cleanup Alternative 1.
- **Source Area Excavation –** TPH-G-contaminated soils from the area of the fire line would be excavated and disposed of off site. Excavation of affected soils would be conducted to the extent practicable, given the constraints imposed by the presence of the existing building and underground utilities.
- **Enhanced Bioremediation –** The degradation of petroleum compounds would be enhanced by injecting a TEA, such as ORC, ammonium nitrate, or calcium nitrate, into the source area groundwater.
- **Monitored Attenuation –** Monitored attenuation for this alternative is intended to be a final "polishing" mechanism, following the active enhanced bioremediation, to ensure that cleanup levels for all COCs are met at the CPOC established just downgradient of the source area, as shown on Figure 33. Fate and transport groundwater modeling presented in Appendix A indicates that natural attenuation may be currently attaining the cleanup levels for the groundwater COCs at the CPOC.

14.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 14 provides a comparison of the cleanup alternatives from the FS report based on the criteria outlined in Section 3.3. These criteria were used in the FS to evaluate cleanup alternatives for AOC-092. Estimated costs for each of the alternatives are presented in Appendix B.

As discussed in Section 17.6 of the FS report, the proposed cleanup action for AOC-092 is Cleanup Alternative 2, source area excavation, enhanced bioremediation, and monitored attenuation. Cleanup Alternative 2 would achieve the benefits of remediation sooner than Cleanup Alternative 1 and does not have a disproportionate cost. Under Cleanup Alternative 2, most affected soil would be removed. However, any affected soils under the adjacent building would remain and would be contained by the building and floor to prevent potential runoff and infiltration of rainfall. In addition, ORC introduced into the base of the excavation would promote further biodegradation of COCs. Groundwater in the area is not used for any purpose, and potable water is readily available from the Renton public water system. The institutional controls included in Cleanup Alternative 2 have been implemented

and proven by Boeing, who would continue to maintain overall responsibility for this site and ensure that the institutional controls are properly enforced.

14.4 PROPOSED CLEANUP ACTION

Cleanup Alternative 2 has been selected as the proposed cleanup action for this site. Source area excavation, enhanced bioremediation, monitored attenuation, and institutional controls meet the MTCA requirements for cleanup actions, as discussed in Section 3.4. Groundwater fate and transport modeling presented in Appendix A suggests that the benzene groundwater plume would meet the cleanup standard at a CPOC located approximately 80 feet downgradient from the source area. A detailed description of the specific elements of the proposed cleanup action is presented in the following subsections.

14.4.1 Source Area Excavation

Source area excavation for this alternative would consist of excavation and off-site disposal of TPH-G-contaminated soils from the area of the fire line. Excavation of affected soils would be conducted to the extent practicable, given the constraints imposed by the presence of the existing building and underground utilities. It was assumed that the source area to be excavated is a relatively small area (6 feet by 17 feet) to a shallow depth. The volume of soil to be removed is estimated as approximately 30 cubic yards. To determine whether elevated TPH-G concentrations in soil and water at PP073 are related to AOC-92, soil confirmation samples would be collected in the area surrounding PP073 during excavation.

14.4.2 Enhanced Bioremediation

Enhanced bioremediation for AOC-092 would consist of injecting a TEA, such as ORC, ammonium nitrate, or calcium nitrate, into the source area groundwater to promote degradation of petroleum compounds. For cost estimation purposes, it was assumed that approximately 200 pounds of ORC would be applied to the open excavation after contaminated soil was removed and prior to backfilling with clean soil. If a nitrate is selected, an equivalent dosage would be determined and applied in the same general manner as assumed for ORC.

14.4.3 Institutional Controls

The following institutional controls are included in the proposed cleanup action to reduce the risk of human exposure to impacted soil or groundwater.

- Continued institutional and engineering controls, protocols, and monitoring previously established by Boeing would be implemented to ensure that industrial workers inside buildings are protected and indoor air concentrations meet PELs established by the Washington Department of Labor and Industry.

- Continued engineering controls, protocols, and monitoring would be implemented to ensure that temporary construction workers adhere to WAC 296-62-300, applicable Washington Labor and Industry standards, and OSHA HAZWOPER regulations (29 CFR 1919.120) for all construction work conducted in exposed areas of affected soil and groundwater.

14.4.4 Monitored Attenuation

Monitored attenuation for this alternative is intended to be a final "polishing" mechanism, following the active enhanced bioremediation, to ensure that cleanup levels for all COCs are met at the CPOC proposed for this alternative. With this alternative, it is assumed that MA would follow enhanced bioremediation and would consist of the long-term groundwater monitoring for three shallow wells located within and near the source area excavation for AOC-092, as shown on Figure 33. Groundwater monitoring would be conducted semiannually for benzene, ethylbenzene, toluene, TPH-G, and a limited suite of geochemical parameters (dissolved oxygen, oxidation/reduction potential, temperature, and pH). To ensure plume control, all three monitoring wells would be analyzed once every 5 years for the entire list of analytes. It is assumed that monitoring would continue following active remediation for up to 15 years of monitoring and that annual reporting would be required for the duration. Long-term groundwater monitoring and associated remedial actions would end when site-specific groundwater cleanup levels have been achieved.

15.0 PROPOSED CLEANUP ACTION: AOC-093

This section describes the proposed cleanup action for AOC-093.

15.1. BACKGROUND

AOC-093 is located north of Building 4-20, near the shore of Lake Washington (see Figure 34 for the general location). This AOC was discovered while conducting downgradient sampling for AOC-001 and AOC-002.

15.1.1. 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 and AOC-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. The Pre-CAP soil samples contained detectable levels of TPH-G and related fuel hydrocarbons, but none of these results exceeded applicable soil cleanup levels.

15.1.2. Implemented Interim Actions

No interim actions have been undertaken at AOC-093.

15.1.3. Constituents of Concern

Figure 34 shows the nature and extent of COCs in soil and groundwater based on the investigations completed at this AOC since 2003. As listed in Tables 1 and 2, the COCs for this area are:

- Soil: TPH-G;
- Groundwater: TPH-G.

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

15.2. IDENTIFICATION OF CLEANUP ALTERNATIVES

AOC-093 is an area of affected soil that was identified while delineating affected groundwater for AOCs-001/002. No activities are known that caused the release of TPH-G to site soil. AOC-093 is located about 45 feet from the Lake Washington shoreline and within the affected groundwater plume associated with AOC-001/002.

The site is also located within the tow path for partially assembled aircraft. The tow path is critical to the manufacture of aircraft at the Facility. Each aircraft produced at the Facility must

be towed through the area where AOC-093 is located. Any remedial alternative implemented for AOC-093 must accommodate the movement of aircraft through the area; any interference with movement of the aircraft would affect aircraft production and have significant cost implications. Due to the size of the aircraft produced at the Facility, no alternative tow path is available.

Based on the screening evaluation, MTCA minimum threshold requirements, and the site considerations discussed above, the following two cleanup alternatives that could be used to address COCs at AOC-093 were developed in the FS:

- Cleanup Alternative 1 – Source Area Excavation and Monitored Natural Attenuation;
- Cleanup Alternative 2 – Source Area Excavation, Enhanced Bioremediation, and Monitored Attenuation.

15.2.1 Cleanup Alternative 1 – Source Area Excavation and Monitored Natural Attenuation

Cleanup Alternative 1 would consist of institutional controls, limited soil excavation, and MNA. Although soil samples have historically contained TPH-G above the applicable cleanup level, most recent sampling results have shown TPH-G below cleanup levels (AMEC, 2008). Moreover, TPH-G concentrations in groundwater samples collected in the immediate vicinity of the source area have been historically below the groundwater cleanup level, and most recent groundwater samples did not contain detectable concentrations. For the purposes of evaluation of this alternative, limited excavation of TPH-G affected soils was included as a conservative measure under this alternative. The groundwater cleanup standard for this remedial alternative would be the groundwater cleanup level for TPH-G at a CPOC located within the source area.

The specific elements included in this cleanup alternative are:

- **Institutional Controls –** Institutional controls would be incorporated into this alternative to protect human health and the environment. In general, the institutional controls that would be incorporated into this remedial alternative would be a continuation of the controls that have been implemented at the Renton Facility and that have been proven effective. Institutional controls would be required during implementation of the alternative and continue until general cleanup levels are attained throughout the site.
- **Monitored Natural Attenuation –** Since source area soils exceeded cleanup levels for TPH-G, limited excavation of affected soil would be performed in the source area, however, no soil would be excavated below the water table. After excavation was completed, MNA would be used to verify that groundwater cleanup

levels had been achieved at a CPOC established within the source area, as shown on Figure 35. Fate and transport groundwater modeling presented in Appendix A indicates that natural attenuation would continue to meet the cleanup levels for TPH-G.

15.2.2 Cleanup Alternative 2 – Source Area Excavation, Enhanced Bioremediation, and Monitored Attenuation

Cleanup Alternative 2 consists of the following three primary elements: institutional controls, source area soil excavation with enhanced bioremediation, and MA. This alternative includes source excavation (to the extent practicable given the location of the site within the tow path) to remove affected soils in the source area and enhanced bioremediation to accelerate site cleanup.

The specific elements included in this cleanup alternative are:

- **Institutional Controls –** Institutional controls for Cleanup Alternative 2 would be the same as those discussed above for Cleanup Alternative 1. For this alternative, however, institutional controls would be discontinued after monitoring and/or confirmation sampling showed that the site had been effectively remediated.

- **Enhanced Bioremediation –** As with Cleanup Alternative 1, limited excavation of soil would be performed near PP081. This limited excavation would be the same for both alternatives. Enhanced bioremediation for AOC-093 would consist of increasing oxygen in the subsurface aqueous system by adding approximately 200 pounds of ORC to the open excavation after the affected soil is removed and prior to backfilling with clean soil. The ORC would gradually release oxygen and promote biodegradation of any TPH constituents that may have leached to groundwater.

- **Monitored Attenuation –** Monitored attenuation would be accomplished using a small network of groundwater monitoring wells to assess the effectiveness of enhanced bioremediation and confirm that the cleanup standard is met. An on-site POC would be used to ensure the cleanup standard is being attained during the bioremediation program.

15.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 15 provides a comparison of the cleanup alternatives from the FS report based on the criteria from MTCA regulations governing feasibility studies and the Agreed Order. These criteria included protectiveness and risk reduction, permanence, cost, long-term effectiveness, management of short-term risks, technical and administrative implementability, public concern, and a reasonable restoration time frame. These criteria were used in the FS to select cleanup alternatives for AOC-093.

As discussed in Section 18.6 of the FS report, source area excavation was the preferred remedial alternative for AOC-093. Affected soils would remain covered by the pavement or

tarmac, which would prevent potential runoff and infiltration of rainfall. Groundwater in the area is not used for any purpose, and potable water is readily available from the Renton public water system. The institutional controls included in this alternative have been implemented and proven by Boeing, who would continue to maintain overall responsibility for this site and ensure that the institutional controls are properly enforced.

Based on the information from the Pre-CAP investigation, it appears that natural attenuation may have already remediated the source area for AOC-093. No soil COCs were detected above the CUL.

Based on the results of the FS, Alternative 1 (source area excavation and monitored natural attenuation) is the preferred cleanup alternative for AOC-093.

15.4 PROPOSED CLEANUP ACTION

The proposed cleanup action for AOC-093 identified in the FS included source area excavation and monitored natural attenuation. Soil sample results from the Pre-CAP field investigation posted on Figure 34 (AMEC, 2008) show that natural attenuation has already reduced the concentration of TPH-G at AOC-093 below CULs. The final remedy for this AOC consists of MNA for groundwater.

To address groundwater, a new groundwater monitoring well would be installed along the AOC-93 CPOC (Figure 35). The new well would be used for monitoring both AOC-093 and AOC-001/002. This monitoring well would be sampled and analyzed for TPH-G as well as the chlorinated VOCs associated with AOC-001/002.

The new CPOC well for AOC-93 would be included in the AOC-001/002 detailed MA monitoring plan (Section 8.4.4), as it is also located near the CPOC for AOC-001/002. Monitoring parameters and analytes for the AOC-93 well would include TPH-G for AOC-093 and chlorinated groundwater COCs and their degradation products for AOC-001/002. VOC results for the new monitoring well would be included with AOC-001/002 reports. TPH-G results for the new well would be reported for AOC-093.

Long-term groundwater monitoring would follow the initial characterization/validation sampling program. Quarterly monitoring of the AOC-93 well would continue until a variance is approved by Ecology. Estimated costs for the proposed cleanup action are based on the assumption that 2 years of quarterly monitoring would be followed by 13 years of semiannual monitoring with Ecology approval. For the estimate, it was assumed that the AOC-93 well would be analyzed once every 5 years for the full list of characterization/validation analytes to monitor overall plume control (in addition to the routine analytes). For conceptual design, it was

assumed that long-term monitoring results from the AOC-93 well would be included within the AOC-001/002 reports submitted to Ecology annually (Section 8.4.4). Long-term monitoring and associated remedial action would end when groundwater meets the site-specific cleanup levels, as approved by Ecology.

16.0 REFERENCES

AMEC (AMEC Geomatrix, Inc.), 2008, Draft Pre-Cleanup Action Plan Investigation Results, Boeing Renton Facility Renton, Washington: Prepared for The Boeing Company, Seattle, Washington, August.

AMEC, 2010, Final Draft Cleanup Action Plan, Boeing Renton Facility, Renton, Washington: Prepared for The Boeing Company, Seattle, Washington, February 2010; revised October 2010.

Boeing, 2001, Letter from Boeing to Washington State Department of Ecology, 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.

Boeing, 2008, Letter from Boeing to Ecology, Feasibility Study and Draft Cleanup Action Plan Boeing Renton (WAD 009 262 171), July 16.

Ecology, 1994, Natural Background Soil Metals Concentrations in Washington State: Publication #94-115, October.

Ecology, 1997, Interim Total Petroleum Hydrocarbon Guidelines: Publication No. ECY 97-600, January.

Ecology, 2008, Letter from Ecology to Boeing, RE: Feasibility Study Report and Draft Cleanup Plan, Boeing Renton (WAD 009 262 171), June 30.

Geomatrix (Geomatrix Consultants, Inc.), 2003, Quarterly Monitoring Report, MTCA (RCRA) Corrective Action Program, Second Quarter 2003, Volume 1, Boeing Renton Facility, Renton, Washington: Prepared for The Boeing Company, September.

Geomatrix, 2004a, Quarterly Monitoring Report, RCRA Corrective Action Program, Fourth Quarter 2003, Boeing Renton Facility, Renton, Washington: Prepared for The Boeing Company, February.

Geomatrix, 2004b, Final Feasibility Study Work Plan, Boeing Renton Plant, Renton, Washington: Prepared for The Boeing Company, April.

Geomatrix, 2004c, Recommended Corrective Action Groundwater Monitoring Well Installation at AOCs-001, -002, and -003 Technical Memorandum: Prepared for The Boeing Company, August 13.

Geomatrix, 2006, Quarterly Monitoring Report, RCRA Corrective Action Program, Third Quarter 2006, Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, November.

Geomatrix, 2007, AOC-001/-002 and AOC-090 Interim Action Work Plan, Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, February.

Geomatrix, 2008, Draft Final Feasibility Study Report, Boeing Renton Facility, Renton Washington: Prepared for the Boeing Company, June 2.

Weston (Roy F. Weston, Inc.), 1994, Feasibility Study Report In Situ Bioremediation Assessment, Former Fuel Farm: Prepared for The Boeing Company, Energy and Environmental Affairs, Seattle, Washington, September.

Weston, 2001, Remedial Investigation Report, Boeing Renton Plant, Renton, Washington: Prepared for The Boeing Company, Boeing Shared Services Group, Energy and Environmental Affairs, August 10.

TABLES

TABLE 1

SOIL CLEANUP LEVELS

Boeing Renton Facility
Renton, Washington

Soil Constituent of Concern	Soil Cleanup Level[1] (mg/kg)
SWMU-168	
Methylene Chloride	0.024
SWMU-172/174	
Tetrachloroethene	0.01
Trichloroethene	0.006
Vinyl Chloride	0.004
1,1-Dichloroethene	0.001
cis -1,2-Dichloroethene	0.003
Methylene Chloride	0.024
Benzene	0.009
Copper	36
Thallium	0.34
Zinc	39.8
Building 4-78/79 SWMU/AOC Group	
Vinyl Chloride	0.1
Trichloroethene	0.1
cis -1,2-Dichloroethene	0.2
Tetrachloroethene	0.16
Carbon Disulfide	11
Benzene	19
TPH-Gasoline w/benzene	30
Former Fuel Farm SWMU/AOC Group	
TPH-Jet Fuel	2,000
TPH-Diesel	2,000
Benzene	0.012
2-Methylnaphthalene	45.8
AOC-001/002	
Trichloroethene	0.02
cis -1,2-Dichloroethene	0.01
Vinyl Chloride	0.02
TPH-Gasoline w/ benzene	30
AOC-003	
Trichloroethene	0.09
AOC-004	
Benzene	9.5
Ethylbenzene	21.5
Acetone	3.3
Toluene	19
TPH-Gasoline w/benzene	30
AOC-034/035	
cis -1,2-Dichloroethene	0.05
Vinyl Chloride	0.04

TABLE 1

SOIL CLEANUP LEVELS
Boeing Renton Facility
Renton, Washington

Soil Constituent of Concern	Soil Cleanup Level[1] (mg/kg)
AOC-090	
Benzene	0.7
Toluene	19
1,1,2-Trichloroethane	0.01
1,1-Dichloroethene	0.001
Carbon Tetrachloride	0.008
Chloroform	0.079
cis -1,2-Dichloroethene	0.006
Methylene Chloride	0.027
Tetrachloroethene	0.03
Trichloroethene	0.01
Vinyl Chloride	0.006
2-Methylnaphthalene	45.8
Isophorone	0.1
Phenanthrene	0.009
TPH-Gasoline w/benzene	30
TPH-Diesel	2,000
TPH-Motor Oil	2,000
Antimony	5.06
Arsenic	7
Cadmium	1
Chromium(III)	1,140
Chromium(VI)	3.84
Copper	36
Mercury	0.013
Selenium	0.52
Silver	13.6
AOC-092	
Benzene	0.15
TPH-Gasoline w/benzene	30
AOC-093	
TPH-Gasoline w/o benzene	100

Notes:

1. The cleanup level proposed for application to each SWMU and AOC. The proposed soil cleanup levels are either the calculated soil concentrations protective of groundwater at the CPOC (see Appendix A for calculations), the MTCA Method A industrial criteria for TPH fractions, or the standard MTCA Method C criteria for those constituents for which soil concentrations protective of groundwater at the CPOC were not calculated.

TABLE 2

GROUNDWATER CLEANUP LEVELS
Boeing Renton Facility
Renton, Washington

Constituent of Concern	Groundwater Cleanup Level[1] (µg/L)
SWMU-168	
Vinyl chloride	0.11
SWMU-172/174	
1,1-Dichloroethene	0.057
Benzene	0.80
Chloromethane	0.5
cis -1,2-Dichloroethene	0.03
Methylene chloride	4.6
Tetrachloroethene	0.02
Trichloroethene	0.02
Vinyl chloride	0.11
bis (2-Ethylhexyl) phthalate	1.2
Arsenic	1.0
Chromium, total, as Cr(III)	57
Chromium, total, as Cr(VI)	10
Copper	3.5
Lead	1.0
Building 4-78/79 SWMU/AOC Group	
Vinyl chloride	0.20
Trichloroethene	0.23
cis -1,2-Dichloroethene	0.70
Benzene	0.80
TPH-Gasoline w/benzene	800
Former Fuel Farm SWMU/AOC Group	
TPH-Jet Fuel	500
TPH-Diesel	500
AOC-001/002	
Benzene	0.80
Trichloroethene	0.02
cis -1,2-Dichloroethene	0.02
trans -1,2-Dichloroethene	24
1,1-Dichloroethene	0.057
Chloroform	5.7
Vinyl chloride	0.05
Naphthalene	119
AOC-003	
Tetrachloroethene	0.02
Trichloroethene	0.16
Vinyl Chloride	0.24
cis -1,2- Dichloroethene	0.78
AOC-004	
Benzene	5.0
Lead	1.0
TPH-Gasoline w/benzene	800

TABLE 2

GROUNDWATER CLEANUP LEVELS
Boeing Renton Facility
Renton, Washington

Constituent of Concern	Groundwater Cleanup Level[1] (µg/L)
AOC-034/035	
Vinyl chloride	0.29
cis-1,2-Dichloroethene	0.65
AOC-060	
Vinyl chloride	0.26
Trichloroethene	0.02
cis-1,2-Dichloroethene	0.08
AOC-090	
1,1-Dichloroethene	0.057
1,1,2-Trichloroethane	0.20
1,1,2,2-Tetrachloroethane	0.17
Acetone	300
Benzene	0.8
Toluene	75
Carbon tetrachloride	0.23
Chloroform	2.0
cis-1,2-Dichloroethene	2.4
trans-1,2-Dichloroethene	53.9
Methylene chloride	2.0
Vinyl chloride	0.13
Tetrachloroethene	0.05
Trichloroethene	0.08
TPH-Gasoline w/benzene	800
TPH-Diesel	500
TPH-Motor Oil	500
AOC-092	
Benzene	5.0
TPH-Gasoline w/benzene	800
AOC-093	
TPH-Gasoline w/o benzene	1,000

Notes
1. The groundwater cleanup level applicable at the CPOC for the designated SWMU or AOC. The groundwater cleanup level is protective of surface water and was established in accordance with MTCA regulatory requirements. The process used for establishing these cleanup levels is described in the FS (Geomatrix, 2008b).

Abbreviations
µg/L = micrograms per liter
AOC = area of concern
CPOC = conditional point ot compliance
FS = Feasibility Study
MTCA = Model Toxics Control Act
SWMU = solid waste management unit
TPH = total petroleum hydrocarbons

TABLE 3

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIRMENTS
Boeing Renton Facility
Renton, Washington

	Citation	Applicability	Area											
			SWMU-168	SWMU-172 and -174	Building 4/78-79	Former Fuel Farm	AOC-001 and -002	AOC-003	AOC-004	AOC-034 and -035	AOC-060	AOC-090	AOC-092	AOC-093
Chemical-Specific Laws and Regulations														
Washington Dangerous Waste Regulations	WAC 173-303	Waste management	X	X	X	X	X	X	X	X	X	X	X	X
Washington Model Toxics Control Act Regulations	WAC 173-340	Establishment of cleanup levels and POCs, Remediation	X	X	X	X	X	X	X	X	X	X	X	X
Washington Clean Air Act/Puget Sound Clean Air Agency Regulations	WAC 173-400	Permitting, air quality impacts		X	X									
National Emission Standards for Hazardous Air Pollutants	40 CFR Part 61	Emission control requirements, permitting		X	X									
Action-Specific Laws and Regulations														
Washington State Environmental Policy Act Regulations	WAC 197-11	Permitting, EIA/EIS requirements	X	X	X	X	X	X	X	X	X	X	X	X
Washington Industrial Safety and Health Act Regulations	WAC 296-24	Occupational health and safety	X	X	X	X	X	X	X	X	X	X	X	X
Transportation regulations	49 CFR Parts 100 & 177, WAC 446-50	Transportation for wastes and materials	X	X	X	X	X	X	X	X	X	X	X	X
Washington well drilling regulations	WAC 173-160 & -162	Well design and installation standards	X	X	X	X	X	X	X	X	X	X	X	X
Washington underground injection control regulations	WAC 713-218	Underground injection permitting	X	X	X		X	X	X	X		X		
Washington solid waste disposal regulations	WAC 173-304	Disposal of nondangerous waste	X	X	X	X	X	X	X	X	X	X	X	X
Location-Specific Regulations														
Shoreline Management Act	RCW 90.58	Standards for construction within 200 ft of shoreline	X	X		X	X				X	X	X	X

Abbreviations
AOC = area of concern
CFR = Code of Federal Regulations
EIA = Environmental Impact Assessment
EIS = Environmental Impact Statement.
POCs = points of compliance
RCW = Revised Code of Washington
SWMU = solid waste management unit
WAC = Washington Administrative Code

TABLE 4

COMPARISON OF REMEDIAL ALTERNATIVES, SWMU-168 [1]
Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives		
		1 - Monitored Natural Attenuation	**2 - SVE, Monitored Attenuation**	**3 - Enhanced Bioremediation, Monitored Attenuation**
Protectiveness and Risk Reduction	Pros	Destroys COCs.	Destroys COCs.	Destroys COCs.
	Cons	Slow to achieve cleanup.	Requires off-site waste management.	
	Rating	ML	MH	MH
Permanence	Pros	Natural carbon promotes MNA; Destroys COCs; No residuals.	Destroys COCs; Reasonably rapid cleanup.	Destroys COCs; No residuals; Reasonably rapid cleanup.
	Cons	Slow degradation rates.		
	Rating	MH	H	MH
Cost	Pros	Lowest total cost		Good cost/benefit ratio
	Cons		High total cost.	
	Rating	MH	ML	MH
Long-Term Effectiveness	Pros	Destroys COCs; Passive, natural process.	Removes/Destroys COCs.	Removes/Destroys COCs.
	Cons		Requires vapor treatment for SVE off-gas, and off-site waste management.	
	Rating	MH	MH	MH
Management of Short-Term Risks	Pros	Simplest implementation; No residuals.		Fairly simple implementation.
	Cons		Requires periodic maintenance; potential risk due to SVE emissions and residuals.	
	Rating	H	MH	MH
Technical and Administrative Implementability	Pros	Simple system.	Simple system.	Simple system.
	Cons		Requires air permitting; GAC requires periodic replacement.	Injection permit required.
	Rating	H	ML	MH
Public Concerns	Pros	Industrial site.	Industrial site.	Industrial site
	Cons	Requires City of Renton approval.	Requires City of Renton approval.	Requires City of Renton approval.
	Rating	ML	ML	ML
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.
	Cons			
	Rating	ML	ML	ML

Notes
1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
MH = Medium High;
ML = Medium Low;
L = Low.

Abbreviations
COCs = constituents of concern
GAC = granular-activated carbon
MNA = monitored natural attenuation
SVE = soil vapor extraction

TABLE 5

COMPARISON OF REMEDIAL ALTERNATIVES, SWMU-172/174 [1]

Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives		
		1 -Source Area Excavation/Enhanced Bioremediation/MA	2 - Soil Vapor Extraction/Enhanced Bioremediation/MA	3 - Monitored Natural Attenuation
Protectiveness and Risk Reduction	Pros	Removes or destroys soil COCs, including metals. Soil COCs addressed quickly. Destroys or immobilizes groundwater COCs.	Removes volatile soil COCs. Destroys or immobilizes groundwater COCs. Removes VOCs beneath buildings.	Destroys organic groundwater COCs. Immobilizes metals.
	Cons	Slow to achieve cleanup for groundwater. Cannot remediate area beneath buildings. Off-site waste management required.	Cannot remove nonvolatile soil COCs.	Metals remain at site. Long remediation time.
	Rating	MH	H	ML
Permanence	Pros	Most soil COCs, including metals, are removed from site. Organic groundwater COCs are destroyed.	Volatile soil and groundwater COCs are destroyed.	Natural carbon in site soils promotes MNA. COCs are destroyed, no toxic residuals.
	Cons	COCs beneath building remain at site. Metals remain in site soil. Residuals managed at off-site facility. Off-site CPOC.	Nonvolatile soil COCs remain at site. Metals remain in site soil. Residuals managed at off-site facility. Off-site-CPOC.	Metals remain in site soil. Slow degradation rates; Off-site CPOC.
	Rating	MH	H	ML
Cost	Pros	Long-term costs minimized.		Lowest total cost. Minimal impact on site activities.
	Cons	Affects site activities. May damage facilities. High initial cost.		Long-term monitoring costs incurred.
	Rating	ML	MH	H
Long-Term Effectiveness	Pros	Removes or destroys accessible soil COCs. Groundwater organic COCs destroyed.	Removes or destroys volatile soil COCs. Organic groundwater COCs destroyed.	Destroys COCs; Passive, natural process.
	Cons	Soil COCs remain beneath buildings. Requires institutional controls. Off-site waste management.	Requires periodic injections. Metals remain in site soils. Requires institutional controls. Off-site waste management.	Requires institutional controls.
	Rating	MH	H	ML
Management of Short-Term Risks	Pros	In situ management of affected groundwater.	In situ management of affected groundwater.	Simplest implementation. Minimal potential for exposure to site COCs.
	Cons	Exposure of affected soil, potential emission of dust and volatiles. Waste transportation. Requires periodic electron donor injection.	Requires periodic electron donor injection. Volatile COCs are extracted, potential for emissions.	
	Rating	L	ML	H
Technical and Administrative Implementability	Pros	Off-site landowner has indicated general acceptance for CPOC.	Moderate impact on site activities. Off-site landowner has indicated general acceptance for CPOC.	Simple system, minimal impact on ongoing activities. No permits needed. Off-site landowner has indicated general acceptance for CPOC.
	Cons	Requires excavation and backfill permits, waste manifests, coordination with site manufacturing activities. Potential for damaging facilities. Periodic electron donor injection. Injection permit required. Off-site landowner permission needed for CPOC.	Requires periodic electron donor injection. Injection and emission permitting. Off-site landowner permission for CPOC.	Off-site landowner permission for CPOC.
	Rating	L	MH	H
Public Concerns	Pros	Industrial site.	Industrial site.	Industrial site.
	Cons	Requires City of Renton approval for CPOC. Potential odor issues.	Requires City of Renton approval for CPOC.	Requires City of Renton approval for CPOC.
	Rating	ML	MH	MH
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Most rapid removal of soil COCs.	Industrial site; Proven institutional controls. Alternative water available. Fair to moderate cleanup time frame.	Industrial site; Proven institutional controls; Alternative water available.
	Cons	Does not address COCs beneath building. Practicability of shorter time frame limited by facility operations	Practicability of shorter time frame limited by facility operations. Metals remain in site soil.	Longest cleanup time. Metals remain in site soil. Practicability of shorter time frame limited by facility operations.
	Rating	ML	ML	L

Notes
1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
MH = Medium High;
ML = Medium Low;
L = Low.

Abbreviations
COCs = constituents of concern
CPOC = conditional point of compliance
MA = monitored attenuation
MNA = monitored natural attenuation
VOCs = volatile organic compounds

TABLE 6

COMPARISON OF REMEDIAL ALTERNATIVES, BUILDING 4-78/79 SWMU/AOC GROUP [1]
Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives		
		1 - Source Area Excavation/Enhanced Bioremediation/MA/MNA	2 - SVE/Enhanced Bioremediation/MA/MNA	3 - Source Area Excavation/MNA
Protectiveness and Risk Reduction	Pros	Removes or destroys soil TPH-G and benzene. Soil COCs addressed quickly. Destroys or immobilizes groundwater COCs.	Removes and destroys volatile soil COCs. Destroys groundwater COCs. Removes VOCs beneath buildings.	Removes and destroys soil TPH-G and benzene. Destroys organic groundwater COCs.
	Cons	Slow to achieve cleanup for solvents plume. Cannot remediate soil beneath buildings. Soil COCs may remain beneath Bldg. 4-78. Off-site waste management required.	Slow to achieve cleanup for solvents plume.	Long remediation time. Does not address source area soil for chlorinated VOCs.
	Rating	MH	H	MH
Permanence	Pros	Most soil COCs are removed from site. Organic groundwater COCs are destroyed.	Volatile soil COCs are destroyed with no residuals. Groundwater COCs destroyed before reaching CPOC.	Soil COCs in TPH source area removed from site. Natural carbon in site soils promotes MNA. COCs are destroyed, no toxic residuals.
	Cons	COCs may remain beneath buildings. Residuals managed at off-site facility. Off-site CPOC.	Residuals managed at off-site facility. Off-site CPOC.	Residuals managed off-site. Slow degradation rates; Off-site CPOC.
	Rating	MH	H	ML
Cost	Pros			
	Cons			
	Rating	ML	ML	MH
Long-Term Effectiveness	Pros	Removes or destroys accessible soil COCs. Groundwater organic COCs destroyed before reaching CPOC.	Removes or destroys volatile soil COCs in both source areas. Organic groundwater COCs destroyed.	Removes or destroys soil COCs. Groundwater COCs destroyed at CPOC. Passive, natural process requires minimal operation.
	Cons	TPH COCs may remain beneath buildings. Requires long-term institutional controls. Residuals managed off-site. Periodic electron donor injection required.	Requires periodic electron donor injections. Requires institutional controls. Off-site waste management.	Requires institutional controls.
	Rating	MH	H	MH
Management of Short-Term Risks	Pros	In situ management of affected groundwater.	In situ management of affected groundwater.	In situ management of groundwater. Simplest implementation. Minimal potential for exposure to site COCs.
	Cons	Exposure of affected soil, potential emission of dust and volatiles. Waste transportation. Requires periodic electron donor injection.	Requires periodic electron donor injection. Volatile COCs are extracted, potential for emissions.	Exposure of affected soil, potential emission of dust and volatiles. Waste transportation.
	Rating	ML	MH	ML
Technical and Administrative Implementability	Pros	Off-site landowner has indicated general acceptance for CPOC.	Only moderate impact on site activities. Off-site landowner has indicated general acceptance for CPOC.	Off-site landowner has indicated general acceptance for CPOC.
	Cons	Requires excavation and backfill permits, coordination with site manufacturing activities. Potential for damaging facilities. Periodic electron donor injection. Injection permit required. Requires City of Renton permission for CPOC.	Requires periodic electron donor injection. Injection and emission permitting.	Requires excavation and backfill permits, coordination with site manufacturing activities. Potential for damaging facilities. Periodic electron donor injection. Injection permit required. Requires City of Renton permission for CPOC.
	Rating	ML	MH	ML
Public Concerns	Pros	Industrial site.	Industrial site.	Industrial site.
	Cons	Potential odor and dust issues.	Requires City of Renton approval for CPOC. Potential air quality impacts.	Potential odor and dust issues.
	Rating	ML	MH	ML
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Most rapid removal of soil COCs.	Industrial site; Proven institutional controls. Alternative water available. Fair to moderate cleanup time for soil.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.
	Cons	Does not address COCs beneath building. Practicability of shorter time frame limited by facility operations.	Practicability of shorter time frame limited by facility operations.	Longest cleanup time. Does not address soil COCs beneath buildings. Practicability of shorter time frame limited by facility operations.
	Rating	MH	MH	MH

Notes
1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
MH = Medium High;
ML = Medium Low;
L = Low.

Abbreviations
COCs = constituents of concern
CPOC = conditional point of compliance
MA = monitored attenuation
MNA = monitored natural attenuation
SVE = soil vapor extraction
TPH = total petroleum hydrocarbons
TPH-G = TPH-gasoline
VOC = volatile organic compounds

TABLE 7

COMPARISON OF REMEDIAL ALTERNATIVES, FORMER FUEL FARM [1]

Boeing Renton Facility

Renton, Washington

Standards/Criteria		Alternatives		
		1- Existing Biosparging/Bioventing and Monitored Attenuation	**2 - Upgrade Biosparging/Bioventing and Monitored Attenuation**	**3 - Monitored Natural Attenuation**
Protectiveness and Risk Reduction	Pros	Destroys COCs.	Destroys COCs.	Destroys COCs.
	Cons	Slow to achieve cleanup.	Slow to achieve cleanup.	Slow to achieve cleanup.
	Rating	MH	MH	ML
Permanence	Pros	Destroys COCs; No residuals.	Destroys COCs; No residuals.	Destroys COCs; No residuals.
	Cons	Slow degradation rates.	Slow degradation rates.	Slow degradation rates.
	Rating	MH	H	MH
Cost	Pros	System already exists.		Lowest total cost.
	Cons	High long-term costs.	High short and long-term costs.	High long-term costs.
	Rating	ML	L	MH
Long-Term Effectiveness	Pros	Destroys COCs.	Destroys COCs.	Destroys COCs; Passive, natural process.
	Cons	Active process requiring input.	Active process requiring input.	
	Rating	ML	ML	MH
Management of Short-Term Risks	Pros	System already operational.	Additional biosparge wells should improve effectiveness.	Simplest implementation; No residuals.
	Cons	Existing design flaw limits effectiveness.	Additional well and piping installation required.	
	Rating	MH	ML	H
Technical and Administrative Implementability	Pros	Easily implementable.	Moderately implementable.	Simple system.
	Cons			
	Rating	H	MH	H
Public Concerns	Pros	Industrial site.	Industrial site.	Industrial site.
	Cons			
	Rating	MH	MH	MH
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.
	Cons			
	Rating	ML	ML	ML

Notes

1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
   MH = Medium High;
   ML = Medium Low;
   L = Low.

Abbreviations

COCs = constituents of concern

TABLE 8

COMPARISON OF REMEDIAL ALTERNATIVES, AOC-001 AND AOC-002 [1]

Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives	
		1 - Enhanced Bioremediation/Monitored Attenuation	2 - Monitored Natural Attenuation
Protectiveness and Risk Reduction	Pros	Rapidly destroys groundwater COCs.	Removes or destroys COCs in source area quickly. Destroys organic groundwater COCs. Immobilizes metals.
	Cons	A few years are required to achieve cleanup standards for groundwater. Active injection of electron donor required.	Very long remediation time.
	Rating	MH	ML
Permanence	Pros	Groundwater COCs are permanently destroyed; no toxic residuals.	Natural carbon in site soils promotes MNA. COCs are destroyed, no toxic residuals.
	Cons	Toxic degradation products are generated and are present in groundwater for the short term.	Toxic degradation products are generated and are present in groundwater for the short term.
	Rating	MH	MH
Cost	Pros		Lowest total cost.
	Cons	Moderate initial costs, high long-term monitoring costs.	Low initial costs, high long-term monitoring costs.
	Rating	ML	MH
Long-Term Effectiveness	Pros	Groundwater COCs destroyed. Remediation complete in 2-4 years.	Slow destruction of COCs; passive, natural process.
	Cons		Remediation time likely to be greater than 10 years.
	Rating	H	MH
Management of Short-Term Risks	Pros	In situ management of affected groundwater.	Simplest implementation, in situ management of groundwater.
	Cons	Well drilling and active injection of electron donor required.	
	Rating	MH	MH
Technical and Administrative Implementability	Pros	Site is readily accessible. No technical or physical constraints.	Site is readily accessible. No technical or physical constraints.
	Cons	Well drilling, periodic electron donor injection. Injection permitting required.	.
	Rating	MH	MH
Public Concerns	Pros	Industrial site, minimal potential impact on public.	Industrial site, minimal potential impact on public.
	Cons		
	Rating	H	H
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; More rapid removal of groundwater COCs.	Industrial site; Proven institutional controls; Alternative water available.
	Cons	Expected time to complete remediation is 2-4 years.	Longer cleanup time, expected to require 10 or more years.
	Rating	MH	MH

Notes

1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
   MH = Medium High;
   ML = Medium Low;
   L = Low.

Abbreviations

COCs = constituents of concern
MNA = monitored natural attenuation

TABLE 9

COMPARISON OF REMEDIAL ALTERNATIVES, AOC-003 [1]

Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives	
		1 - Monitored Natural Attenuation	2 - Enhanced Bioremediation/MA
Protectiveness and Risk Reduction	Pros	Destroys COCs.	Destroys COCs.
	Cons	Slow to achieve cleanup.	
	Rating	ML	MH
Permanence	Pros	Natural carbon promotes MNA; Destroys COCs; No residuals.	Destroys COCs; No residuals; Reasonably rapid cleanup.
	Cons	Slow degradation rates.	
	Rating	MH	H
Cost	Pros	Lower cost.	
	Cons		Higher cost.
	Rating	H	MH
Long-Term Effectiveness	Pros	Destroys COCs; Passive, natural process.	Destroys COCs.
	Cons		Requires periodic injections.
	Rating	MH	MH
Management of Short-Term Risks	Pros	Simplest implementation; No residuals.	
	Cons		Requires periodic injections.
	Rating	H	MH
Technical and Administrative Implementability	Pros	Simple system.	Simple system.
	Cons		Requires periodic injections; Injection permit required.
	Rating	H	MH
Public Concerns	Pros	Industrial site.	Industrial site.
	Cons		
	Rating	MH	MH
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.
	Cons		
	Rating	ML	ML

Notes
1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
MH = Medium High;
ML = Medium Low;
L = Low.

Abbreviations
COCs = constituents of concern
MA = monitored attenuation
MNA = monitored natural attenuation

TABLE 10

COMPARISON OF REMEDIAL ALTERNATIVES, AOC-004 [1]
Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives	
		1 - Monitored Natural Attenuation	2 - Enhanced Bioremediation/MA
Protectiveness and Risk Reduction	Pros	Destroys COCs.	Destroys COCs.
	Cons	Slow to achieve cleanup.	
	Rating	ML	MH
Permanence	Pros	Destroys COCs; No residuals.	Destroys COCs; Reasonably rapid cleanup.
	Cons	Slow degradation rates.	
	Rating	MH	H
Cost	Pros	Lower cost.	
	Cons		Higher cost
	Rating	H	MH
Long-Term Effectiveness	Pros	Destroys COCs; Passive, natural process.	Destroys COCs, Mostly passive process.
	Cons		
	Rating	MH	MH
Management of Short-Term Risks	Pros	Simple implementation; No residuals.	Simple implementation, No residuals.
	Cons	Minor short-term risk associated with limited excavation of affected soils.	Short-term risk associated with limited excavation of affected soils and electron donor injection.
	Rating	H	MH
Technical and Administrative Implementability	Pros	Simple system.	Simple system.
	Cons	Limited excavation of affected soils	Limited excavation of affected soils; Injection permit needed.
	Rating	H	MH
Public Concerns	Pros	Industrial site.	Industrial site.
	Cons		
	Rating	MH	MH
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.
	Cons		
	Rating	ML	ML

Notes
1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
MH = Medium High;
ML = Medium Low;
L = Low.

Abbreviations
COCs = constituents of concern
MA = monitored attenuation

TABLE 11

COMPARISON OF REMEDIAL ALTERNATIVES, AOC-034/035 [1]

Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives	
		1 - Monitored Natural Attenuation	2 - Enhanced Bioremediation/MA
Protectiveness and Risk Reduction	Pros	Destroys COCs.	Destroys COCs.
	Cons	Slow to achieve cleanup.	
	Rating	ML	MH
Permanence	Pros	Natural carbon promotes MNA; Destroys COCs; No residuals.	Destroys COCs; No residuals; Reasonably rapid cleanup.
	Cons	Slow degradation rates.	
	Rating	MH	H
Cost	Pros	Lower cost.	
	Cons		Higher cost.
	Rating	H	MH
Long-Term Effectiveness	Pros	Destroys COCs; Passive, natural process.	Destroys COCs.
	Cons		Requires periodic injections.
	Rating	M	MH
Management of Short-Term Risks	Pros	Simplest implementation; No residuals.	
	Cons		Requires periodic injections.
	Rating	H	MH
Technical and Administrative Implementability	Pros	Simple system.	Simple system.
	Cons		Requires periodic injections; Injection permit required.
	Rating	H	MH
Public Concerns	Pros	Industrial site.	Industrial site.
	Cons		
	Rating	MH	MH
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.
	Cons		
	Rating	ML	ML

Notes

1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
   MH = Medium High;
   M = Medium
   ML = Medium Low;
   L = Low.

Abbreviations

COCs = constituents of concern
MA = monitored attenuation
MNA = monitored natural attenuation

TABLE 12

COMPARISON OF REMEDIAL ALTERNATIVES, AOC-060[1]
Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives		
		1 - Monitored Natural Attenuation	2 - Enhanced Bioremediation/MA	3 - Air Sparging/Soil Vapor Extraction/MA
Protectiveness and Risk Reduction	Pros	Destroys COCs.	Destroys COCs.	Removes COCs; Fastest to achieve cleanup levels in majority of plume.
	Cons	Slow to achieve cleanup.		Requires off-site waste management.
	Rating	ML	MH	H
Permanence	Pros	Natural carbon promotes MNA; Destroys COCs; No residuals.	Destroys COCs; No residuals; Reasonably rapid cleanup.	Removes COCs rapidly; Fastest to achieve cleanup levels in majority of plume.
	Cons	Slow degradation rates; Off-site CPOC.	Off-site CPOC.	Off-site CPOC.
	Rating	MH	MH	H
Cost	Pros	Lowest Cost.		
	Cons			Highest Cost.
	Rating	H	MH	L
Long-Term Effectiveness	Pros	Destroys COCs; Passive, natural process.	Destroys COCs.	Removes COCs.
	Cons		Requires periodic injections.	Requires engineering controls; Requires off-site waste management.
	Rating	MH	MH	ML
Management of Short-Term Risks	Pros	Simplest implementation; No residuals.		
	Cons		Requires periodic injections.	Some risks related to handling of residuals.
	Rating	H	MH	MH
Technical and Administrative Implementability	Pros	Simple system.	Simple system.	Removes COCs.
	Cons	Off-site landowner permission needed.	Requires periodic injections; Off-site landowner permission needed; Injection permit required.	Complex system; Requires engineering controls; Requires air permitting; Active operation and maintenance; off-site landowner permission.
	Rating	H	MH	ML
Public Concerns	Pros	Industrial site.	Industrial site.	Industrial site.
	Cons	Requires City of Renton approval for CPOC.	Requires City of Renton approval for CPOC.	Requires City of Renton approval for CPOC.
	Rating	MH	MH	MH
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.
	Cons			
	Rating	ML	ML	ML

Notes
1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
MH = Medium High;
ML = Medium Low;
L = Low.

Abbreviations
COCs = constitutents of concern
CPOC = conditional point of compliance
MA = monitored attenuation
MNA = monitored natural attenuation

TABLE 13

COMPARISON OF REMEDIAL ALTERNATIVES, AOC-090 [1]

Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives		
		1 - Monitored Attenuation	**2 - Enhanced Bioremediation/MA**	**3 - Soil Vapor Extraction/MA**
Protectiveness and Risk Reduction	Pros	Destroys COCs.	Fairly rapid COC destruction throughout plume.	Rapidly removes COCs; slow COC destruction within plume.
	Cons	Slow to achieve cleanup.		Requires off-site waste management.
	Rating	ML	MH	MH
Permanence	Pros	Natural carbon promotes MNA; Destroys COCs; No residuals.	Destroys COCs; No residuals; Reasonably rapid cleanup.	Removes COCs rapidly; Fastest to achieve cleanup levels in majority of plume.
	Cons	Slow degradation rates; Off-site CPOC.	Off-site CPOC.	Slow groundwater degradation rates; Off-site CPOC.
	Rating	ML	MH	H
Cost	Pros	Lowest cost.		
	Cons			Highest cost.
	Rating	MH	ML	L
Long-Term Effectiveness	Pros	Destroys COCs; Passive, natural process.	Destroys COCs.	Removes/Destroys COCs.
	Cons		Requires periodic injections.	Requires engineering controls; Requires off-site waste management.
	Rating	MH	MH	ML
Management of Short-Term Risks	Pros	Simplest implementation; No residuals.		
	Cons		Requires periodic injections.	Potential risks related to emissions and to handling of residuals.
	Rating	H	MH	ML
Technical and Administrative Implementability	Pros	Simple system.	Simple system.	Existing soil vapor collector.
	Cons	Off-site landowner permission needed.	Requires periodic injections; Off-site landowner permission needed; Injection permit required.	More complex system; Requires engineering controls; Requires air permitting; Active operations and maintenance; off-site landowner permission.
	Rating	H	MH	ML
Public Concerns	Pros	Industrial site.	Industrial site.	Industrial site.
	Cons	Requires City of Renton approval for CPOC.	Requires City of Renton approval for CPOC.	Requires City of Renton approval for CPOC.
	Rating	ML	ML	ML
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.
	Cons			
	Rating	ML	ML	ML

Notes
1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
MH = Medium High;
ML = Medium Low;
L = Low.

Abbreviations
COCs = constituents of concern
CPOC = conditional point of compliance
MA = monitored attenuation
MNA = monitored natural attenuation

TABLE 14

COMPARISON OF REMEDIAL ALTERNATIVES, AOC-092 [1]

Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives	
		1 - Monitored Natural Attenuation	2 - Soil Excavation/Enhanced Bioremediation/MA
Protectiveness and Risk Reduction	Pros	Destroys COCs.	Removes some COCs, destroys some COCs.
	Cons	Slow to achieve cleanup.	
	Rating	ML	MH
Permanence	Pros	Destroys COCs; No residuals.	Destroys COCs; Excavated soil requires disposal; Reasonably rapid cleanup.
	Cons	Slow degradation rates.	
	Rating	MH	H
Cost	Pros	Low initial cost.	
	Cons	High long-term cost.	High initial cost.
	Rating	MH	ML
Long-Term Effectiveness	Pros	Destroys COCs; Passive, natural process.	Removes some COCs, destroys some COCs.
	Cons		Produces residuals requiring handling.
	Rating	MH	ML
Management of Short-Term Risks	Pros	Simplest implementation; No residuals.	
	Cons		Minor short-term risks during excavation.
	Rating	H	MH
Technical and Administrative Implementability	Pros	Simple system.	Simple system.
	Cons	Installation and monitoring of wells inside Building 4-20 extremely difficult due to manufacturing activities.	Requires off-site handling of excavated soils.
	Rating	L	MH
Public Concerns	Pros	Industrial site.	Industrial site.
	Cons		
	Rating	MH	MH
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.
	Cons		
	Rating	ML	ML

Notes
1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
MH = Medium High;
ML = Medium Low;
L = Low.

Abbreviations
COCs = constituents of concern
MA = monitored attenuation

TABLE 15

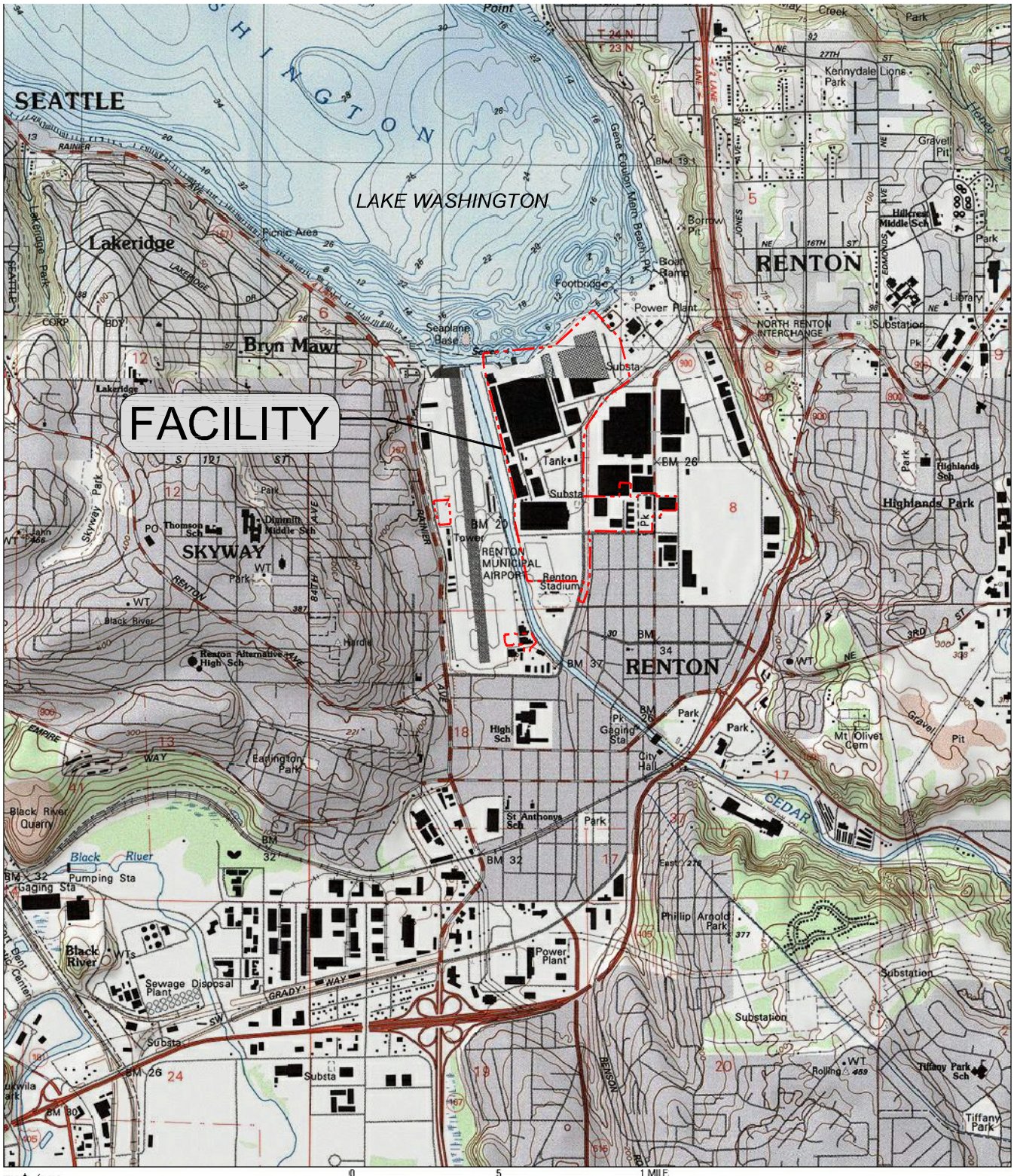
COMPARISON OF REMEDIAL ALTERNATIVES, AOC-093 [1]
Boeing Renton Facility
Renton, Washington

Standards/Criteria		Alternatives	
		1 - Monitored Natural Attenuation	2 - Soil Excavation/Enhanced Bioremediation/MA
Protectiveness and Risk Reduction	Pros	Destroys organic constituents that may leach to groundwater. Appears to be active at site.	Removes soil COCs, destroys potential groundwater constituents.
	Cons	Slow to achieve cleanup.	
	Rating	MH	H
Permanence	Pros	Destroys potential groundwater constituents, No residuals.	Removes soil COCs, destroys potential groundwater constituents; Rapid cleanup.
	Cons	Slow degradation rates.	Residuals managed at off-site disposal facility.
	Rating	ML	MH
Cost	Pros	Low initial cost.	
	Cons		High initial cost.
	Rating	H	L
Long-Term Effectiveness	Pros	Destroys potential groundwater COCs; Passive, natural process.	Removes some COCs from site. Potential groundwater COCs would be destroyed.
	Cons		
	Rating	MH	MH
Management of Short-Term Risks	Pros	Simplest implementation; No residuals.	
	Cons	Minor short-term risks during excavation.	Minor short-term risks during excavation.
	Rating	MH	MH
Technical and Administrative Implementability	Pros	Simple, passive system. No permits required.	
	Cons	Excavation would interfere with site activities due to location in aircraft tow path.	Excavation would interfere with site activities due to location in aircraft tow path.
	Rating	ML	ML
Public Concerns	Pros	Industrial site.	Industrial site.
	Cons		
	Rating	MH	MH
Restoration Time Frame	Pros	Industrial site; Proven institutional controls; Alternative water available; Practicability of shorter time frame limited by facility operations.	Industrial site; Proven institutional controls; Alternative water available; short cleanup time.
	Cons		
	Rating	ML	H

Notes
1. Comparison Ratings: H = Highest (if the decision were based solely on one criterion, an H score would indicate the alternative is the preferred alternative);
MH =Medium High;
ML = Medium Low;
L = Low.

Abbreviations
COCs = constituents of concern

FIGURES



BOEING FACILITY LOCATION
Boeing Renton Facility
Renton, Washington

By: APS	Date: 08/15/12	Project No. 8888
AMEC Geomatrix		Figure 1

BOEING

Plot Date: 08/15/12 - 11:32am, Plotted by: mike.stenberg
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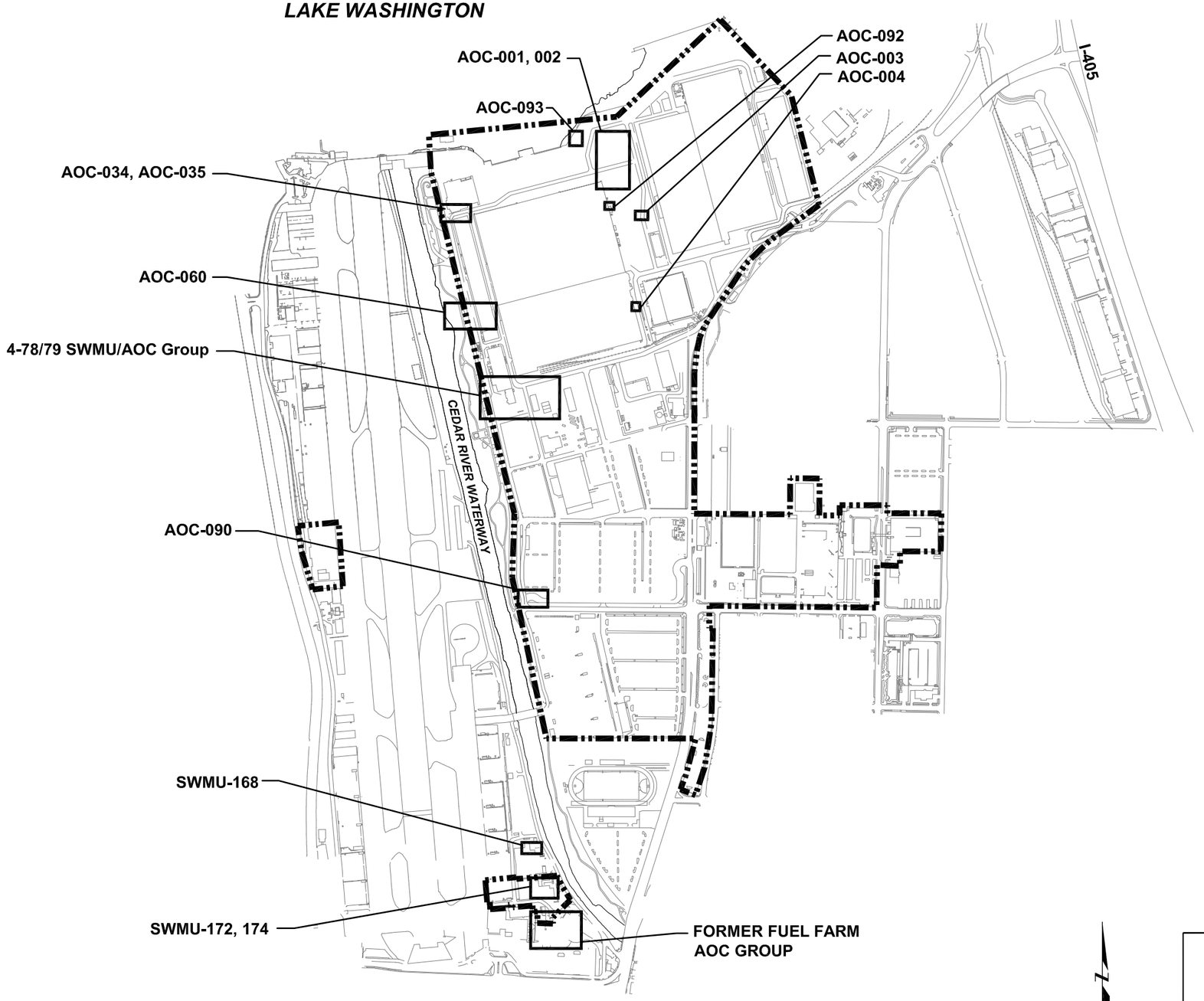

LEGEND

GENERAL LOCATION OF SWMUs AND AOCs

FACILITY BOUNDARY

NOTES

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

N

0 400 800

APPROXIMATE SCALE IN FEET

BOEING

SWMU AND AOC LOCATION MAP
Boeing Renton Facility
Renton, Washington

By: APS	Date: 08/14/12	Project No. 8888
AMEC Geomatrix		Figure 2

Plot Date: 08/14/12 - 11:03am Plotted by: mike.stenberg
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Plot Date: 10/20/10 - 4:02pm, Plotted by: adam.stenberg
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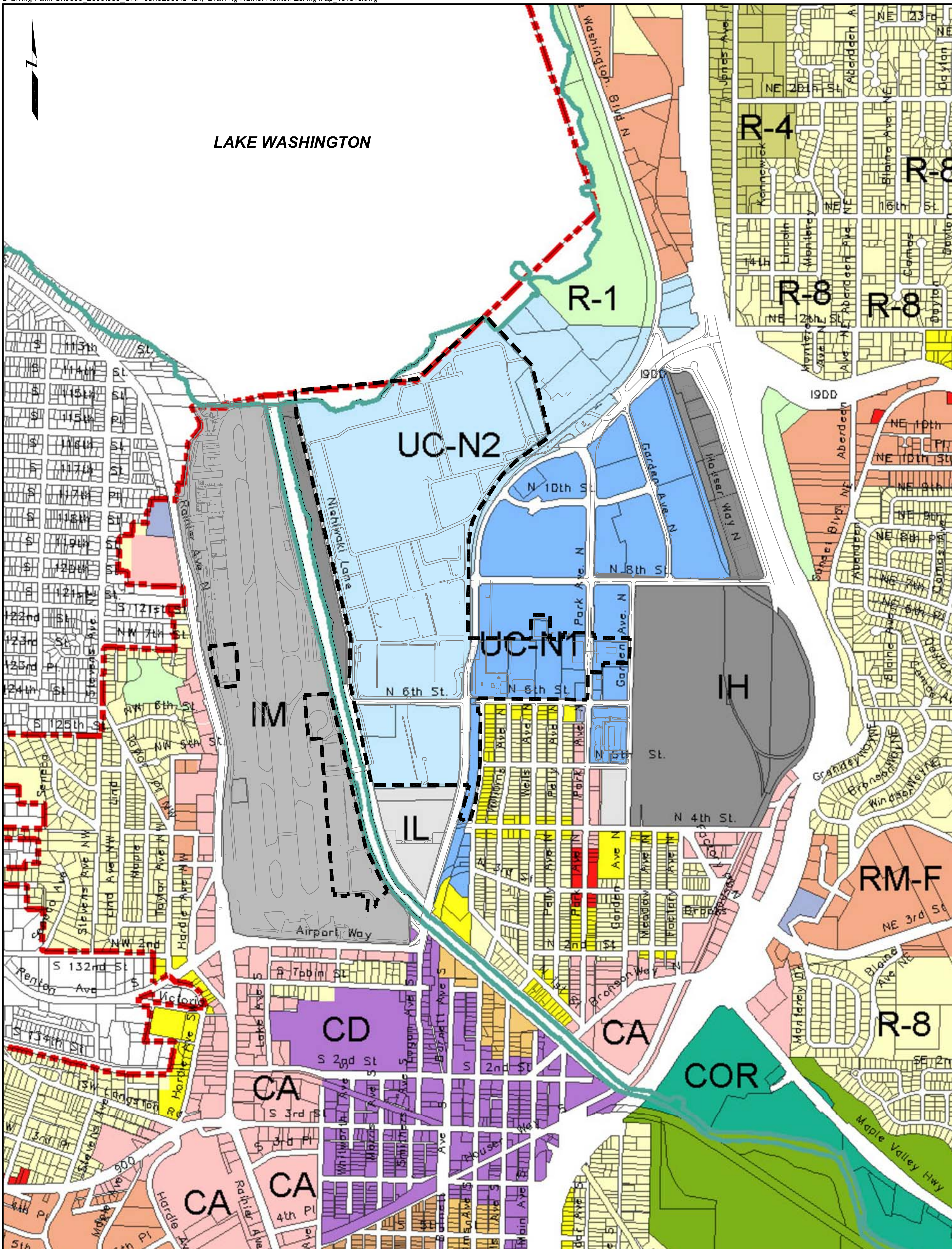


0 500 1,000
APPROXIMATE SCALE IN FEET

RESIDENTIAL
- (RC) Resource Conservation
- (R-1) Residential 1du/ac
- (R-4) Residential 4du/ac
- (R-8) Residential 8du/ac
- (RMH) Residential Manufactured Homes
- (R-10) Residential 10du/ac
- (R-14) Residential 14du/ac
- (RM-F) Residential Multi-Family
- (RM-T) Resi. Multi-Family Traditional
- (RM-U) Resi. Multi-Family Urban Center

MIXED USE CENTERS
- (CV) Center Village
- (UC-N1) Urban Center North 1
- (UC-N2) Urban Center North 2
- (CD) Center Downtown

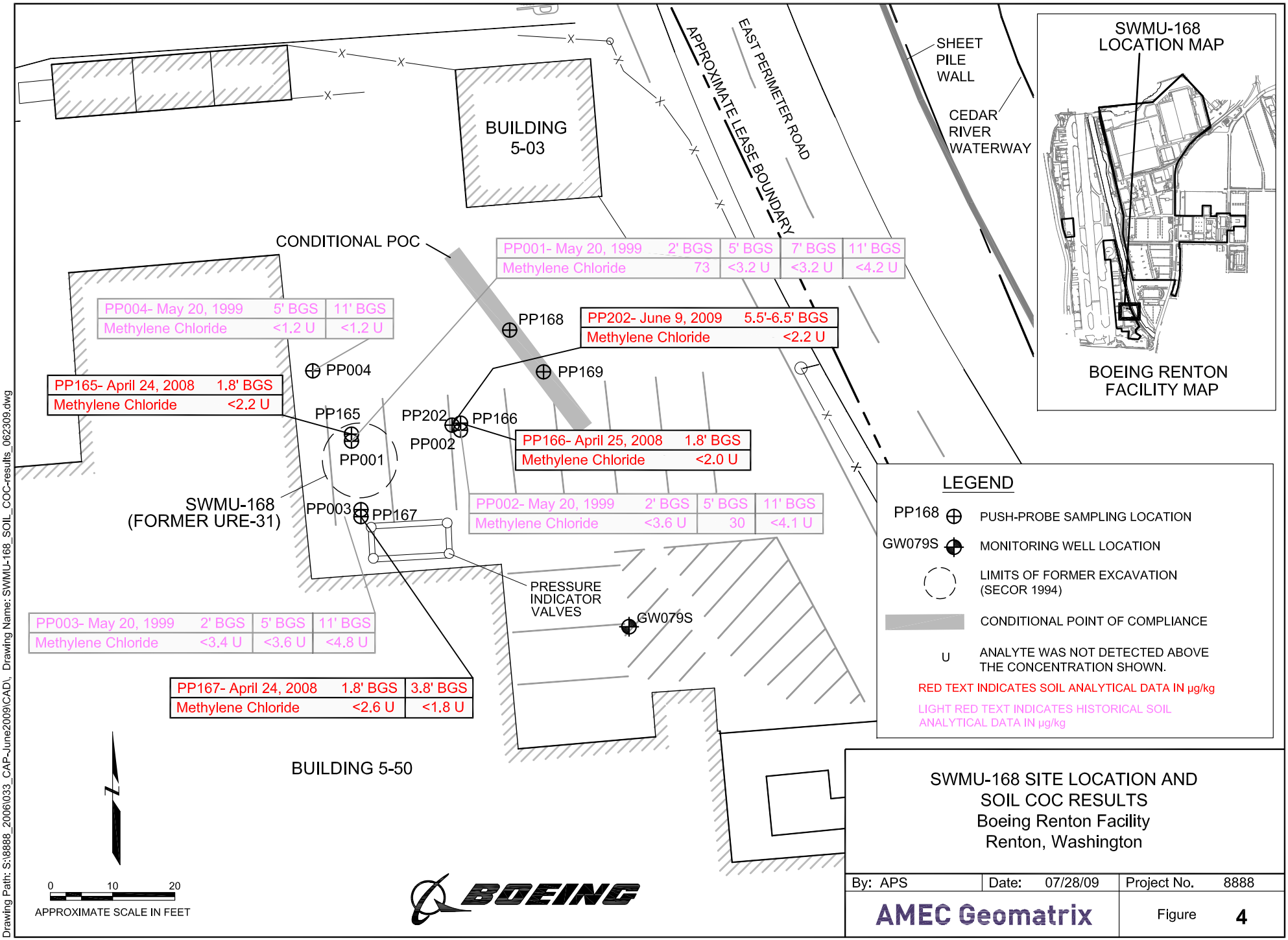
COMMERCIAL/MIXED USE
- (COR) Commercial/Office/Residential
- (CA) Commercial Arterial
- (CO) Commercial Office
- (CN) Commercial Neighborhood

INDUSTRIAL
- (IL) Industrial Light
- (IM) Industrial Medium
- (IH) Industrial Heavy

- Renton City Limits
- Boeing Facility Boundary

BOEING RENTON FACILITY BOUNDARY
AND ZONING TYPES
Renton, Washington

By: APS	Date: 10/20/10	Project No. 8888
AMEC Geomatrix		Figure 3



SWMU-168 SITE LOCATION AND SOIL COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 07/28/09	Project No. 8888
AMEC Geomatrix	Figure	4

Plot Date: 07/28/09 - 1:07pm, Plotted by: adam.stenberg
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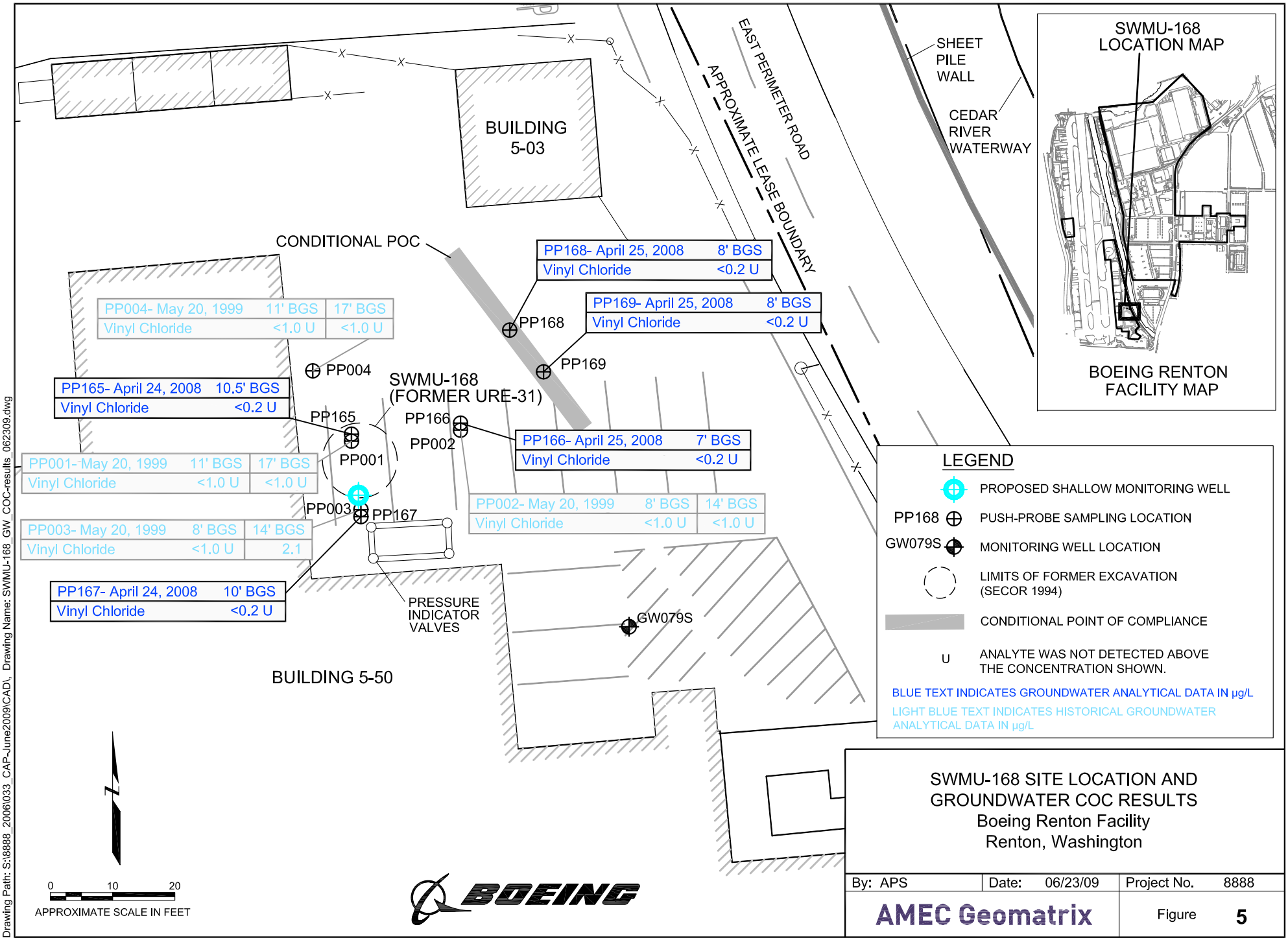

SWMU-168 SITE LOCATION AND GROUNDWATER COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/23/09	Project No. 8888
AMEC Geomatrix		Figure 5

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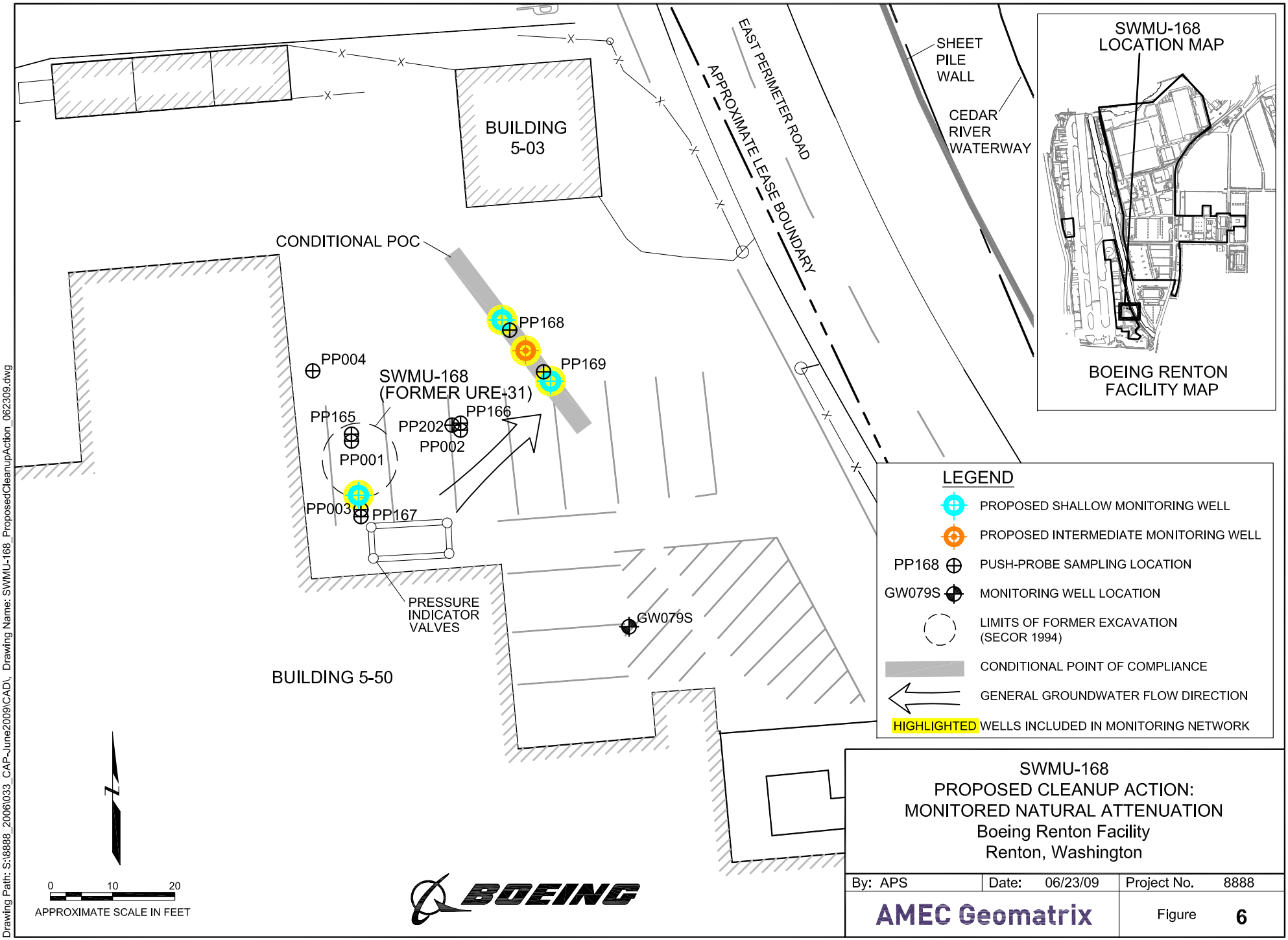


SWMU-168
PROPOSED CLEANUP ACTION:
MONITORED NATURAL ATTENUATION
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/23/09	Project No. 8888
AMEC Geomatrix	Figure	6

BOEING

Plot Date: 06/23/09 - 4:01pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: SWMU-168_ProposedCleanupAction_062309.dwg

PP171 April 24, 2008	1.8' BGS	4.8' BGS
1,1-DCE	<1.3 U	<1.3 U
Benzene	2.9	<1.3 U
cis-1,2-DCE	<1.3 U	4.3
Methylene Chloride	<2.7 U	24
Tetrachloroethene	9.9	78
Trichloroethene	<1.3 U	21
Vinyl Chloride	<1.3 U	<1.3 U

GW153S May 24, 1999	2.0' BGS	8.5' BGS	15.0' BGS
Benzene	<1.1 U	<1.1 U	<1.3 U
Methylene Chloride	<7.3 U	<4.1 U	<3.9 U
Tetrachloroethene	16	30	<1.3 U
Trichloroethene	17	27	15

PP008 May 21, 1999	2.0' BGS	9.0' BGS	15.0' BGS
Benzene	<14 U	<4.0 U	<2.0 U
Methylene Chloride	23	<6.0 U	<3.9 U
Tetrachloroethene	<4.0 U	<2.0 U	1,700
Trichloroethene	22	14	61

PP170- April 24, 2008	1.5' BGS	3.8' BGS
1,1-DCE	<1.2 U	<740 U
Benzene	<1.2 U	<740 U
cis-1,2-DCE	<1.2 U	<740 U
Methylene Chloride	<2.4 U	<1,500 U
Tetrachloroethene	2,900	5,800
Trichloroethene	52	<740 U
Vinyl Chloride	<1.2 U	<740 U

PP007 May 26, 1999	8.0' BGS	15.0' BGS
Benzene	<1.1 U	<1.2 U
Methylene Chloride	<3.2 U	<3.6 U
Tetrachloroethene	2.6	<1.2 U
Trichloroethene	3.5	2.1

PP005 May 26, 1999	2.0' BGS	8.0' BGS	15.0' BGS
Benzene	<1.1 U	<1.0 U	<1.2 U
Methylene Chloride	<13 U	5.5	<3.6 U
Tetrachloroethene	<1.1 U	130	2.5
Trichloroethene	<4.0 U	14	4.1

PP006 May 21, 1999	2.0' BGS	15.0' BGS
Benzene	1200	<1.5 U
Methylene Chloride	<380 U	<4.5 U
Tetrachloroethene	5,900	5.7
Trichloroethene	400	24

PP172 April 24, 2008	1.5' BGS	4.8' BGS
1,1-DCE	24	<1.1 U
Benzene	<1.4 U	<1.1 U
cis-1,2-DCE	2,200	82
Methylene Chloride	<2.8 U	<2.3 U
Tetrachloroethene	27,000	6,600
Trichloroethene	6,400	90
Vinyl Chloride	22	1.2

GW152S May 24, 1999	2.0' BGS	8.5' BGS	15.0' BGS
Benzene	<1.2 U	<1.1 U	<1.9 U
Methylene Chloride	<16 U	<44 U	<7.0 U
Tetrachloroethene	70	110	<1.9 U
Trichloroethene	29	51	<1.9 U

PP061 Augsut 8, 2000	2.0' BGS	4.0' BGS
Benzene	<1.3 U	<1.4 U
Methylene Chloride	<3.9 U	<4.2 U
Tetrachloroethene	1700	310
Trichloroethene	61	17

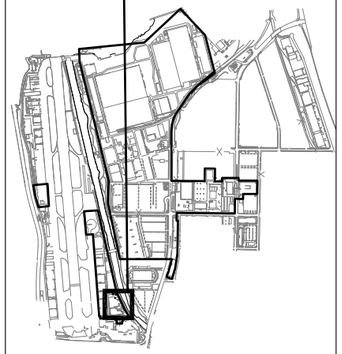
PP173 April 24, 2008	1.7' BGS	4.7' BGS
1,1-DCE	<1.5 U	<2.9 U
Benzene	4.1	5.1
cis-1,2-DCE	<1.5 U	9.9
Methylene Chloride	<2.9 U	<5.8 U
Tetrachloroethene	1,800	1,600
Trichloroethene	18	52
Vinyl Chloride	<1.5 U	<2.9 U

PP062 Augsut 8, 2000	2.0' BGS	5.0' BGS
Benzene	<1.1 U	<1.0 U
Methylene Chloride	<3.4 U	<3.1 U
Tetrachloroethene	2.7	130
Trichloroethene	2.3	<1.0 U

PP174 April 24, 2008	1.8' BGS	4.8' BGS
1,1-DCE	<1.6 U	<1.3 U
Benzene	<1.6 U	<1.3 U
cis-1,2-DCE	<1.6 U	<1.3 U
Methylene Chloride	<3.1 U	<2.6 U
Tetrachloroethene	58	150
Trichloroethene	<1.6 U	<1.3 U
Vinyl Chloride	<1.6 U	<1.3 U

GW079S
GW136S
SHEET PILE WALL
CONDITIONAL POC
CEDAR RIVER WATERWAY
EAST PERIMETER ROAD
BUILDING 5-50
AOC-049 (FORMER URE-30)
GW080S
GW081S
PP175
PP088
GW173S
GW083S
GW082S
GW226S
GW153S
PP063
PP087
PP110
GW084S
PP089
PP007
PP008
PP170
SWMU-174 (FORMER URE-73)
GW172S
PP176
PP171
GW152S
PP061
PP086
PP006
PP172
PP173
SWMU-172 (FORMER URE-66)
PP005
BUILDING 5-09
BUILDING 5-08
PP177
PP062
PP174
PP077
GW183S
APPROXIMATE LEASE BOUNDARY

AOC-172 and AOC-174 LOCATION MAP



BOEING RENTON FACILITY MAP

LEGEND

- PP173 — DIRECT PUSH SAMPLING LOCATION
- GW083S — MONITORING WELL LOCATION
- GW082S — ABANDONED GROUNDWATER MONITORING WELL LOCATION REPLACED BY GW226S
- FENCE
- APPROXIMATE SOURCE AREA
- CONDITIONAL POINT OF COMPLIANCE

J Analyte was positively identified; the value shown is the approximate concentration of the analyte.

U Analyte was not detected above the concentration shown.

RED TEXT INDICATES SOIL ANALYTICAL DATA IN µg/kg

LIGHT RED TEXT INDICATES HISTORICAL SOIL ANALYTICAL DATA IN µg/kg

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 20 40
APPROXIMATE SCALE IN FEET

BOEING

SWMU-172 and SWMU-174 SITE LOCATION AND SOIL COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 09/14/12	Project No. 8888
amec		Figure 7

Plot Date: 09/14/12 - 10:53am, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\, Drawing Name: SWMU-172 and 174_SOIL_COC-results_081412.dwg

BUILDING 5-50

BUILDING 5-08

BUILDING 5-09

SHEET PILE WALL

CONDITIONAL POC

EAST PERIMETER ROAD

CEDAR RIVER WATERWAY

APPROXIMATE LEASE BOUNDARY

SWMU-174 (FORMER URE-73)

SWMU-172 (FORMER URE-66)

AOC-049 (FORMER URE-30)

GW079S

GW136S

GW080S

GW081S

GW083S

GW082S

GW226S

GW153S

GW084S

GW171S

GW183S

GW173S

GW172S

GW152S

PP063

PP008

PP007

PP170

PP110

PP089

PP171

PP006

PP172

PP005

PP175

PP088

PP087

PP176

PP086

PP061

PP173

PP177

PP062

PP174

PP077

GW082S May 14, 2008	
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	0.5
Trichloroethene	0.2
cis-1,2-DCE	0.3
Vinyl Chloride	0.4

PP063 August 8, 2000	25' BGS	32' BGS
1,1-Dichloroethene	<1.0 U	<1.0 U
Benzene	<1.0 U	<1.0 U
Chloromethane	<1.0 U	<1.0 U
Methylene Chloride	<2.0 U	<2.0 U
Tetrachloroethene	<1.0 U	<1.0 U
Trichloroethene	<1.0 U	<1.0 U
cis-1,2-DCE	<1.0 U	<1.0 U
Vinyl Chloride	<1.0 U	<1.0 U

GW083S May 14, 2008	
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	<0.5 U
Trichloroethene	0.2
cis-1,2-DCE	0.2
Vinyl Chloride	0.4

GW081S May 14, 2008	
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U

PP175 April 25, 2008	6.5' BGS
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	0.2
Methylene Chloride	<0.5 U
Tetrachloroethene	0.5
Trichloroethene	0.2
cis-1,2-DCE	0.5
Vinyl Chloride	<0.2 U

GW173S May 14, 2008	
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	0.3
Trichloroethene	0.2
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U

GW153S May 14, 2008	
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	1.9
Trichloroethene	0.5
cis-1,2-DCE	0.3
Vinyl Chloride	0.3

PP007 May 26, 1999	17' BGS
1,1-Dichloroethene	<1.0 U
Benzene	<1.0 U
Chloromethane	<1.0 U
Methylene Chloride	<2.0 U
Tetrachloroethene	<1.0 U
Trichloroethene	32
cis-1,2-DCE	2.4
Vinyl Chloride	<1.0 U

GW152S May 14, 2008	
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	6.0
Trichloroethene	1.3
cis-1,2-DCE	14
Vinyl Chloride	8.0

GW172S May 14, 2008	
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	1.4
Trichloroethene	1.8
cis-1,2-DCE	1.5
Vinyl Chloride	0.7

PP176 April 24, 2008	3' BGS
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	0.3
Trichloroethene	0.2
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U

PP008 May 21, 1999	12' BGS	18' BGS
1,1-Dichloroethene	<1.0 U	<1.0 U
Benzene	<1.0 U	<1.0 U
Chloromethane	<1.0 U	<1.0 U
Methylene Chloride	<2.0 U	<2.0 U
Tetrachloroethene	<1.0 U	7.3
Trichloroethene	<1.0 U	<1.0 U
cis-1,2-DCE	<1.0 U	<1.0 U
Vinyl Chloride	<1.0 U	<1.0 U

PP061 August 8, 2000	12' BGS
1,1-Dichloroethene	3.8
Benzene	<1.0 U
Chloromethane	<1.0 U
Methylene Chloride	<2.0 U
Tetrachloroethene	100
Trichloroethene	1,900
cis-1,2-DCE	2,500
Vinyl Chloride	22

PP170 April 24, 2008	10' BGS
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	0.2
Methylene Chloride	<0.5 U
Tetrachloroethene	9.0
Trichloroethene	1.2
cis-1,2-DCE	2.0
Vinyl Chloride	0.4

PP171 April 24, 2008	7' BGS
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	0.2
Methylene Chloride	<0.5 U
Tetrachloroethene	3.2
Trichloroethene	0.8
cis-1,2-DCE	0.4
Vinyl Chloride	<0.2 U

PP172 April 24, 2008	10' BGS
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	65
Trichloroethene	7.9
cis-1,2-DCE	10
Vinyl Chloride	0.7

PP173 April 24, 2008	7' BGS
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	380
Trichloroethene	28
cis-1,2-DCE	110
Vinyl Chloride	1

PP177 April 24, 2008	7' BGS
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U

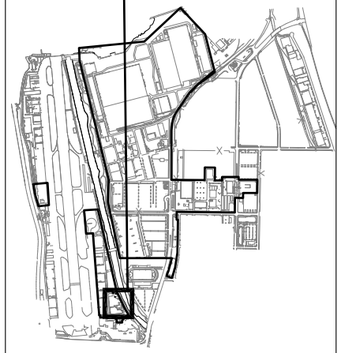
PP062 August 8, 2000	12' BGS
1,1-Dichloroethene	<1.0 U
Benzene	<1.0 U
Chloromethane	<1.0 U
Methylene Chloride	<2.0 U
Tetrachloroethene	3.6
Trichloroethene	<1.0 U
cis-1,2-DCE	1.1
Vinyl Chloride	<1.0 U

PP174 April 24, 2008	10' BGS
1,1-Dichloroethene	<0.2 U
Benzene	<0.2 U
Chloromethane	<0.2 U
Methylene Chloride	<0.5 U
Tetrachloroethene	7.8
Trichloroethene	0.3
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U

PP005 May 26, 1999	12' BGS	18' BGS
1,1-Dichloroethene	<1.0 U	<1.0 U
Benzene	<1.0 U	<1.0 U
Chloromethane	<1.0 UJ	<1.0 U
Methylene Chloride	<2.0 U	<2.0 U
Tetrachloroethene	180	<1.0 U
Trichloroethene	19	<1.0 U
cis-1,2-DCE	41	<1.0 U
Vinyl Chloride	3	<1.0 U

PP006 May 21, 1999	12' BGS	18' BGS
1,1-Dichloroethene	<1.0 U	<1.0 U
Benzene	<1.0 U	<1.0 U
Chloromethane	<1.0 U	<1.0 U
Methylene Chloride	<2.0 U	<2.0 U
Tetrachloroethene	300	<1.0 U
Trichloroethene	33	<1.0 U
cis-1,2-DCE	51	<1.0 U
Vinyl Chloride	<1.0 U	<1.0 U

AOC-172 and AOC-174 LOCATION MAP



BOEING RENTON FACILITY MAP

LEGEND

PP173 — DIRECT PUSH SAMPLING LOCATION

GW083S — MONITORING WELL LOCATION

GW082S — ABANDONED GROUNDWATER MONITORING WELL LOCATION REPLACED BY GW226S

FENCE

APPROXIMATE SOURCE AREA

CONDITIONAL POINT OF COMPLIANCE

J — Analyte was positively identified; the value shown is the approximate concentration of the analyte.

U — Analyte was not detected above the concentration shown.

BLUE TEXT INDICATES GROUNDWATER ANALYTICAL DATA IN µg/L

LIGHT BLUE TEXT INDICATES HISTORICAL GROUNDWATER ANALYTICAL DATA IN µg/L

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 20 40

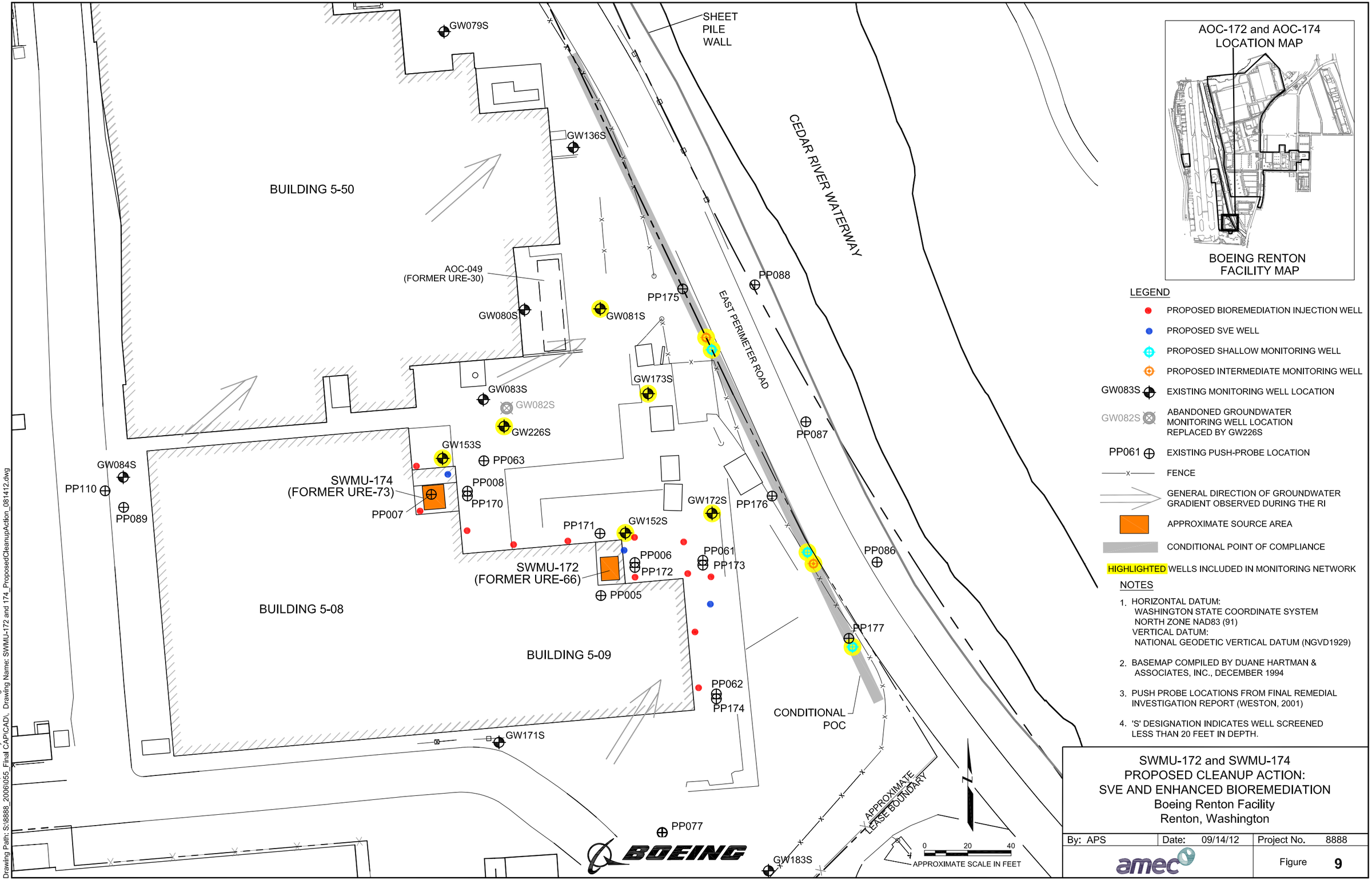
APPROXIMATE SCALE IN FEET

N

SWMU-172 and SWMU-174 SITE LOCATION AND GROUNDWATER COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 09/14/12	Project No. 8888
amec		Figure 8

Plot Date: 09/14/12 - 10:46am, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\, Drawing Name: SWMU-172 and 174_GW_COC-results_082112.dwg



AOC-172 and AOC-174
LOCATION MAP

BOEING RENTON
FACILITY MAP

LEGEND

- PROPOSED BIOREMEDIATION INJECTION WELL
- PROPOSED SVE WELL
- PROPOSED SHALLOW MONITORING WELL
- PROPOSED INTERMEDIATE MONITORING WELL
- GW083S — EXISTING MONITORING WELL LOCATION
- GW082S — ABANDONED GROUNDWATER MONITORING WELL LOCATION REPLACED BY GW226S
- PP061 — EXISTING PUSH-PROBE LOCATION
- FENCE
- GENERAL DIRECTION OF GROUNDWATER GRADIENT OBSERVED DURING THE RI
- APPROXIMATE SOURCE AREA
- CONDITIONAL POINT OF COMPLIANCE
- HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

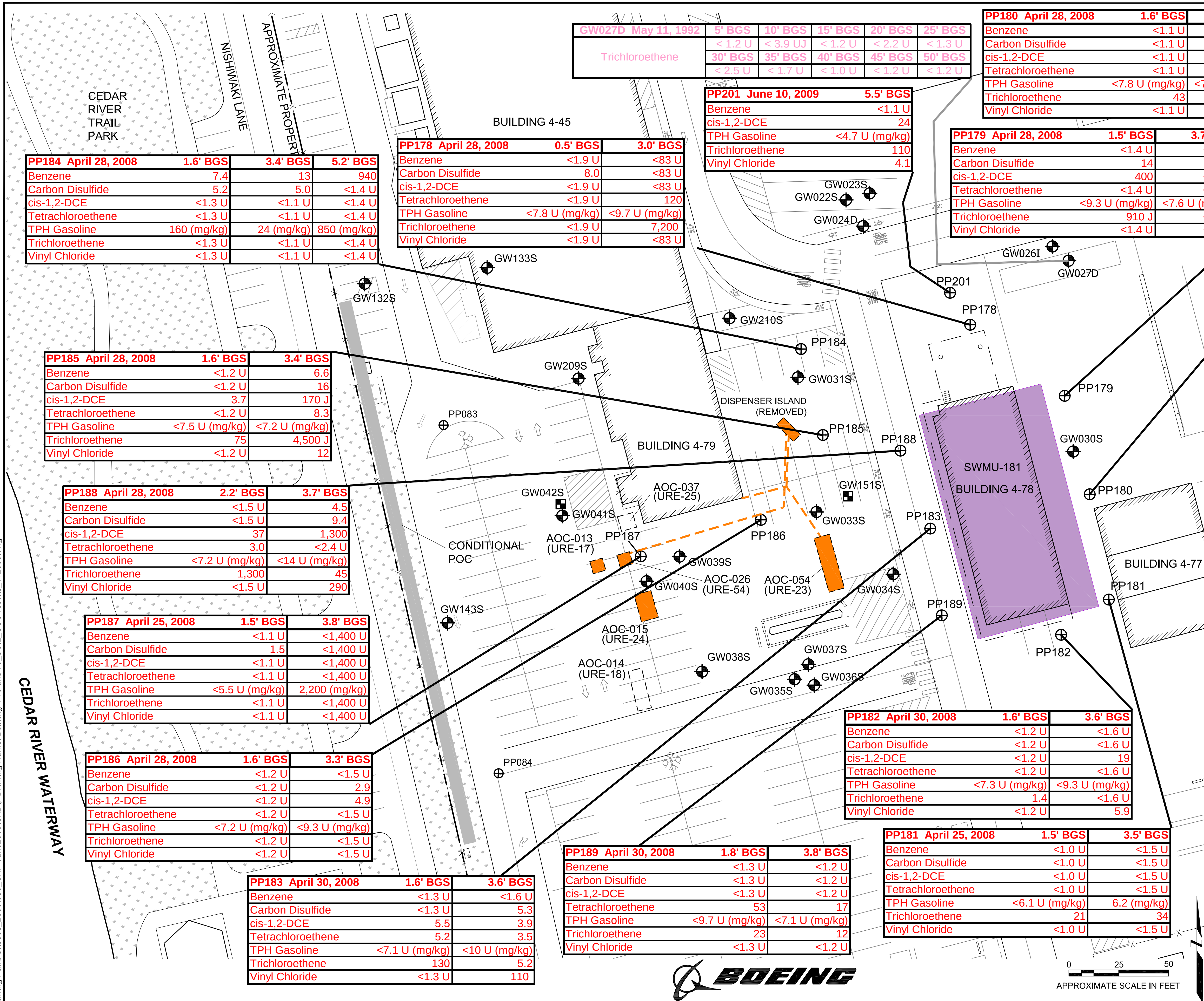
NOTES

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.

SWMU-172 and SWMU-174
PROPOSED CLEANUP ACTION:
SVE AND ENHANCED BIOREMEDIATION
Boeing Renton Facility
Renton, Washington

By: APS	Date: 09/14/12	Project No. 8888
amec		Figure 9

Plot Date: 09/14/12 - 10:47am, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\, Drawing Name: SWMU-172 and 174_ProposedCleanupAction_081412.dwg



GW027D May 11, 1992	5' BGS	10' BGS	15' BGS	20' BGS	25' BGS
Trichloroethene	< 1.2 U	< 3.9 UJ	< 1.2 U	< 2.2 U	< 1.3 U
	30' BGS	35' BGS	40' BGS	45' BGS	50' BGS
	< 2.5 U	< 1.7 U	< 1.0 U	< 1.2 U	< 1.2 U

PP180 April 28, 2008	1.6' BGS	3.6' BGS
Benzene	<1.1 U	<1.0 U
Carbon Disulfide	<1.1 U	<1.0 U
cis-1,2-DCE	<1.1 U	<1.0 U
Tetrachloroethene	<1.1 U	<1.0 U
TPH Gasoline	<7.8 U (mg/kg)	<7.2 U (mg/kg)
Trichloroethene	43	64
Vinyl Chloride	<1.1 U	<1.0 U

PP201 June 10, 2009	5.5' BGS
Benzene	<1.1 U
cis-1,2-DCE	24
TPH Gasoline	<4.7 U (mg/kg)
Trichloroethene	110
Vinyl Chloride	4.1

PP178 April 28, 2008	0.5' BGS	3.0' BGS
Benzene	<1.9 U	<83 U
Carbon Disulfide	8.0	<83 U
cis-1,2-DCE	<1.9 U	<83 U
Tetrachloroethene	<1.9 U	120
TPH Gasoline	<7.8 U (mg/kg)	<9.7 U (mg/kg)
Trichloroethene	<1.9 U	7,200
Vinyl Chloride	<1.9 U	<83 U

PP179 April 28, 2008	1.5' BGS	3.7' BGS
Benzene	<1.4 U	<1.1 U
Carbon Disulfide	14	5.0
cis-1,2-DCE	400	<1.1 U
Tetrachloroethene	<1.4 U	<1.1 U
TPH Gasoline	<9.3 U (mg/kg)	<7.6 U (mg/kg)
Trichloroethene	910 J	<1.1 U
Vinyl Chloride	<1.4 U	<1.1 U

PP184 April 28, 2008	1.6' BGS	3.4' BGS	5.2' BGS
Benzene	7.4	13	940
Carbon Disulfide	5.2	5.0	<1.4 U
cis-1,2-DCE	<1.3 U	<1.1 U	<1.4 U
Tetrachloroethene	<1.3 U	<1.1 U	<1.4 U
TPH Gasoline	160 (mg/kg)	24 (mg/kg)	850 (mg/kg)
Trichloroethene	<1.3 U	<1.1 U	<1.4 U
Vinyl Chloride	<1.3 U	<1.1 U	<1.4 U

PP185 April 28, 2008	1.6' BGS	3.4' BGS
Benzene	<1.2 U	6.6
Carbon Disulfide	<1.2 U	16
cis-1,2-DCE	3.7	170 J
Tetrachloroethene	<1.2 U	8.3
TPH Gasoline	<7.5 U (mg/kg)	<7.2 U (mg/kg)
Trichloroethene	75	4,500 J
Vinyl Chloride	<1.2 U	12

PP188 April 28, 2008	2.2' BGS	3.7' BGS
Benzene	<1.5 U	4.5
Carbon Disulfide	<1.5 U	9.4
cis-1,2-DCE	37	1,300
Tetrachloroethene	3.0	<2.4 U
TPH Gasoline	<7.2 U (mg/kg)	<14 U (mg/kg)
Trichloroethene	1,300	45
Vinyl Chloride	<1.5 U	290

PP187 April 25, 2008	1.5' BGS	3.8' BGS
Benzene	<1.1 U	<1,400 U
Carbon Disulfide	1.5	<1,400 U
cis-1,2-DCE	<1.1 U	<1,400 U
Tetrachloroethene	<1.1 U	<1,400 U
TPH Gasoline	<5.5 U (mg/kg)	2,200 (mg/kg)
Trichloroethene	<1.1 U	<1,400 U
Vinyl Chloride	<1.1 U	<1,400 U

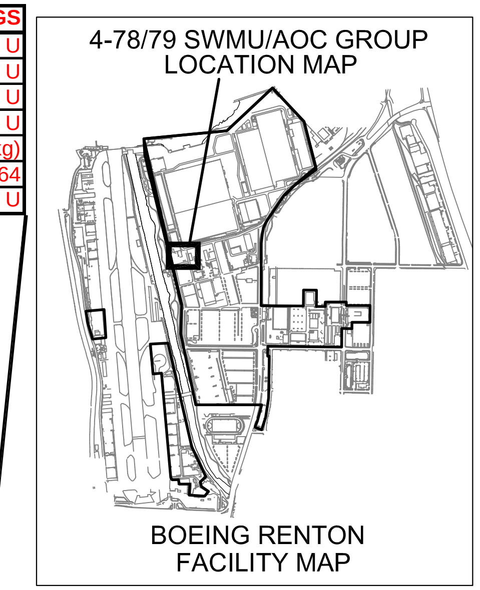
PP186 April 28, 2008	1.6' BGS	3.3' BGS
Benzene	<1.2 U	<1.5 U
Carbon Disulfide	<1.2 U	2.9
cis-1,2-DCE	<1.2 U	4.9
Tetrachloroethene	<1.2 U	<1.5 U
TPH Gasoline	<7.2 U (mg/kg)	<9.3 U (mg/kg)
Trichloroethene	<1.2 U	<1.5 U
Vinyl Chloride	<1.2 U	<1.5 U

PP183 April 30, 2008	1.6' BGS	3.6' BGS
Benzene	<1.3 U	<1.6 U
Carbon Disulfide	<1.3 U	5.3
cis-1,2-DCE	5.5	3.9
Tetrachloroethene	5.2	3.5
TPH Gasoline	<7.1 U (mg/kg)	<10 U (mg/kg)
Trichloroethene	130	5.2
Vinyl Chloride	<1.3 U	110

PP189 April 30, 2008	1.8' BGS	3.8' BGS
Benzene	<1.3 U	<1.2 U
Carbon Disulfide	<1.3 U	<1.2 U
cis-1,2-DCE	<1.3 U	<1.2 U
Tetrachloroethene	53	17
TPH Gasoline	<9.7 U (mg/kg)	<7.1 U (mg/kg)
Trichloroethene	23	12
Vinyl Chloride	<1.3 U	<1.2 U

PP182 April 30, 2008	1.6' BGS	3.6' BGS
Benzene	<1.2 U	<1.6 U
Carbon Disulfide	<1.2 U	<1.6 U
cis-1,2-DCE	<1.2 U	19
Tetrachloroethene	<1.2 U	<1.6 U
TPH Gasoline	<7.3 U (mg/kg)	<9.3 U (mg/kg)
Trichloroethene	1.4	<1.6 U
Vinyl Chloride	<1.2 U	5.9

PP181 April 25, 2008	1.5' BGS	3.5' BGS
Benzene	<1.0 U	<1.5 U
Carbon Disulfide	<1.0 U	<1.5 U
cis-1,2-DCE	<1.0 U	<1.5 U
Tetrachloroethene	<1.0 U	<1.5 U
TPH Gasoline	<6.1 U (mg/kg)	6.2 (mg/kg)
Trichloroethene	21	34
Vinyl Chloride	<1.0 U	<1.5 U



LEGEND

PP180 DIRECT PUSH SAMPLING LOCATION
GW033S MONITORING WELL LOCATION
GW151S EXTRACTION WELL 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)
CONDITIONAL POINT OF COMPLIANCE

J Analyte was positively identified; the value shown is the approximate concentration of the analyte.

U Analyte was not detected above the concentration shown.

RED TEXT INDICATES SOIL ANALYTICAL DATA IN μg/kg UNLESS OTHERWISE NOTED.
LIGHT RED TEXT INDICATES HISTORICAL SOIL ANALYTICAL DATA

NOTES

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

BOEING

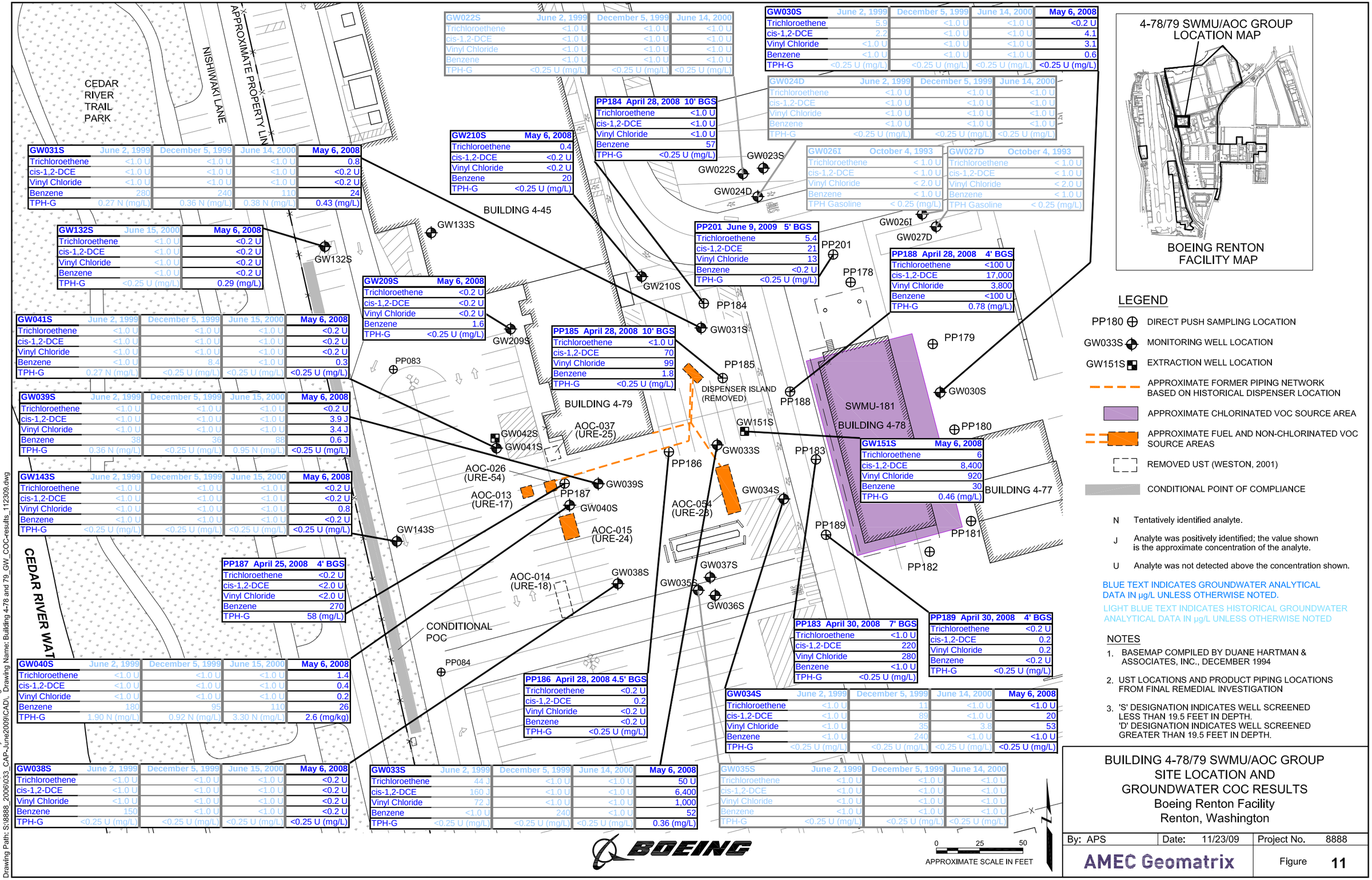
BUILDING 4-78/79 SWMU/AOC GROUP SITE LOCATION AND SOIL COC RESULTS

Boeing Renton Facility
Renton, Washington

By: APS | Date: 11/23/09 | Project No. 8888

AMEC Geomatrix | Figure 10

Plot Date: 11/23/09 - 11:23am, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: Building 4-78 and 79_SOIL_COC-results_112309.dwg



GW031S	June 2, 1999	December 5, 1999	June 14, 2000	May 6, 2008
Trichloroethene	<1.0 U	<1.0 U	<1.0 U	0.8
cis-1,2-DCE	<1.0 U	<1.0 U	<1.0 U	<0.2 U
Vinyl Chloride	<1.0 U	<1.0 U	<1.0 U	<0.2 U
Benzene	280	240	110	24
TPH-G	0.27 N (mg/L)	0.36 N (mg/L)	0.38 N (mg/L)	0.43 (mg/L)

GW132S	June 15, 2000	May 6, 2008
Trichloroethene	<1.0 U	<0.2 U
cis-1,2-DCE	<1.0 U	<0.2 U
Vinyl Chloride	<1.0 U	<0.2 U
Benzene	<1.0 U	<0.2 U
TPH-G	<0.25 U (mg/L)	0.29 (mg/L)

GW209S	May 6, 2008
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U
Benzene	1.6
TPH-G	<0.25 U (mg/L)

GW041S	June 2, 1999	December 5, 1999	June 15, 2000	May 6, 2008
Trichloroethene	<1.0 U	<1.0 U	<1.0 U	<0.2 U
cis-1,2-DCE	<1.0 U	<1.0 U	<1.0 U	<0.2 U
Vinyl Chloride	<1.0 U	<1.0 U	<1.0 U	<0.2 U
Benzene	<1.0 U	8.4	<1.0 U	0.3
TPH-G	0.27 N (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)

GW039S	June 2, 1999	December 5, 1999	June 15, 2000	May 6, 2008
Trichloroethene	<1.0 U	<1.0 U	<1.0 U	<0.2 U
cis-1,2-DCE	<1.0 U	<1.0 U	<1.0 U	3.9 J
Vinyl Chloride	<1.0 U	<1.0 U	<1.0 U	3.4 J
Benzene	38	36	88	0.6 J
TPH-G	0.36 N (mg/L)	<0.25 U (mg/L)	0.95 N (mg/L)	<0.25 U (mg/L)

GW143S	June 2, 1999	December 5, 1999	June 15, 2000	May 6, 2008
Trichloroethene	<1.0 U	<1.0 U	<1.0 U	<0.2 U
cis-1,2-DCE	<1.0 U	<1.0 U	<1.0 U	<0.2 U
Vinyl Chloride	<1.0 U	<1.0 U	<1.0 U	0.8
Benzene	<1.0 U	<1.0 U	<1.0 U	<0.2 U
TPH-G	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)

GW040S	June 2, 1999	December 5, 1999	June 15, 2000	May 6, 2008
Trichloroethene	<1.0 U	<1.0 U	<1.0 U	1.4
cis-1,2-DCE	<1.0 U	<1.0 U	<1.0 U	0.4
Vinyl Chloride	<1.0 U	<1.0 U	<1.0 U	0.2
Benzene	180	95	110	26
TPH-G	1.90 N (mg/L)	0.92 N (mg/L)	3.30 N (mg/L)	2.6 (mg/kg)

GW038S	June 2, 1999	December 5, 1999	June 15, 2000	May 6, 2008
Trichloroethene	<1.0 U	<1.0 U	<1.0 U	<0.2 U
cis-1,2-DCE	<1.0 U	<1.0 U	<1.0 U	<0.2 U
Vinyl Chloride	<1.0 U	<1.0 U	<1.0 U	<0.2 U
Benzene	150	<1.0 U	<1.0 U	<0.2 U
TPH-G	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)

GW022S	June 2, 1999	December 5, 1999	June 14, 2000
Trichloroethene	<1.0 U	<1.0 U	<1.0 U
cis-1,2-DCE	<1.0 U	<1.0 U	<1.0 U
Vinyl Chloride	<1.0 U	<1.0 U	<1.0 U
Benzene	<1.0 U	<1.0 U	<1.0 U
TPH-G	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)

GW030S	June 2, 1999	December 5, 1999	June 14, 2000	May 6, 2008
Trichloroethene	5.9	<1.0 U	<1.0 U	<0.2 U
cis-1,2-DCE	2.2	<1.0 U	<1.0 U	4.1
Vinyl Chloride	<1.0 U	<1.0 U	<1.0 U	3.1
Benzene	<1.0 U	<1.0 U	<1.0 U	0.6
TPH-G	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)

GW024D	June 2, 1999	December 5, 1999	June 14, 2000
Trichloroethene	<1.0 U	<1.0 U	<1.0 U
cis-1,2-DCE	<1.0 U	<1.0 U	<1.0 U
Vinyl Chloride	<1.0 U	<1.0 U	<1.0 U
Benzene	<1.0 U	<1.0 U	<1.0 U
TPH-G	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)

GW026I	October 4, 1993
Trichloroethene	< 1.0 U
cis-1,2-DCE	< 1.0 U
Vinyl Chloride	< 2.0 U
Benzene	< 1.0 U
TPH Gasoline	< 0.25 (mg/L)

GW027D	October 4, 1993
Trichloroethene	< 1.0 U
cis-1,2-DCE	< 1.0 U
Vinyl Chloride	< 2.0 U
Benzene	< 1.0 U
TPH Gasoline	< 0.25 (mg/L)

PP184 April 28, 2008 10' BGS	
Trichloroethene	<1.0 U
cis-1,2-DCE	<1.0 U
Vinyl Chloride	<1.0 U
Benzene	57
TPH-G	<0.25 U (mg/L)

GW210S	May 6, 2008
Trichloroethene	0.4
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U
Benzene	20
TPH-G	<0.25 U (mg/L)

PP201 June 9, 2009 5' BGS	
Trichloroethene	5.4
cis-1,2-DCE	21
Vinyl Chloride	13
Benzene	<0.2 U
TPH-G	<0.25 U (mg/L)

PP188 April 28, 2008 4' BGS	
Trichloroethene	<100 U
cis-1,2-DCE	17,000
Vinyl Chloride	3,800
Benzene	<100 U
TPH-G	0.78 (mg/L)

PP185 April 28, 2008 10' BGS	
Trichloroethene	<1.0 U
cis-1,2-DCE	70
Vinyl Chloride	99
Benzene	1.8
TPH-G	<0.25 U (mg/L)

GW151S	May 6, 2008
Trichloroethene	6
cis-1,2-DCE	8,400
Vinyl Chloride	920
Benzene	30
TPH-G	0.46 (mg/L)

PP187 April 25, 2008 4' BGS	
Trichloroethene	<0.2 U
cis-1,2-DCE	<2.0 U
Vinyl Chloride	<2.0 U
Benzene	270
TPH-G	58 (mg/L)

PP186 April 28, 2008 4.5' BGS	
Trichloroethene	<0.2 U
cis-1,2-DCE	0.2
Vinyl Chloride	<0.2 U
Benzene	<0.2 U
TPH-G	<0.25 U (mg/L)

PP183 April 30, 2008 7' BGS	
Trichloroethene	<1.0 U
cis-1,2-DCE	220
Vinyl Chloride	280
Benzene	<1.0 U
TPH-G	<0.25 U (mg/L)

PP189 April 30, 2008 4' BGS	
Trichloroethene	<0.2 U
cis-1,2-DCE	0.2
Vinyl Chloride	0.2
Benzene	<0.2 U
TPH-G	<0.25 U (mg/L)

GW034S	June 2, 1999	December 5, 1999	June 14, 2000	May 6, 2008
Trichloroethene	<1.0 U	11	<1.0 U	<1.0 U
cis-1,2-DCE	<1.0 U	89	<1.0 U	20
Vinyl Chloride	<1.0 U	35	3.8	53
Benzene	<1.0 U	240	<1.0 U	<1.0 U
TPH-G	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)

GW033S	June 2, 1999	December 5, 1999	June 14, 2000	May 6, 2008
Trichloroethene	44 J	<1.0 U	<1.0 U	50 U
cis-1,2-DCE	160 J	<1.0 U	<1.0 U	6,400
Vinyl Chloride	72 J	<1.0 U	<1.0 U	1,000
Benzene	<1.0 U	240	<1.0 U	52
TPH-G	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)	0.36 (mg/L)

GW035S	June 2, 1999	December 5, 1999	June 14, 2000
Trichloroethene	<1.0 U	<1.0 U	<1.0 U
cis-1,2-DCE	<1.0 U	<1.0 U	<1.0 U
Vinyl Chloride	<1.0 U	<1.0 U	<1.0 U
Benzene	<1.0 U	<1.0 U	<1.0 U
TPH-G	<0.25 U (mg/L)	<0.25 U (mg/L)	<0.25 U (mg/L)

4-78/79 SWMU/AOC GROUP LOCATION MAP

BOEING RENTON FACILITY MAP

LEGEND

- PP180 ⊕ DIRECT PUSH SAMPLING LOCATION
- GW033S ⊕ MONITORING WELL LOCATION
- GW151S ■ EXTRACTION WELL 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)
- CONDITIONAL POINT OF COMPLIANCE

N Tentatively identified analyte.

J Analyte was positively identified; the value shown is the approximate concentration of the analyte.

U Analyte was not detected above the concentration shown.

BLUE TEXT INDICATES GROUNDWATER ANALYTICAL DATA IN µg/L UNLESS OTHERWISE NOTED.

LIGHT BLUE TEXT INDICATES HISTORICAL GROUNDWATER ANALYTICAL DATA IN µg/L UNLESS OTHERWISE NOTED

NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
2. UST LOCATIONS AND PRODUCT PIPING LOCATIONS FROM FINAL REMEDIAL INVESTIGATION
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 19.5 FEET IN DEPTH.
   'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 19.5 FEET IN DEPTH.

BOEING

0 25 50
APPROXIMATE SCALE IN FEET

BUILDING 4-78/79 SWMU/AOC GROUP SITE LOCATION AND GROUNDWATER COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 11/23/09	Project No. 8888
AMEC Geomatrix		Figure 11

Plot Date: 11/23/09 - 11:27am Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\ Drawing Name: Building 4-78 and 79_GW_COC-results_112309.dwg

CEDAR RIVER TRAIL PARK

NISHIWAKI LANE

APPROXIMATE PROPERTY LINE

BUILDING 4-45

BUILDING 4-79

BUILDING 4-78

BUILDING 4-77

SWMU-181

GW132S

GW133S

GW209S

GW210S

GW022S

GW023S

GW024D

GW026I

GW027D

GW031S

GW030S

GW033S

GW034S

GW035S

GW036S

GW037S

GW038S

GW039S

GW040S

GW041S

GW042S

GW143S

GW151D

PP083

PP084

PP178

PP179

PP180

PP181

PP182

PP183

PP184

PP185

PP186

PP187

PP188

PP189

PP201

DISPENSER ISLAND (REMOVED)

AOC-037 (URE-25)

AOC-013 (URE-17)

AOC-026 (URE-54)

AOC-015 (URE-24)

AOC-014 (URE-18)

AOC-054 (URE-23)

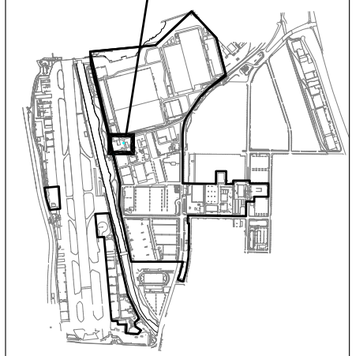
CONDITIONAL POC

CEDAR RIVER WATERWAY

0 25 50

APPROXIMATE SCALE IN FEET

4-78/79 SWMU/AOC GROUP LOCATION MAP



BOEING RENTON FACILITY MAP

LEGEND

- PROPOSED SVE WELL
- PROPOSED BIOREMEDIATION INJECTION WELL
- PROPOSED SHALLOW MONITORING WELL
- PROPOSED INTERMEDIATE MONITORING WELL
- PROPOSED DEEP MONITORING WELL
- GW033S EXISTING MONITORING WELL LOCATION
- GW151S EXISTING EXTRACTION WELL LOCATION
- PP083 EXISTING PUSH PROBE LOCATION
- APPROXIMATE FORMER PIPING NETWORK BASED ON HISTORICAL DISPENSER LOCATION
- APPROXIMATE CHLORINATED VOC SOURCE AREA
- APPROXIMATE FUEL AND NON-CHLORINATED VOC SOURCE AREAS
- GENERAL GROUNDWATER FLOW DIRECTION BASED ON QUARTERLY WATER LEVEL MEASUREMENTS
- REMOVED UST (WESTON, 2001)
- CONDITIONAL POINT OF COMPLIANCE
- HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

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.

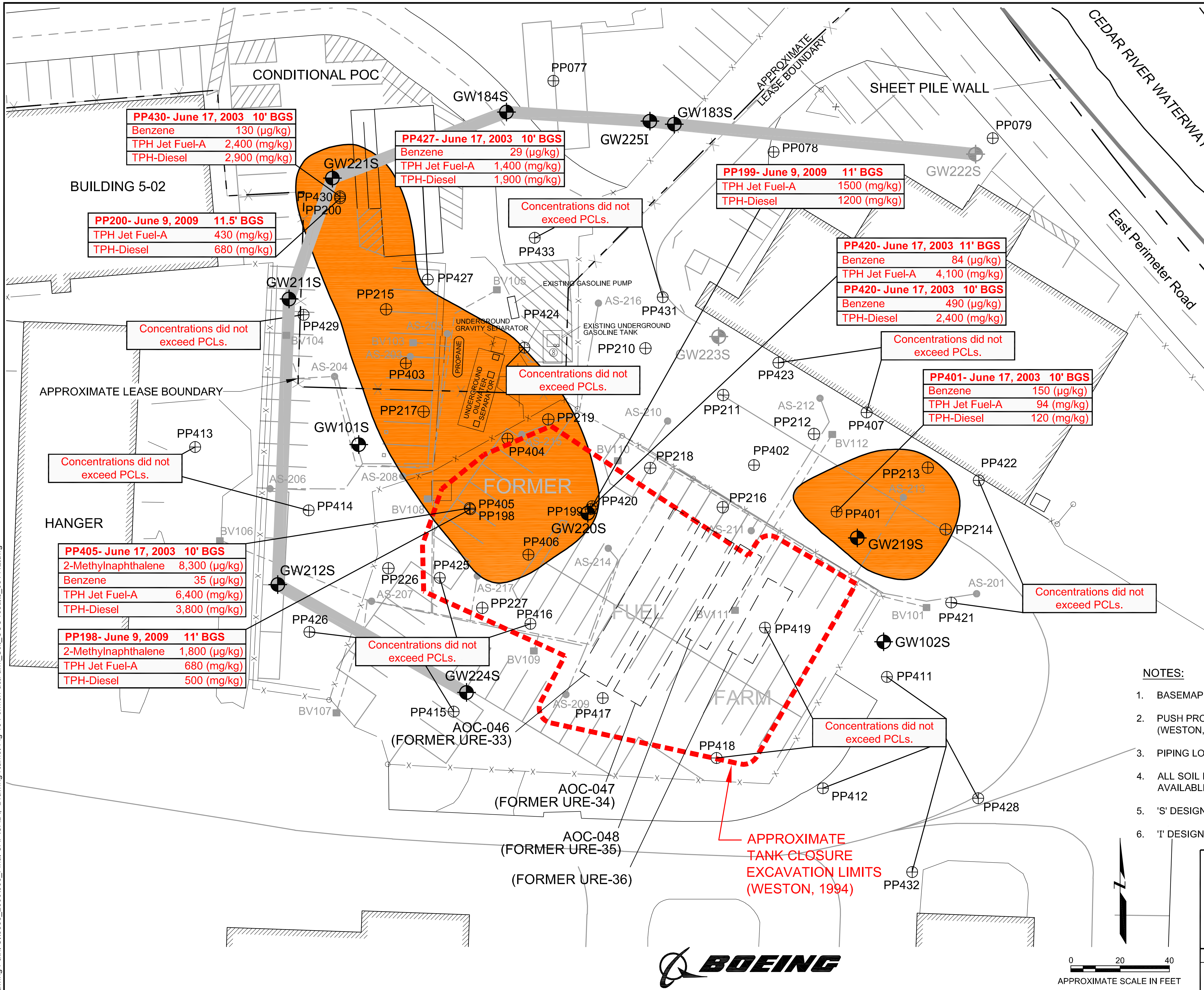
BUILDING 4-78/79 SWMU/AOC GROUP PROPOSED CLEANUP ACTION

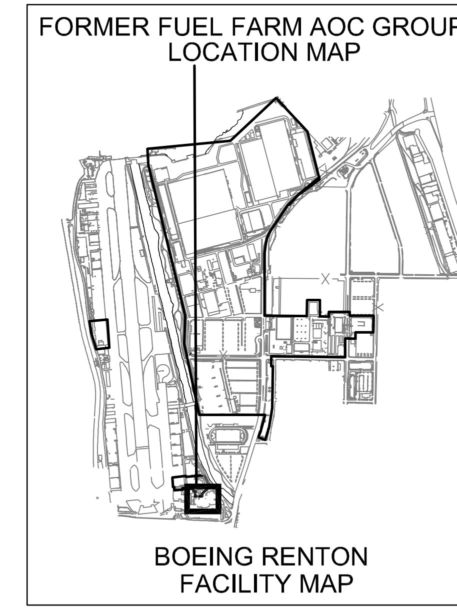
Boeing Renton Facility
Renton, Washington

By: APS	Date: 02/09/10	Project No. 8888
AMEC Geomatrix		Figure 12

BOEING

Plot Date: 02/09/10 - 1:31pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP~June2009\CAD\, Drawing Name: Building 4-78 and 79_ProposedCleanupAction_012610.dwg





LEGEND

- GW101S — MONITORING WELL LOCATION
- GW222S — FORMER MONITORING WELL
- PP402 — PUSH PROBE LOCATION
- AS-204 — FORMER UNDERGROUND AIR SPARGING WELL
- BV112 — FORMER UNDERGROUND BIOVENTING WELL
- UNDERGROUND BIOVENTING LINE
- UNDERGROUND AIR SPARGING LINE
- 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.
- CONDITIONAL POINT OF COMPLIANCE

TPH Total Petroleum Hydrocarbons
PCLs Preliminary Cleanup Levels

RED TEXT INDICATES SOIL ANALYTICAL DATA

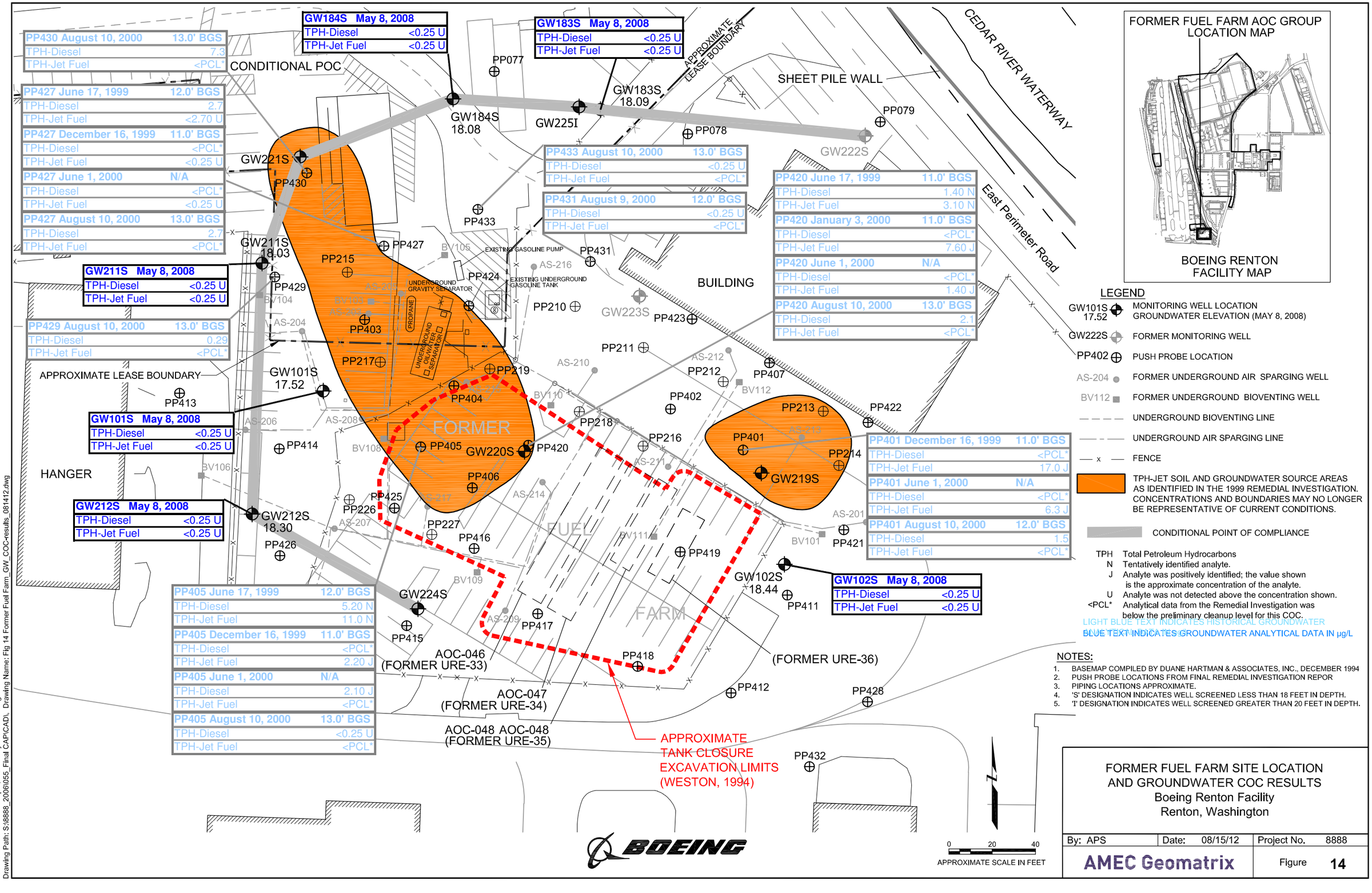
NOTES:

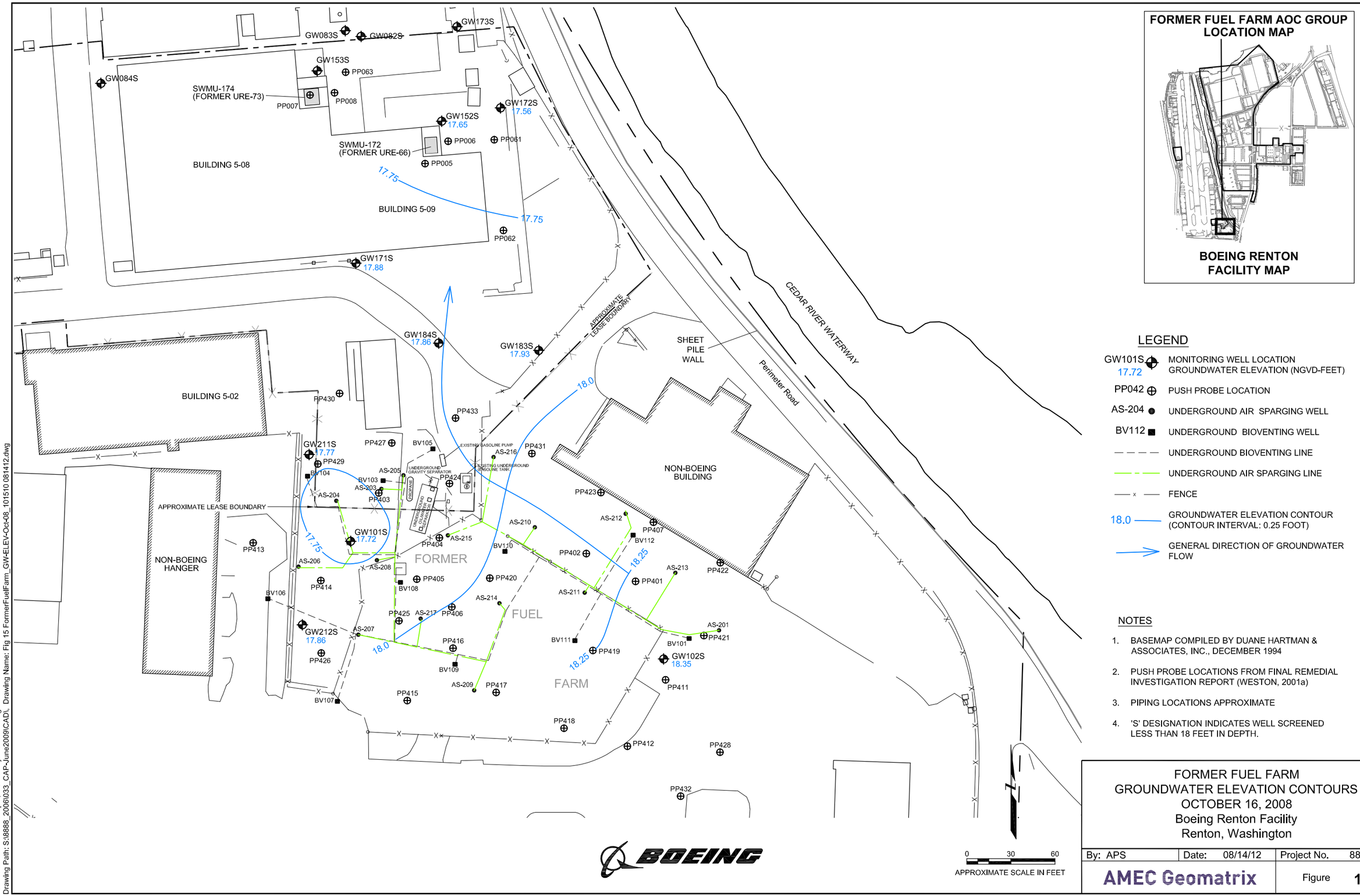
1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994.
2. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001a).
3. PIPING LOCATIONS APPROXIMATE.
4. ALL SOIL DATA FOR THE PUSH PROBES ARE THE MOST RECENT DATA AVAILABLE.
5. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 18 FEET IN DEPTH.
6. 'I' DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH.

FORMER FUEL FARM SITE LOCATION AND SOIL COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 08/15/12	Project No. 8888
AMEC Geomatrix		Figure 13

Plot Date: 08/15/12 - 12:02pm, Plotted by: mike.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\, Drawing Name: Fig 13 FormerFuelFarm_Soil_COC-results_081412.dwg


PP430 August 10, 2000 13.0' BGS
TPH-Diesel 7.3
TPH-Jet Fuel <PCL*
CONDITIONAL POC
GW184S May 8, 2008
TPH-Diesel <0.25 U
TPH-Jet Fuel <0.25 U
GW183S May 8, 2008
TPH-Diesel <0.25 U
TPH-Jet Fuel <0.25 U
APPROXIMATE LEASE BOUNDARY
SHEET PILE WALL
CEDAR RIVER WATERWAY
PP427 June 17, 1999 12.0' BGS
TPH-Diesel 2.7
TPH-Jet Fuel <2.70 U
PP427 December 16, 1999 11.0' BGS
TPH-Diesel <PCL*
TPH-Jet Fuel <0.25 U
PP427 June 1, 2000 N/A
TPH-Diesel <PCL*
TPH-Jet Fuel <0.25 U
PP427 August 10, 2000 13.0' BGS
TPH-Diesel 2.7
TPH-Jet Fuel <PCL*
GW184S 18.08
GW183S 18.09
GW225I
PP077
PP078
PP079
GW222S
GW221S
PP430
PP433 August 10, 2000 13.0' BGS
TPH-Diesel <0.25 U
TPH-Jet Fuel <PCL*
PP431 August 9, 2000 12.0' BGS
TPH-Diesel <0.25 U
TPH-Jet Fuel <PCL*
PP420 June 17, 1999 11.0' BGS
TPH-Diesel 1.40 N
TPH-Jet Fuel 3.10 N
PP420 January 3, 2000 11.0' BGS
TPH-Diesel <PCL*
TPH-Jet Fuel 7.60 J
PP420 June 1, 2000 N/A
TPH-Diesel <PCL*
TPH-Jet Fuel 1.40 J
PP420 August 10, 2000 13.0' BGS
TPH-Diesel 2.1
TPH-Jet Fuel <PCL*
East Perimeter Road
PP433
GW211S 18.03
PP427
PP215
BV105
EXISTING GASOLINE PUMP
PP431
AS-216
PP424
EXISTING UNDERGROUND GASOLINE TANK
UNDERGROUND GRAVITY SEPARATOR
PROPANE
BUILDING
GW211S May 8, 2008
TPH-Diesel <0.25 U
TPH-Jet Fuel <0.25 U
PP429
BV104
AS-205
BV103
AS-203
PP403
PP210
GW223S
PP423
AS-204
PP429 August 10, 2000 13.0' BGS
TPH-Diesel 0.29
TPH-Jet Fuel <PCL*
PP217
PP219
PP211
AS-210
AS-212
PP212
PP407
BV112
APPROXIMATE LEASE BOUNDARY
GW101S 17.52
PP413
PP404
BV110
PP402
PP422
GW101S May 8, 2008
TPH-Diesel <0.25 U
TPH-Jet Fuel <0.25 U
AS-206
AS-208
PP218
PP213
PP216
PP401
PP414
BV108
PP405
GW220S
PP420
FORMER
AS-213
PP214
PP406
GW219S
PP401 December 16, 1999 11.0' BGS
TPH-Diesel <PCL*
TPH-Jet Fuel 17.0 J
PP401 June 1, 2000 N/A
TPH-Diesel <PCL*
TPH-Jet Fuel 6.3 J
PP401 August 10, 2000 12.0' BGS
TPH-Diesel 1.5
TPH-Jet Fuel <PCL*
HANGER
BV106
AS-217
AS-214
PP425
PP226
AS-207
PP227
PP416
FUEL
BV111
AS-201
PP421
BV101
PP419
GW212S May 8, 2008
TPH-Diesel <0.25 U
TPH-Jet Fuel <0.25 U
GW212S 18.30
PP426
GW102S 18.44
PP411
GW102S May 8, 2008
TPH-Diesel <0.25 U
TPH-Jet Fuel <0.25 U
PP405 June 17, 1999 12.0' BGS
TPH-Diesel 5.20 N
TPH-Jet Fuel 11.0 N
PP405 December 16, 1999 11.0' BGS
TPH-Diesel <PCL*
TPH-Jet Fuel 2.20 J
PP405 June 1, 2000 N/A
TPH-Diesel 2.10 J
TPH-Jet Fuel <PCL*
PP405 August 10, 2000 13.0' BGS
TPH-Diesel <0.25 U
TPH-Jet Fuel <PCL*
GW224S
BV109
AS-209
PP417
FARM
PP415
AOC-046
(FORMER URE-33)
PP418
(FORMER URE-36)
AOC-047
(FORMER URE-34)
PP412
PP428
AOC-048 AOC-048
(FORMER URE-35)
APPROXIMATE
TANK CLOSURE
EXCAVATION LIMITS
(WESTON, 1994)
PP432
FORMER FUEL FARM AOC GROUP
LOCATION MAP
BOEING RENTON
FACILITY MAP
LEGEND
GW101S 17.52 MONITORING WELL LOCATION
GROUNDWATER ELEVATION (MAY 8, 2008)
GW222S FORMER MONITORING WELL
PP402 PUSH PROBE LOCATION
AS-204 FORMER UNDERGROUND AIR SPARGING WELL
BV112 FORMER UNDERGROUND BIOVENTING WELL
UNDERGROUND BIOVENTING LINE
UNDERGROUND AIR SPARGING LINE
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.
CONDITIONAL POINT OF COMPLIANCE
TPH Total Petroleum Hydrocarbons
N Tentatively identified analyte.
J Analyte was positively identified; the value shown is the approximate concentration of the analyte.
U Analyte was not detected above the concentration shown.
<PCL* Analytical data from the Remedial Investigation was below the preliminary cleanup level for this COC.
LIGHT BLUE TEXT INDICATES HISTORICAL GROUNDWATER
BLUE TEXT INDICATES GROUNDWATER ANALYTICAL DATA IN µg/L
NOTES:
1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
2. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPOR
3. PIPING LOCATIONS APPROXIMATE.
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 18 FEET IN DEPTH.
5. 'I' DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH.
0 20 40
APPROXIMATE SCALE IN FEET
BOEING
FORMER FUEL FARM SITE LOCATION
AND GROUNDWATER COC RESULTS
Boeing Renton Facility
Renton, Washington
By: APS
Date: 08/15/12
Project No. 8888
AMEC Geomatrix
Figure 14
Plot Date: 08/15/12 - 1:32pm, Plotted by: mike.stenberg
Drawing Path: S:\8888_20060055_Final CAP\CAD\, Drawing Name: Fig 14 Former Fuel Farm_GW_COC-results_081412.dwg



FORMER FUEL FARM GROUNDWATER ELEVATION CONTOURS OCTOBER 16, 2008 Boeing Renton Facility Renton, Washington

By: APS	Date: 08/14/12	Project No. 8888
AMEC Geomatrix		Figure 15

Plot Date: 08/14/12 - 4:09pm Plotted by: mike.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\ Drawing Name: Fig 15 FormerFuelFarm_GW-ELEV-Oct-08_101510 081412.dwg

CONDITIONAL POC

BUILDING 5-02

HANGER

APPROXIMATE LEASE BOUNDARY

APPROXIMATE LEASE BOUNDARY

SHEET PILE WALL

CEDAR RIVER WATERWAY

East Perimeter Road

BUILDING

FORMER FUEL FARM

EXISTING GASOLINE PUMP

EXISTING UNDERGROUND GASOLINE TANK

UNDERGROUND GRAVITY SEPARATOR

UNDERGROUND OIL/WATER SEPARATOR

PROPANE

GW184S
GW183S
GW225I
GW221S
GW211S
GW101S
GW212S
GW224S
GW220S
GW223S
GW222S
GW219S
GW102S

PP077
PP078
PP079
PP200
PP430
PP433
PP427
PP215
PP424
PP431
PP429
PP403
PP210
PP423
PP217
PP219
PP211
PP212
PP407
PP413
PP404
PP218
PP402
PP213
PP422
PP405
PP198
PP420
PP199
PP216
PP401
PP214
PP406
PP425
PP226
PP227
PP416
PP419
PP421
PP426
PP415
PP417
PP411
PP418
PP412
PP428
PP432

BV104
BV105
BV103
BV110
BV112
BV108
BV106
BV107
BV109
BV111
BV101

AS-216
AS-205
AS-204
AS-206
AS-208
AS-210
AS-212
AS-203
AS-211
AS-214
AS-217
AS-207
AS-209
AS-201

AOC-046
(FORMER URE-33)

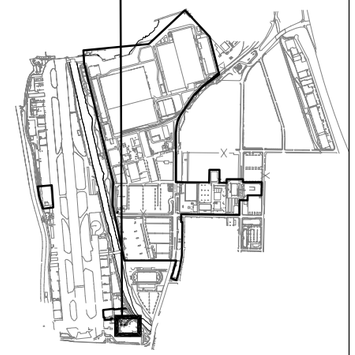
AOC-047
(FORMER URE-34)

AOC-048
(FORMER URE-35)

(FORMER URE-36)

APPROXIMATE TANK CLOSURE EXCAVATION LIMITS (WESTON, 1994)

FORMER FUEL FARM AOC GROUP LOCATION MAP



BOEING RENTON FACILITY MAP

LEGEND

- SHALLOW MONITORING WELL
- INTERMEDIATE MONITORING WELL
- GW101S — MONITORING WELL LOCATION
- PP420 — PUSH-PROBE LOCATION
- GW222S — FORMER MONITORING WELL
- AS-204 — FORMER UNDERGROUND AIR SPARGING WELL
- BV112 — FORMER UNDERGROUND BIOVENTING WELL
- UNDERGROUND BIOVENTING LINE
- UNDERGROUND AIR SPARGING LINE
- 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.
- 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.
5. 'I' DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH.

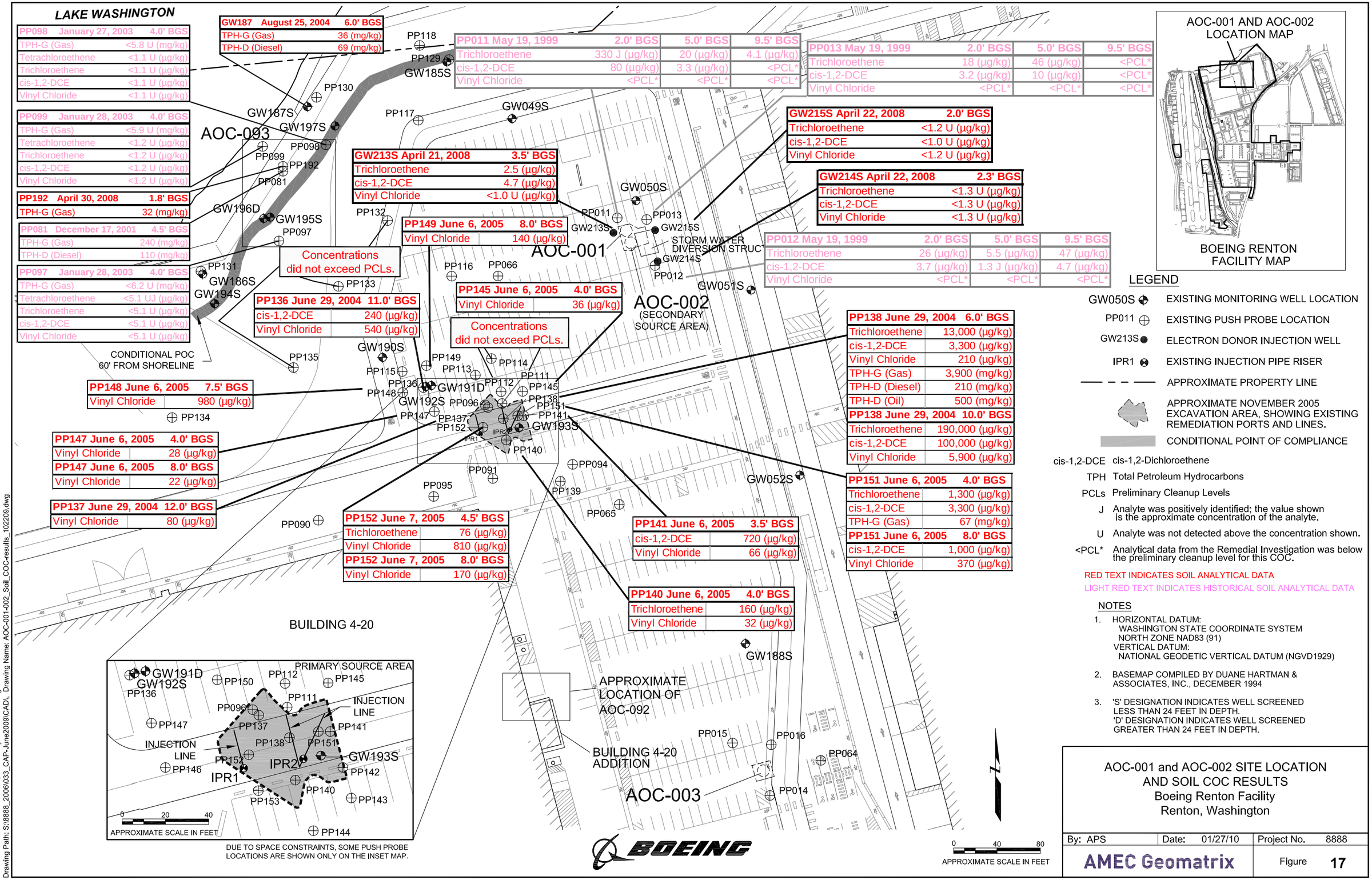
0 20 40
APPROXIMATE SCALE IN FEET

BOEING

FORMER FUEL FARM CLEANUP ACTION SITE MAP
Boeing Renton Facility
Renton, Washington

By: APS	Date: 08/15/12	Project No. 8888
AMEC Geomatrix		Figure 16

Plot Date: 08/15/12 - 11:58am Plotted by: mike.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\ Drawing Name: Fig16 FormerFuelFarm_ProposedCleanupAction_081412.dwg


LAKE WASHINGTON
PP098 January 27, 2003 4.0' BGS
TPH-G (Gas) <5.8 U (mg/kg)
Tetrachloroethene <1.1 U (µg/kg)
Trichloroethene <1.1 U (µg/kg)
cis-1,2-DCE <1.1 U (µg/kg)
Vinyl Chloride <1.1 U (µg/kg)
PP099 January 28, 2003 4.0' BGS
TPH-G (Gas) <5.9 U (mg/kg)
Tetrachloroethene <1.2 U (µg/kg)
Trichloroethene <1.2 U (µg/kg)
cis-1,2-DCE <1.2 U (µg/kg)
Vinyl Chloride <1.2 U (µg/kg)
PP192 April 30, 2008 1.8' BGS
TPH-G (Gas) 32 (mg/kg)
PP081 December 17, 2001 4.5' BGS
TPH-G (Gas) 240 (mg/kg)
TPH-D (Diesel) 110 (mg/kg)
PP097 January 28, 2003 4.0' BGS
TPH-G (Gas) <6.2 U (mg/kg)
Tetrachloroethene <5.1 UJ (µg/kg)
Trichloroethene <5.1 U (µg/kg)
cis-1,2-DCE <5.1 U (µg/kg)
Vinyl Chloride <5.1 U (µg/kg)
GW187 August 25, 2004 6.0' BGS
TPH-G (Gas) 36 (mg/kg)
TPH-D (Diesel) 69 (mg/kg)
PP011 May 19, 1999 2.0' BGS 5.0' BGS 9.5' BGS
Trichloroethene 330 J (µg/kg) 20 (µg/kg) 4.1 (µg/kg)
cis-1,2-DCE 80 (µg/kg) 3.3 (µg/kg) <PCL*
Vinyl Chloride <PCL* <PCL* <PCL*
PP013 May 19, 1999 2.0' BGS 5.0' BGS 9.5' BGS
Trichloroethene 18 (µg/kg) 46 (µg/kg) <PCL*
cis-1,2-DCE 3.2 (µg/kg) 10 (µg/kg) <PCL*
Vinyl Chloride <PCL* <PCL* <PCL*
GW215S April 22, 2008 2.0' BGS
Trichloroethene <1.2 U (µg/kg)
cis-1,2-DCE <1.0 U (µg/kg)
Vinyl Chloride <1.2 U (µg/kg)
GW214S April 22, 2008 2.3' BGS
Trichloroethene <1.3 U (µg/kg)
cis-1,2-DCE <1.3 U (µg/kg)
Vinyl Chloride <1.3 U (µg/kg)
GW213S April 21, 2008 3.5' BGS
Trichloroethene 2.5 (µg/kg)
cis-1,2-DCE 4.7 (µg/kg)
Vinyl Chloride <1.0 U (µg/kg)
PP149 June 6, 2005 8.0' BGS
Vinyl Chloride 140 (µg/kg)
PP012 May 19, 1999 2.0' BGS 5.0' BGS 9.5' BGS
Trichloroethene 26 (µg/kg) 5.5 (µg/kg) 47 (µg/kg)
cis-1,2-DCE 3.7 (µg/kg) 1.3 J (µg/kg) 4.7 (µg/kg)
Vinyl Chloride <PCL* <PCL* <PCL*
PP145 June 6, 2005 4.0' BGS
Vinyl Chloride 36 (µg/kg)
PP136 June 29, 2004 11.0' BGS
cis-1,2-DCE 240 (µg/kg)
Vinyl Chloride 540 (µg/kg)
PP148 June 6, 2005 7.5' BGS
Vinyl Chloride 980 (µg/kg)
PP138 June 29, 2004 6.0' BGS
Trichloroethene 13,000 (µg/kg)
cis-1,2-DCE 3,300 (µg/kg)
Vinyl Chloride 210 (µg/kg)
TPH-G (Gas) 3,900 (mg/kg)
TPH-D (Diesel) 210 (mg/kg)
TPH-D (Oil) 500 (mg/kg)
PP138 June 29, 2004 10.0' BGS
Trichloroethene 190,000 (µg/kg)
cis-1,2-DCE 100,000 (µg/kg)
Vinyl Chloride 5,900 (µg/kg)
PP147 June 6, 2005 4.0' BGS
Vinyl Chloride 28 (µg/kg)
PP147 June 6, 2005 8.0' BGS
Vinyl Chloride 22 (µg/kg)
PP137 June 29, 2004 12.0' BGS
Vinyl Chloride 80 (µg/kg)
PP151 June 6, 2005 4.0' BGS
Trichloroethene 1,300 (µg/kg)
cis-1,2-DCE 3,300 (µg/kg)
TPH-G (Gas) 67 (mg/kg)
PP151 June 6, 2005 8.0' BGS
cis-1,2-DCE 1,000 (µg/kg)
Vinyl Chloride 370 (µg/kg)
PP152 June 7, 2005 4.5' BGS
Trichloroethene 76 (µg/kg)
Vinyl Chloride 810 (µg/kg)
PP152 June 7, 2005 8.0' BGS
Vinyl Chloride 170 (µg/kg)
PP141 June 6, 2005 3.5' BGS
cis-1,2-DCE 720 (µg/kg)
Vinyl Chloride 66 (µg/kg)
PP140 June 6, 2005 4.0' BGS
Trichloroethene 160 (µg/kg)
Vinyl Chloride 32 (µg/kg)
AOC-093
AOC-001
AOC-002
(SECONDARY SOURCE AREA)
AOC-003
Concentrations did not exceed PCLs.
Concentrations did not exceed PCLs.
CONDITIONAL POC 60' FROM SHORELINE
STORM WATER DIVERSION STRUC
BUILDING 4-20
BUILDING 4-20 ADDITION
APPROXIMATE LOCATION OF AOC-092
PP118
PP129
GW185S
PP130
GW167S
GW197S
PP117
GW049S
PP098
PP099
PP192
PP081
GW196D
GW195S
PP097
PP131
GW186S
GW194S
PP133
PP132
GW050S
PP011
GW213S
PP013
GW215S
GW214S
PP012
GW051S
PP116
PP066
PP135
GW190S
PP149
PP113
PP115
PP136
PP148
GW191D
PP112
PP114
PP111
PP145
PP138
GW192S
PP096
PP151
PP141
PP147
PP137
PP152
IPR2
IPR1
GW193S
PP140
PP134
PP091
PP094
PP095
PP139
PP065
PP090
GW052S
GW188S
PP015
PP016
PP064
PP014
PP144
PRIMARY SOURCE AREA
INJECTION LINE
INJECTION LINE
PP150
PP146
PP153
PP142
PP143
0 20 40
APPROXIMATE SCALE IN FEET
DUE TO SPACE CONSTRAINTS, SOME PUSH PROBE LOCATIONS ARE SHOWN ONLY ON THE INSET MAP.
0 40 80
APPROXIMATE SCALE IN FEET
N
AOC-001 AND AOC-002 LOCATION MAP
BOEING RENTON FACILITY MAP
LEGEND
GW050S EXISTING MONITORING WELL LOCATION
PP011 EXISTING PUSH PROBE LOCATION
GW213S ELECTRON DONOR INJECTION WELL
IPR1 EXISTING INJECTION PIPE RISER
APPROXIMATE PROPERTY LINE
APPROXIMATE NOVEMBER 2005 EXCAVATION AREA, SHOWING EXISTING REMEDIATION PORTS AND LINES.
CONDITIONAL POINT OF COMPLIANCE
cis-1,2-DCE cis-1,2-Dichloroethene
TPH Total Petroleum Hydrocarbons
PCLs Preliminary Cleanup Levels
J Analyte was positively identified; the value shown is the approximate concentration of the analyte.
U Analyte was not detected above the concentration shown.
<PCL* Analytical data from the Remedial Investigation was below the preliminary cleanup level for this COC.
RED TEXT INDICATES SOIL ANALYTICAL DATA
LIGHT RED TEXT INDICATES HISTORICAL SOIL ANALYTICAL DATA
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-001 and AOC-002 SITE LOCATION AND SOIL COC RESULTS
Boeing Renton Facility
Renton, Washington
By: APS
Date: 01/27/10
Project No. 8888
AMEC Geomatrix
Figure 17
Plot Date: 01/27/10 - 11:32am, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-001-002_Soil_COC-results_102209.dwg

LAKE WASHINGTON

PP130 June 30, 2004 8.0' BGS	
Chloroform	< 0.2 U
1,1-Dichloroethene	< 0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
trans-1,2-DCE	< 0.2 U
Vinyl Chloride	< 0.2 U
Benzene	< 0.2 U
Naphthalene	< 0.5 U

GW185S May 7, 2008	
Chloroform	<0.2 U
1,1-Dichloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
trans-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U
Benzene	<0.2 U
Naphthalene	<0.5 U

GW187S February 12, 2007	
Chloroform	< 0.2 U
1,1-Dichloroethene	< 0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
trans-1,2-DCE	< 0.2 U
Vinyl Chloride	<0.2 U

GW194S May 7, 2008	
Chloroform	<0.2 U
1,1-Dichloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
trans-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U
Benzene	<0.2 U
Naphthalene	<0.5 U

GW190S May 5, 2008	
Chloroform	<10 U
1,1-Dichloroethene	<10 U
Trichloroethene	<10 U
cis-1,2-DCE	150
trans-1,2-DCE	<10 U
Vinyl Chloride	610
Benzene	<10 U
Naphthalene	<0.5 U

GW192S May 5, 2008	
Chloroform	<0.2 U
1,1-Dichloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	1.3
trans-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U
Benzene	<0.2 U
Naphthalene	<0.5 U

GW191D May 5, 2008	
Chloroform	<0.2 U
1,1-Dichloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
trans-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U
Benzene	<0.2 U
Naphthalene	<0.5 U

GW197S May 7, 2008	
Chloroform	<0.2 U
1,1-Dichloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	1.0
trans-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U
Benzene	<0.2 U
Naphthalene	<0.5 U

PP011 May 19, 1999 6.5' BGS	
Chloroform	<PCL*
1,1-Dichloroethene	<PCL*
Trichloroethene	23
cis-1,2-DCE	2
trans-1,2-DCE	<PCL*
Vinyl Chloride	1.7
Benzene	<PCL*
Naphthalene	<PCL*

PP013 May 19, 1999 6.5' BGS	
Chloroform	<PCL*
1,1-Dichloroethene	<PCL*
Trichloroethene	<PCL*
cis-1,2-DCE	<PCL*
trans-1,2-DCE	<PCL*
Vinyl Chloride	<PCL*
Benzene	<PCL*
Naphthalene	<PCL*

GW215S May 5, 2008	
Chloroform	0.3
1,1-Dichloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
trans-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U
Benzene	<0.2 U
Naphthalene	<0.5 U

GW213S May 5, 2008	
Chloroform	<0.2 U
1,1-Dichloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	4.6
trans-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U
Benzene	<0.2 U
Naphthalene	<0.5 U

GW214S May 5, 2008	
Chloroform	0.5
1,1-Dichloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
trans-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U
Benzene	<0.2 U
Naphthalene	<0.5 U

PP012 May 19, 1999 6.5' BGS	
Chloroform	<PCL*
1,1-Dichloroethene	<PCL*
Trichloroethene	<PCL*
cis-1,2-DCE	<PCL*
trans-1,2-DCE	<PCL*
Vinyl Chloride	<PCL*
Benzene	<PCL*
Naphthalene	<PCL*

GW193S May 5, 2008	
Chloroform	<10 U
1,1-Dichloroethene	<10 U
Trichloroethene	14
cis-1,2-DCE	46
trans-1,2-DCE	<10 U
Vinyl Chloride	630
Benzene	<10 U
Naphthalene	<0.5 U

GW188S May 7, 2008	
Chloroform	<0.2 U
1,1-Dichloroethene	<0.2 U
Trichloroethene	<0.2 U
cis-1,2-DCE	7.4
trans-1,2-DCE	0.2 U
Vinyl Chloride	15
Benzene	0.3
Naphthalene	<0.5 U

PP119 PP118 PP129 GW185S PP130 GW187S PP117 GW197S GW049S PP098 PP099 PP192 PP081 GW195S PP132 GW196D PP097 AOC-093 PP131 GW186S PP133 GW194 PP116 PP066 AOC-001 AOC-002 (SECONDARY SOURCE AREA) GW050S PP011 PP013 GW213S GW215S STORM WATER DIVERSION STRUCTURE GW214S PP012 GW051S

SEE FIGURE 18 (SHEET 2 OF 2) GROUNDWATER COC DATA

CONDITIONAL POC 60' FROM SHORELINE

PP135 GW190S PP115 PP113 PP114 GW192S PP136 GW191D PP112 PP145 PP111 PP138 PP151 PP141 PP096 PP137 PP147 PP152 IPR1 IPR2 GW193S PP140 PP134 PP091 PP094 PP139 PP065 GW052S PP090

BUILDING 4-20

BUILDING 4-81

GW188S

APPROXIMATE LOCATION OF AOC-092

BUILDING 4-20 ADDITION

PP015 PP016 PP064 PP014 AOC-003

PRIMARY SOURCE AREA

GW191D GW192S PP136 PP150 PP112 PP145 PP111 PP096 PP137 PP147 PP141 PP138 PP151 GW193S PP152 IPR1 IPR2 PP142 PP146 PP140 PP153 PP143 PP144

INJECTION LINE

INJECTION LINE

0 20 40
APPROXIMATE SCALE IN FEET

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

0 40 80
APPROXIMATE SCALE IN FEET

AOC-001 AND AOC-002 LOCATION MAP

BOEING RENTON FACILITY MAP

LEGEND

- PP011 ⊕ DIRECT PUSH SAMPLING LOCATION
- GW050S ⊕ MONITORING WELL LOCATION
- GW215S ● ELECTRON DONOR INJECTION WELL
- APPROXIMATE PROPERTY LINE
- APPROXIMATE NOVEMBER 2005 EXCAVATION AREA, SHOWING EXISTING REMEDIATION PORTS AND LINES.
- CONDITIONAL POINT OF COMPLIANCE

BLUE TEXT INDICATES GROUNDWATER ANALYTICAL DATA IN µg/L

LIGHT BLUE TEXT INDICATES HISTORICAL GROUNDWATER ANALYTICAL DATA IN µg/L

cis-1,2-DCE cis-1,2-Dichloroethene

U Analyte was not detected above the concentration shown.

<PCL* Analytical data from the Remedial Investigation was below the preliminary cleanup level for this COC.

NOTES

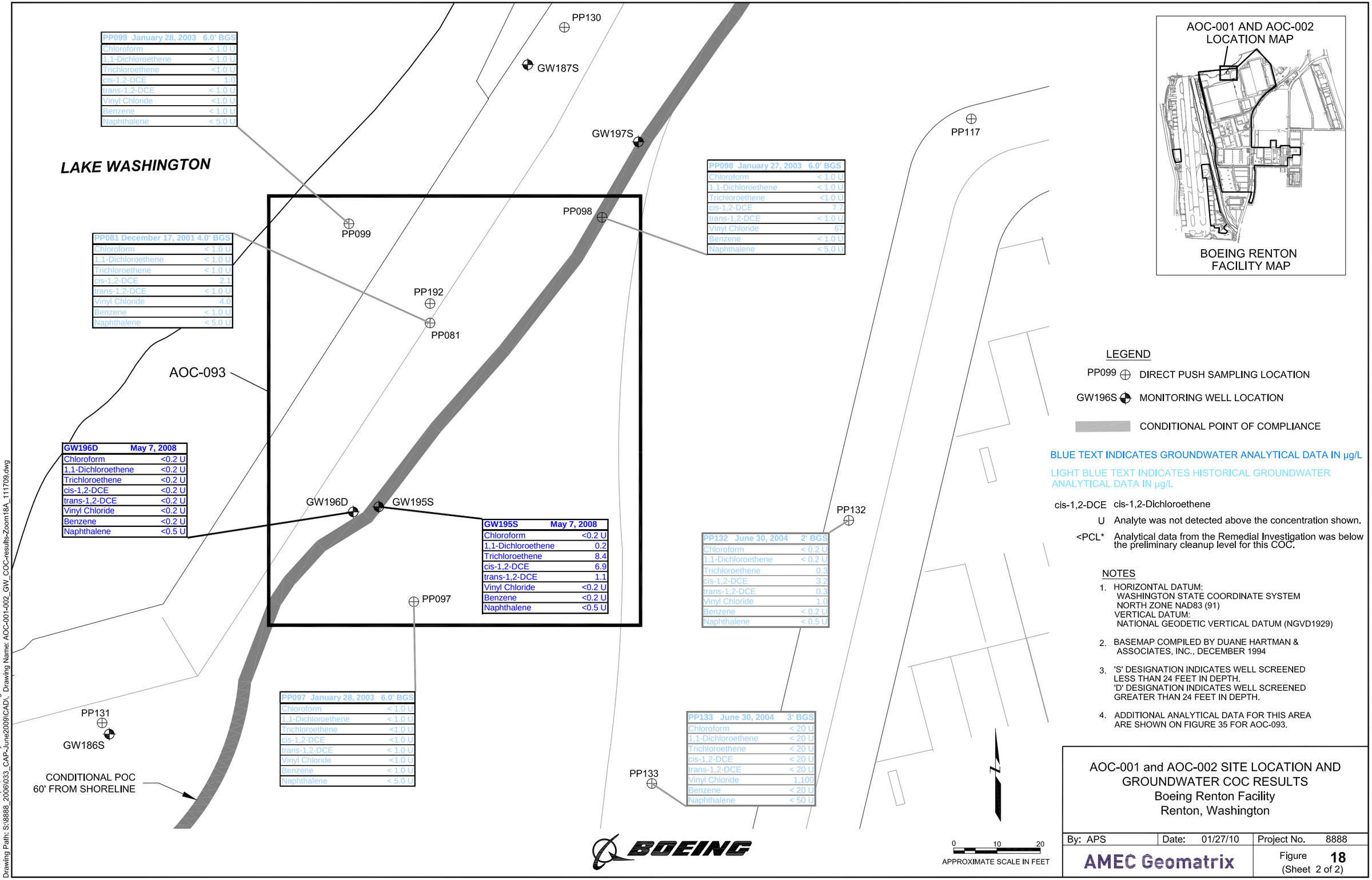
1. HORIZONTAL DATUM: WASHINGTON STATE COORDINATE SYSTEM NORTH ZONE NAD83 (91) VERTICAL DATUM: NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 24 FEET IN DEPTH. 'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 24 FEET IN DEPTH.
4. ADDITIONAL ANALYTICAL DATA FOR THIS AREA ARE SHOWN ON FIGURE 35 FOR AOC-093

AOC-001 and AOC-002 SITE LOCATION AND GROUNDWATER COC RESULTS

Boeing Renton Facility
Renton, Washington

By: APS	Date: 01/27/10	Project No. 8888
AMEC Geomatrix		Figure 18 (Sheet 1 of 2)

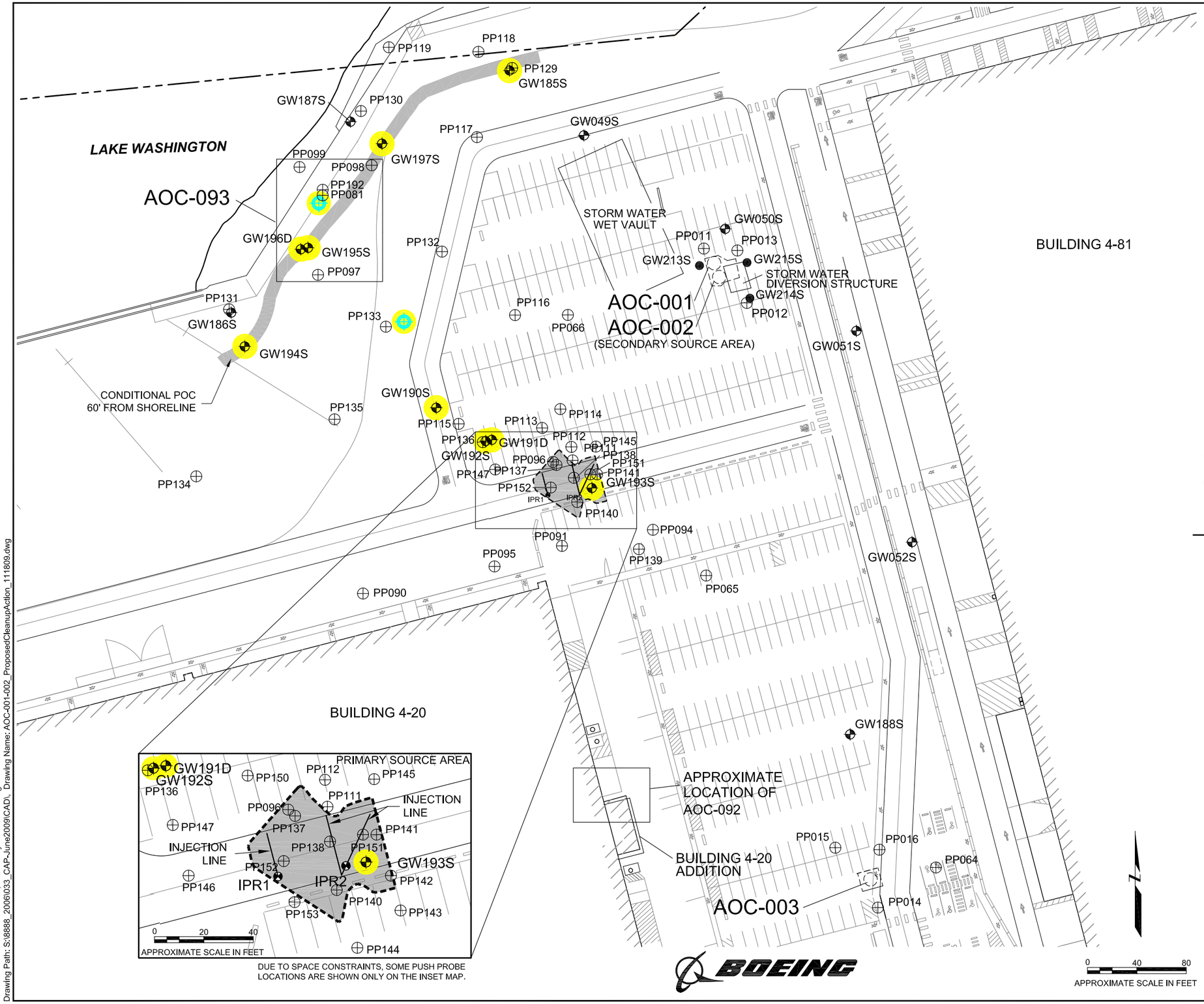
Plot Date: 01/27/10 - 1:44pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-001-002_GW_COC-results_111709.dwg



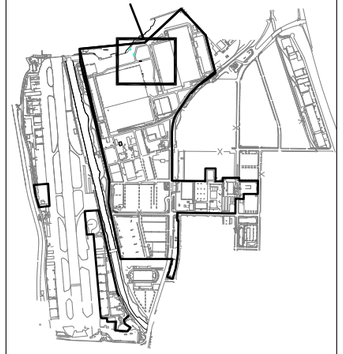
AOC-001 and AOC-002 SITE LOCATION AND GROUNDWATER COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 01/27/10	Project No. 8888
AMEC Geomatrix		Figure 18 (Sheet 2 of 2)

Plot Date: 01/27/10 - 1:46pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-001-002_GW_COC-results-Zoom18A_111709.dwg



AOC-001 AND AOC-002 LOCATION MAP



BOEING RENTON FACILITY MAP

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

LEGEND

- PROPOSED SHALLOW MONITORING WELL
- PP011 — DIRECT PUSH SAMPLING LOCATION
- GW050S — MONITORING WELL LOCATION
- GW215S — ELECTRON DONOR INJECTION WELL
- IPR1 — INJECTION PIPE RISER
- APPROXIMATE PROPERTY LINE
- APPROXIMATE NOVEMBER 2005 EXCAVATION AREA, SHOWING EXISTING REMEDIATION PORTS AND LINES.
- 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.

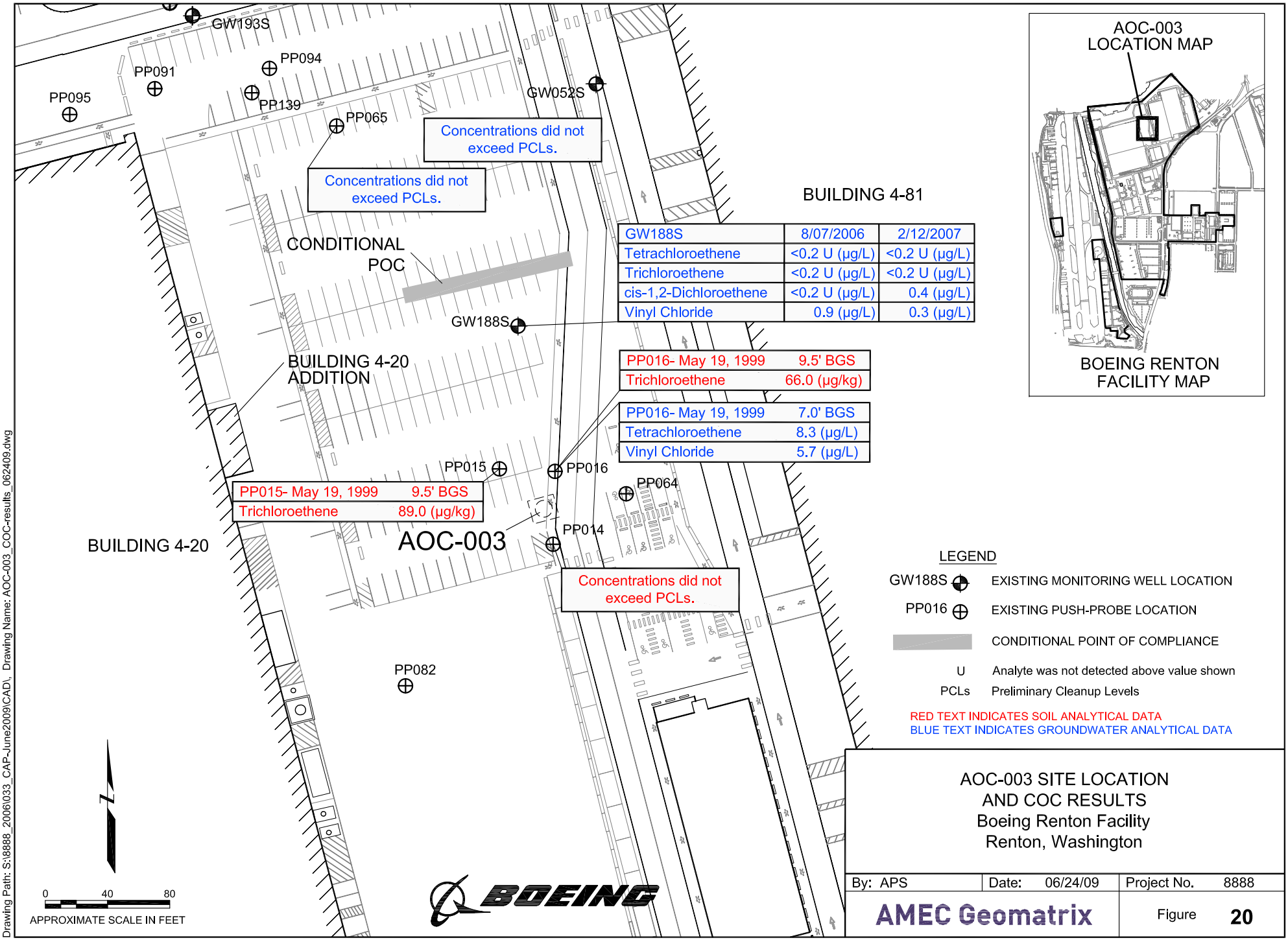
AOC-001 and AOC-002 PROPOSED CLEANUP ACTION

Boeing Renton Facility
Renton, Washington

By: APS	Date: 01/27/10	Project No. 8888
AMEC Geomatrix		Figure 19

BOEING

Plot Date: 01/27/10 - 11:34am Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\03_CAP-June2009\CAD\ Drawing Name: AOC-001-002_ProposedCleanupAction_111809.dwg



GW188S	8/07/2006	2/12/2007
Tetrachloroethene	<0.2 U (µg/L)	<0.2 U (µg/L)
Trichloroethene	<0.2 U (µg/L)	<0.2 U (µg/L)
cis-1,2-Dichloroethene	<0.2 U (µg/L)	0.4 (µg/L)
Vinyl Chloride	0.9 (µg/L)	0.3 (µg/L)

PP016- May 19, 1999	9.5' BGS
Trichloroethene	66.0 (µg/kg)

PP016- May 19, 1999	7.0' BGS
Tetrachloroethene	8.3 (µg/L)
Vinyl Chloride	5.7 (µg/L)

PP015- May 19, 1999	9.5' BGS
Trichloroethene	89.0 (µg/kg)

LEGEND

GW188S — EXISTING MONITORING WELL LOCATION

PP016 — EXISTING PUSH-PROBE LOCATION

CONDITIONAL POINT OF COMPLIANCE

U — Analyte was not detected above value shown

PCLs — Preliminary Cleanup Levels

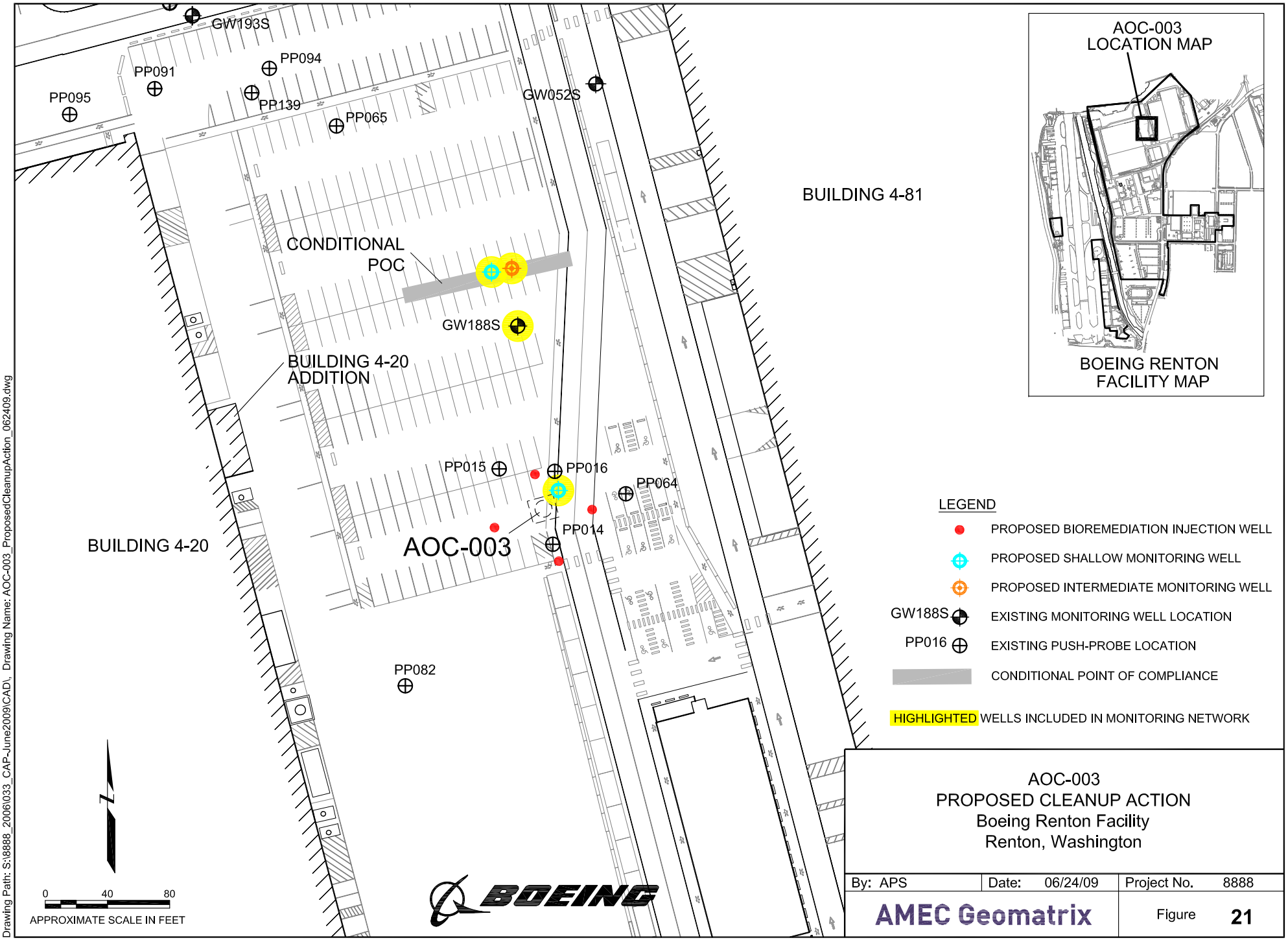
RED TEXT INDICATES SOIL ANALYTICAL DATA
BLUE TEXT INDICATES GROUNDWATER ANALYTICAL DATA

0 40 80
APPROXIMATE SCALE IN FEET

AOC-003 SITE LOCATION AND COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/24/09	Project No. 8888
AMEC Geomatrix		Figure 20

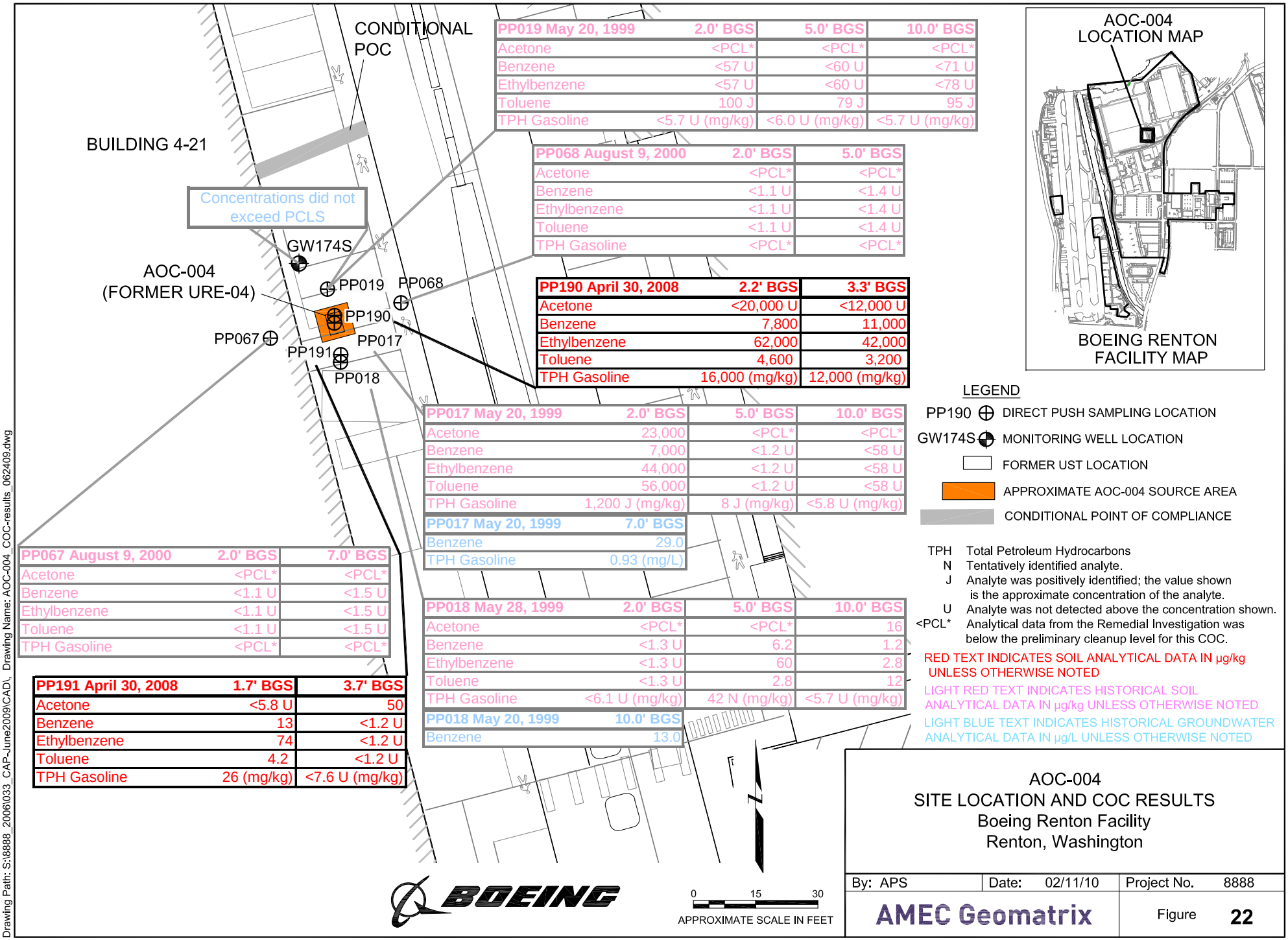
Plot Date: 06/24/09 - 12:25pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-003_COC-results_062409.dwg



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

By: APS	Date: 06/24/09	Project No. 8888
AMEC Geomatrix		Figure 21

Plot Date: 06/24/09 - 12:26pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-003_ProposedCleanupAction_062409.dwg



PP019 May 20, 1999	2.0' BGS	5.0' BGS	10.0' BGS
Acetone	<PCL*	<PCL*	<PCL*
Benzene	<57 U	<60 U	<71 U
Ethylbenzene	<57 U	<60 U	<78 U
Toluene	100 J	79 J	95 J
TPH Gasoline	<5.7 U (mg/kg)	<6.0 U (mg/kg)	<5.7 U (mg/kg)

PP068 August 9, 2000	2.0' BGS	5.0' BGS
Acetone	<PCL*	<PCL*
Benzene	<1.1 U	<1.4 U
Ethylbenzene	<1.1 U	<1.4 U
Toluene	<1.1 U	<1.4 U
TPH Gasoline	<PCL*	<PCL*

PP190 April 30, 2008	2.2' BGS	3.3' BGS
Acetone	<20,000 U	<12,000 U
Benzene	7,800	11,000
Ethylbenzene	62,000	42,000
Toluene	4,600	3,200
TPH Gasoline	16,000 (mg/kg)	12,000 (mg/kg)

PP017 May 20, 1999	2.0' BGS	5.0' BGS	10.0' BGS
Acetone	23,000	<PCL*	<PCL*
Benzene	7,000	<1.2 U	<58 U
Ethylbenzene	44,000	<1.2 U	<58 U
Toluene	56,000	<1.2 U	<58 U
TPH Gasoline	1,200 J (mg/kg)	8 J (mg/kg)	<5.8 U (mg/kg)

PP017 May 20, 1999	7.0' BGS
Benzene	29.0
TPH Gasoline	0.93 (mg/L)

PP067 August 9, 2000	2.0' BGS	7.0' BGS
Acetone	<PCL*	<PCL*
Benzene	<1.1 U	<1.5 U
Ethylbenzene	<1.1 U	<1.5 U
Toluene	<1.1 U	<1.5 U
TPH Gasoline	<PCL*	<PCL*

PP018 May 28, 1999	2.0' BGS	5.0' BGS	10.0' BGS
Acetone	<PCL*	<PCL*	16
Benzene	<1.3 U	6.2	1.2
Ethylbenzene	<1.3 U	60	2.8
Toluene	<1.3 U	2.8	12
TPH Gasoline	<6.1 U (mg/kg)	42 N (mg/kg)	<5.7 U (mg/kg)

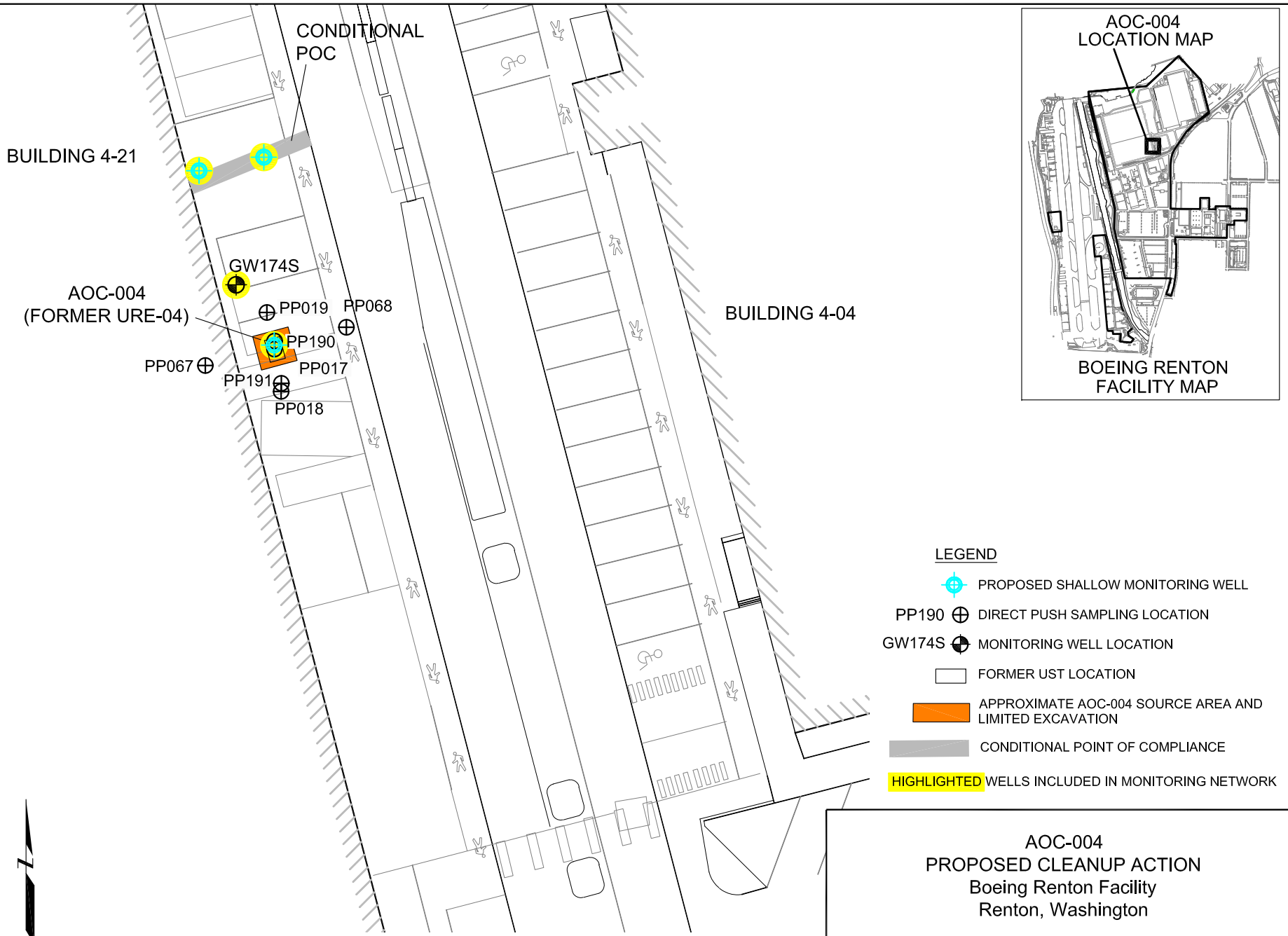
PP018 May 20, 1999	10.0' BGS
Benzene	13.0

PP191 April 30, 2008	1.7' BGS	3.7' BGS
Acetone	<5.8 U	50
Benzene	13	<1.2 U
Ethylbenzene	74	<1.2 U
Toluene	4.2	<1.2 U
TPH Gasoline	26 (mg/kg)	<7.6 U (mg/kg)

AOC-004
SITE LOCATION AND COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 02/11/10	Project No. 8888
AMEC Geomatrix		Figure 22

Plot Date: 02/11/10 - 4:35pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-004_COC-results_062409.dwg



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

By: APS	Date: 11/18/09	Project No. 8888
AMEC Geomatrix		Figure 23

LAKE WASHINGTON

LAKE WASHINGTON

GW001S

GW004S

GW005S

BUILDING
4-41

GW216S

GW006S

GW218S

CONDITIONAL
POC

PILINGS

CEDAR RIVER COMMERCIAL WATERWAY

PARK DRIVE

AOC-035
(FORMER URE-08)

AOC-034
(FORMER URE-07)

(FORMER URE-07)

GW217S

GW007S

DOOR 8A

DOOR 8

DOOR 7

DOOR 6

DOOR 5

PP164

PP035

PP034

PP033

PP163

PP032

PP161

PP162

PP160

PP033 May 18, 1999	5'- 7' BGS
Trichloroethene	ND
cis-1,2-DCE	2.6 (µg/kg)
Vinyl Chloride	ND

PP032 May 18, 1999	2'- 4' BGS
Trichloroethene	2.0 (µg/kg)
PP032 May 18, 1999	5'- 7' BGS
cis-1,2-DCE	7.7 (µg/kg)
Vinyl Chloride	5.2 (µg/kg)

PP163 December 14, 2006	4' BGS
Trichloroethene	<1.1 U (µg/kg)
cis-1,2-DCE	<1.1 U (µg/kg)
Vinyl Chloride	<1.1 U (µg/kg)

PP161 December 14, 2006	4' BGS
Trichloroethene	<0.9 U (µg/kg)
cis-1,2-DCE	<0.9 U (µg/kg)
Vinyl Chloride	<0.9 U (µg/kg)

PP034 May 18, 1999	2'- 11.5' BGS
Trichloroethene	ND
cis-1,2-DCE	ND
Vinyl Chloride	ND

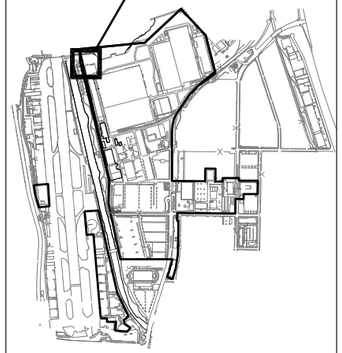
PP035 May 18, 1999	2'- 11.5' BGS
Trichloroethene	ND
cis-1,2-DCE	ND
Vinyl Chloride	ND

PP160 December 14, 2006	4' BGS
Trichloroethene	<0.8 U (µg/kg)
cis-1,2-DCE	<0.8 U (µg/kg)
Vinyl Chloride	<0.8 U (µg/kg)

PP164 December 14, 2006	4' BGS
Trichloroethene	1.9 (µg/kg)
cis-1,2-DCE	<1.1 U (µg/kg)
Vinyl Chloride	<1.1 U (µg/kg)

PP162 December 14, 2006	4' BGS
Trichloroethene	<1.2 U (µg/kg)
cis-1,2-DCE	<1.2 U (µg/kg)
Vinyl Chloride	<1.2 U (µg/kg)

AOC-034 and AOC-035
LOCATION MAP



BOEING RENTON
FACILITY MAP

LEGEND

- GW218S — MONITORING WELL LOCATION
- PP162 — 12/14/2006 PUSH-PROBE SOIL AND GROUNDWATER SAMPLE LOCATION
- PP032 — HISTORICAL PUSH-PROBE LOCATION
- GENERAL DIRECTION OF GROUNDWATER GRADIENT OBSERVED DURING THE RI
- LIMITS OF PREVIOUS EXCAVATION
- FORMER UST LOCATION
- FENCE
- CONDITIONAL POINT OF COMPLIANCE

cis-1,2-DCE	cis-1,2-Dichloroethene
U	Analyte was not detected above value shown
ND	Not detected

RED TEXT INDICATES SOIL ANALYTICAL DATA

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

0 25 50
APPROXIMATE SCALE IN FEET

AOC-034 and AOC-035 SITE LOCATION AND SOIL COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/24/09	Project No. 8888
AMEC Geomatrix	Figure	24

Plot Date: 06/24/09 - 12:37pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-034-035_Soil_COC-results_062409.dwg

LAKE WASHINGTON

LAKE WASHINGTON

CEDAR RIVER COMMERCIAL WATERWAY

GW001S
15.20

GW004S
15.23

GW005S
15.30

15.25

15.3

15.35

BUILDING
4-41

CEDAR
RIVER
TRAIL PARK

PARK DRIVE

PILINGS

CONDITIONAL
POC

AOC-035
(FORMER URE-08)

AOC-034
(FORMER URE-07)

(FORMER URE-07)

GW216S
15.36

GW006S

GW218S
15.29

GW217S
15.33

GW007S

PP032
PP160
PP034
PP163
PP161
PP035
PP164
PP033
PP162

GW216S	May 20, 2008
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U

PP032 May 18, 1999	9' BGS
Trichloroethene	<PCL*
cis-1,2-DCE	<PCL*
Vinyl Chloride	1.8

GW218S	May 20, 2008
cis-1,2-DCE	0.7
Vinyl Chloride	0.3

GW217S	May 20, 2008
cis-1,2-DCE	0.6
Vinyl Chloride	1.3

PP035 May 18, 1999	9' BGS
Trichloroethene	<PCL*
cis-1,2-DCE	<PCL*
Vinyl Chloride	<PCL*

PP161 December 14, 2006	9' BGS
Trichloroethene	<0.2 U
cis-1,2-DCE	0.5
Vinyl Chloride	2.7

PP164 December 14, 2006	9' BGS
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U

PP160 December 14, 2006	9' BGS
Trichloroethene	<0.2 U
cis-1,2-DCE	0.2
Vinyl Chloride	0.6

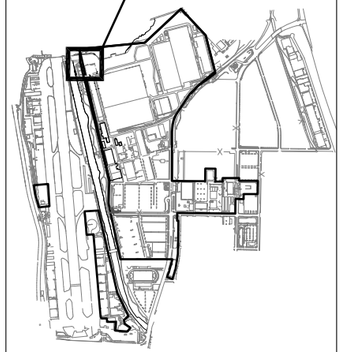
PP034 May 18, 1999	9' BGS
Trichloroethene	<PCL*
cis-1,2-DCE	<PCL*
Vinyl Chloride	<PCL*

PP163 December 14, 2006	9' BGS
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U

PP033 May 18, 1999	9' BGS
Trichloroethene	<PCL*
cis-1,2-DCE	<PCL*
Vinyl Chloride	<PCL*

PP162 December 14, 2006	9' BGS
Trichloroethene	<0.2 U
cis-1,2-DCE	<0.2 U
Vinyl Chloride	<0.2 U

AOC-034 and AOC-035
LOCATION MAP



BOEING RENTON
FACILITY MAP

LEGEND

- GW218S 15.29 — MONITORING WELL LOCATION GROUNDWATER ELEVATION (MAY 20, 2008)
- PP162 — PUSH-PROBE LOCATION
- 15.3 — GROUNDWATER ELEVATION CONTOUR (FT)
- DIRECTION OF GROUNDWATER FLOW
- LIMITS OF PREVIOUS EXCAVATION
- FORMER UST LOCATION
- FENCE
- CONDITIONAL POINT OF COMPLIANCE

cis-1,2-DCE — cis-1,2-Dichloroethene

U — Analyte was not detected above value shown.

<PCL* — Analyte data from the Remedial Investigation was below the preliminary cleanup level for this COC.

BLUE TEXT INDICATES GROUNDWATER ANALYTICAL DATA IN µg/L

LIGHT BLUE TEXT INDICATES HISTORICAL GROUNDWATER ANALYTICAL DATA IN µg/L

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

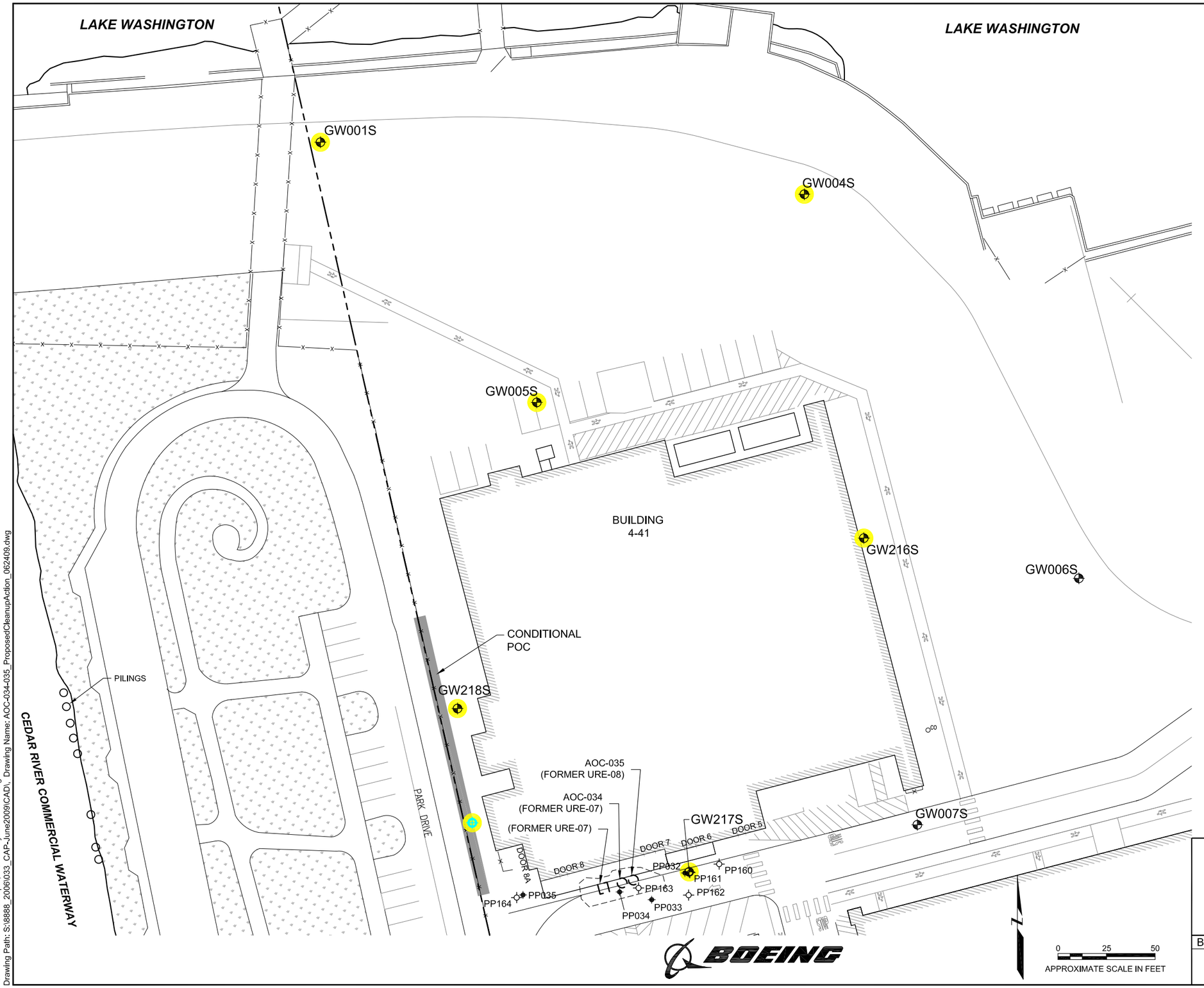
0 30 60
APPROXIMATE SCALE IN FEET

N

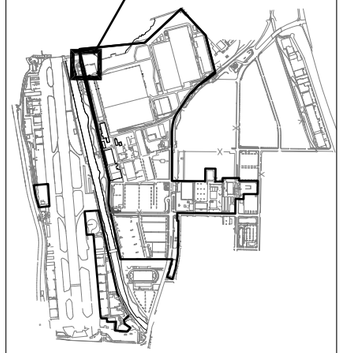
AOC-034 and AOC-035 SITE LOCATION AND GROUNDWATER COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/24/09	Project No. 8888
AMEC Geomatrix		Figure 25

Plot Date: 06/24/09 - 12:40pm Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\ Drawing Name: AOC-034-035_GW_COC-results_062409.dwg



AOC-034 and AOC-035
LOCATION MAP



BOEING RENTON
FACILITY MAP

LEGEND

- PROPOSED SHALLOW MONITORING WELL
- GW218S — MONITORING WELL LOCATION
- PP162 — 12/14/2006 PUSH-PROBE SOIL AND GROUNDWATER SAMPLE LOCATION
- PP032 — HISTORICAL PUSH-PROBE LOCATION
- LIMITS OF PREVIOUS EXCAVATION
- FORMER UST LOCATION
- FENCE
- CONDITIONAL POINT OF COMPLIANCE
- HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

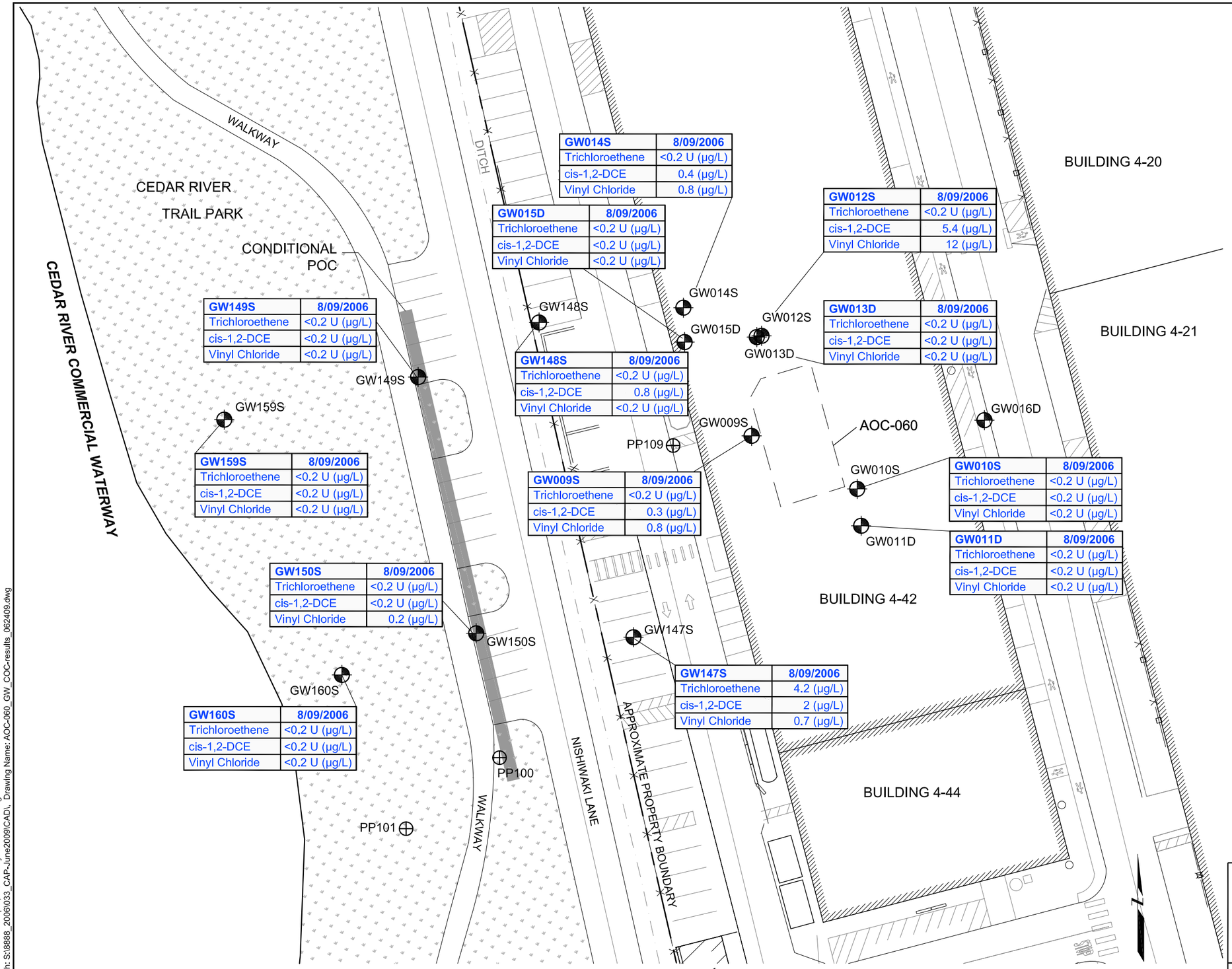
NOTES

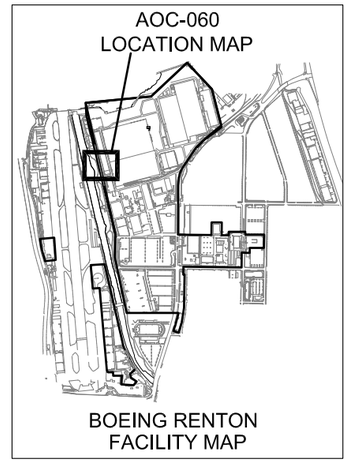
1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 24 FEET IN DEPTH.
   'D' DESIGNATION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

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

By: APS	Date: 10/21/09	Project No. 8888
AMEC Geomatrix		Figure 26

Plot Date: 10/21/09 - 8:03pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CADD_Drawing Name: AOC-034-035_ProposedCleanupAction_062409.dwg





LEGEND

GW150S — EXISTING MONITORING WELL LOCATION

PP109 — EXISTING SUPPLEMENTAL RI PUSH PROBE

CONDITIONAL POINT OF COMPLIANCE

cis-1,2-DCE — cis-1,2-Dichloroethene

U — Analyte was not detected above value shown

BLUE TEXT INDICATES GROUNDWATER ANALYTICAL DATA

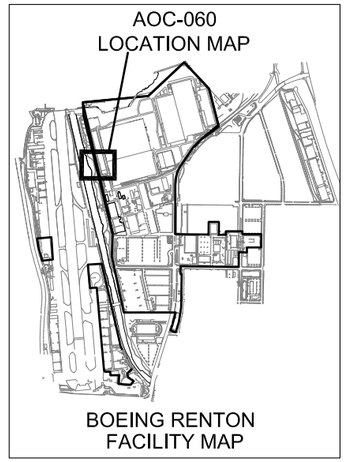
NOTES

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.
   'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 29 FEET IN DEPTH.

AOC-060 SITE LOCATION AND GROUNDWATER COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/24/09	Project No. 8888
AMEC Geomatrix		Figure 27

Plot Date: 06/24/09 - 12:44pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-060_GW_COC-results_062409.dwg



LEGEND

- PROPOSED SHALLOW MONITORING WELL
- PROPOSED INTERMEDIATE MONITORING WELL
- GW150S — EXISTING MONITORING WELL LOCATION
- PP109 — EXISTING SUPPLEMENTAL RI PUSH PROBE
- GENERAL DIRECTION OF GROUNDWATER FLOW AS BASED ON THE GROUNDWATER GRADIENT OBSERVED DURING THE RI
- CONDITIONAL POINT OF COMPLIANCE
- HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

NOTES

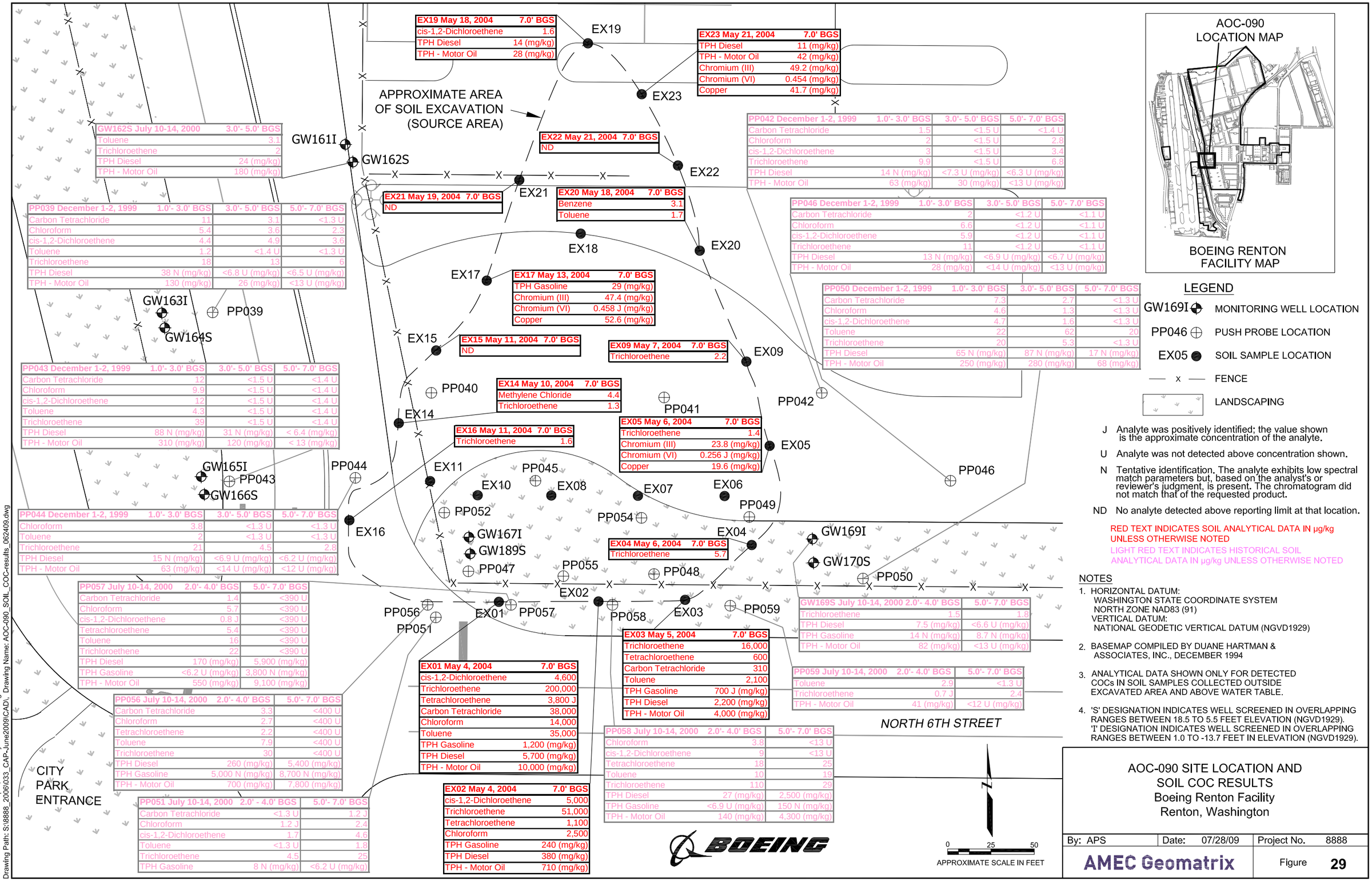
1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER, 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 15 FEET IN DEPTH.
   'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 29 FEET IN DEPTH.

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

By: APS	Date: 06/24/09	Project No. 8888
AMEC Geomatrix	Figure	28

BOEING

Plot Date: 06/24/09 - 12:45pm Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\ Drawing Name: AOC-060_ProposedCleanupAction_062409.dwg


EX19 May 18, 2004 7.0' BGS
cis-1,2-Dichloroethene 1.6
TPH Diesel 14 (mg/kg)
TPH - Motor Oil 28 (mg/kg)
EX19
EX23 May 21, 2004 7.0' BGS
TPH Diesel 11 (mg/kg)
TPH - Motor Oil 42 (mg/kg)
Chromium (III) 49.2 (mg/kg)
Chromium (VI) 0.454 (mg/kg)
Copper 41.7 (mg/kg)
EX23
APPROXIMATE AREA OF SOIL EXCAVATION (SOURCE AREA)
GW162S July 10-14, 2000 3.0'- 5.0' BGS
Toluene 3.1
Trichloroethene 2
TPH Diesel 24 (mg/kg)
TPH - Motor Oil 180 (mg/kg)
GW161I
GW162S
EX22 May 21, 2004 7.0' BGS
ND
EX22
PP042 December 1-2, 1999 1.0'- 3.0' BGS 3.0'- 5.0' BGS 5.0'- 7.0' BGS
Carbon Tetrachloride 1.5 <1.5 U <1.4 U
Chloroform 2 <1.5 U 2.8
cis-1,2-Dichloroethene 3 <1.5 U 3.4
Trichloroethene 9.9 <1.5 U 6.8
TPH Diesel 14 N (mg/kg) <7.3 U (mg/kg) <6.3 U (mg/kg)
TPH - Motor Oil 63 (mg/kg) 30 (mg/kg) <13 U (mg/kg)
EX21
EX21 May 19, 2004 7.0' BGS
ND
EX20 May 18, 2004 7.0' BGS
Benzene 3.1
Toluene 1.7
EX20
PP039 December 1-2, 1999 1.0'- 3.0' BGS 3.0'- 5.0' BGS 5.0'- 7.0' BGS
Carbon Tetrachloride 11 3.1 <1.3 U
Chloroform 5.4 3.6 2.3
cis-1,2-Dichloroethene 4.4 4.9 3.6
Toluene 1.2 <1.4 U <1.3 U
Trichloroethene 18 13 6
TPH Diesel 38 N (mg/kg) <6.8 U (mg/kg) <6.5 U (mg/kg)
TPH - Motor Oil 130 (mg/kg) 26 (mg/kg) <13 U (mg/kg)
EX18
PP046 December 1-2, 1999 1.0'- 3.0' BGS 3.0'- 5.0' BGS 5.0'- 7.0' BGS
Carbon Tetrachloride 2 <1.2 U <1.1 U
Chloroform 6.6 <1.2 U <1.1 U
cis-1,2-Dichloroethene 5.9 <1.2 U <1.1 U
Trichloroethene 11 <1.2 U <1.1 U
TPH Diesel 13 N (mg/kg) <6.9 U (mg/kg) <6.7 U (mg/kg)
TPH - Motor Oil 28 (mg/kg) <14 U (mg/kg) <13 U (mg/kg)
EX17
EX17 May 13, 2004 7.0' BGS
TPH Gasoline 29 (mg/kg)
Chromium (III) 47.4 (mg/kg)
Chromium (VI) 0.458 J (mg/kg)
Copper 52.6 (mg/kg)
GW163I
PP039
GW164S
PP050 December 1-2, 1999 1.0'- 3.0' BGS 3.0'- 5.0' BGS 5.0'- 7.0' BGS
Carbon Tetrachloride 7.3 2.7 <1.3 U
Chloroform 4.6 1.3 <1.3 U
cis-1,2-Dichloroethene 4.7 1.6 <1.3 U
Toluene 22 62 20
Trichloroethene 20 5.3 <1.3 U
TPH Diesel 65 N (mg/kg) 87 N (mg/kg) 17 N (mg/kg)
TPH - Motor Oil 250 (mg/kg) 280 (mg/kg) 68 (mg/kg)
EX15
EX15 May 11, 2004 7.0' BGS
ND
EX09 May 7, 2004 7.0' BGS
Trichloroethene 2.2
EX09
PP043 December 1-2, 1999 1.0'- 3.0' BGS 3.0'- 5.0' BGS 5.0'- 7.0' BGS
Carbon Tetrachloride 12 <1.5 U <1.4 U
Chloroform 9.9 <1.5 U <1.4 U
cis-1,2-Dichloroethene 12 <1.5 U <1.4 U
Toluene 4.3 <1.5 U <1.4 U
Trichloroethene 39 <1.5 U <1.4 U
TPH Diesel 88 N (mg/kg) 31 N (mg/kg) < 6.4 (mg/kg)
TPH - Motor Oil 310 (mg/kg) 120 (mg/kg) < 13 (mg/kg)
PP040
EX14
EX14 May 10, 2004 7.0' BGS
Methylene Chloride 4.4
Trichloroethene 1.3
PP041
PP042
EX16 May 11, 2004 7.0' BGS
Trichloroethene 1.6
EX05 May 6, 2004 7.0' BGS
Trichloroethene 1.4
Chromium (III) 23.8 (mg/kg)
Chromium (VI) 0.256 J (mg/kg)
Copper 19.6 (mg/kg)
EX05
GW165I
PP043
GW166S
PP044
EX11
PP045
EX10
EX08
EX07
EX06
PP049
PP046
PP052
PP054
EX16
PP044 December 1-2, 1999 1.0'- 3.0' BGS 3.0'- 5.0' BGS 5.0'- 7.0' BGS
Chloroform 3.8 <1.3 U <1.3 U
Toluene 2 <1.3 U <1.3 U
Trichloroethene 21 4.5 2.8
TPH Diesel 15 N (mg/kg) <6.9 U (mg/kg) <6.2 U (mg/kg)
TPH - Motor Oil 63 (mg/kg) <14 U (mg/kg) <12 U (mg/kg)
GW167I
GW189S
PP047
EX04 May 6, 2004 7.0' BGS
Trichloroethene 5.7
EX04
GW169I
GW170S
PP050
PP055
PP048
EX02
PP057
PP058
EX03
PP059
PP056
PP051
EX01
PP057 July 10-14, 2000 2.0'- 4.0' BGS 5.0'- 7.0' BGS
Carbon Tetrachloride 1.4 <390 U
Chloroform 5.7 <390 U
cis-1,2-Dichloroethene 0.8 J <390 U
Tetrachloroethene 5.4 <390 U
Toluene 16 <390 U
Trichloroethene 22 <390 U
TPH Diesel 170 (mg/kg) 5,900 (mg/kg)
TPH Gasoline <6.2 U (mg/kg) 3,800 N (mg/kg)
TPH - Motor Oil 550 (mg/kg) 9,100 (mg/kg)
GW169S July 10-14, 2000 2.0'- 4.0' BGS 5.0'- 7.0' BGS
Trichloroethene 1.5 1.8
TPH Diesel 7.5 (mg/kg) <6.6 U (mg/kg)
TPH Gasoline 14 N (mg/kg) 8.7 N (mg/kg)
TPH - Motor Oil 82 (mg/kg) <13 U (mg/kg)
EX03 May 5, 2004 7.0' BGS
Trichloroethene 16,000
Tetrachloroethene 600
Carbon Tetrachloride 310
Toluene 2,100
TPH Gasoline 700 J (mg/kg)
TPH Diesel 2,200 (mg/kg)
TPH - Motor Oil 4,000 (mg/kg)
PP059 July 10-14, 2000 2.0'- 4.0' BGS 5.0'- 7.0' BGS
Toluene 2.9 <1.3 U
Trichloroethene 0.7 J 2.4
TPH - Motor Oil 41 (mg/kg) <12 U (mg/kg)
PP056 July 10-14, 2000 2.0'- 4.0' BGS 5.0'- 7.0' BGS
Carbon Tetrachloride 3.3 <400 U
Chloroform 2.7 <400 U
Tetrachloroethene 2.2 <400 U
Toluene 7.9 <400 U
Trichloroethene 30 <400 U
TPH Diesel 260 (mg/kg) 5,400 (mg/kg)
TPH Gasoline 5,000 N (mg/kg) 8,700 N (mg/kg)
TPH - Motor Oil 700 (mg/kg) 7,800 (mg/kg)
EX01 May 4, 2004 7.0' BGS
cis-1,2-Dichloroethene 4,600
Trichloroethene 200,000
Tetrachloroethene 3,800 J
Carbon Tetrachloride 38,000
Chloroform 14,000
Toluene 35,000
TPH Gasoline 1,200 (mg/kg)
TPH Diesel 5,700 (mg/kg)
TPH - Motor Oil 10,000 (mg/kg)
PP058 July 10-14, 2000 2.0'- 4.0' BGS 5.0'- 7.0' BGS
Chloroform 3.8 <13 U
cis-1,2-Dichloroethene 9 <13 U
Tetrachloroethene 18 25
Toluene 10 19
Trichloroethene 110 29
TPH Diesel 27 (mg/kg) 2,500 (mg/kg)
TPH Gasoline <6.9 U (mg/kg) 150 N (mg/kg)
TPH - Motor Oil 140 (mg/kg) 4,300 (mg/kg)
PP051 July 10-14, 2000 2.0' - 4.0' BGS 5.0'- 7.0' BGS
Carbon Tetrachloride <1.3 U 1.2 U
Chloroform 1.2 J 2.4
cis-1,2-Dichloroethene 1.7 4.6
Toluene <1.3 U 1.8
Trichloroethene 4.5 25
TPH Gasoline 8 N (mg/kg) <6.2 U (mg/kg)
EX02 May 4, 2004 7.0' BGS
cis-1,2-Dichloroethene 5,000
Trichloroethene 51,000
Tetrachloroethene 1,100
Chloroform 2,500
TPH Gasoline 240 (mg/kg)
TPH Diesel 380 (mg/kg)
TPH - Motor Oil 710 (mg/kg)
CITY PARK ENTRANCE
NORTH 6TH STREET
BOEING
0 25 50
APPROXIMATE SCALE IN FEET
AOC-090 LOCATION MAP
BOEING RENTON FACILITY MAP
LEGEND
GW169I MONITORING WELL LOCATION
PP046 PUSH PROBE LOCATION
EX05 SOIL SAMPLE LOCATION
FENCE
LANDSCAPING
J Analyte was positively identified; the value shown is the approximate concentration of the analyte.
U Analyte was not detected above concentration shown.
N Tentative identification. The analyte exhibits low spectral match parameters but, based on the analyst's or reviewer's judgment, is present. The chromatogram did not match that of the requested product.
ND No analyte detected above reporting limit at that location.
RED TEXT INDICATES SOIL ANALYTICAL DATA IN µg/kg UNLESS OTHERWISE NOTED
LIGHT RED TEXT INDICATES HISTORICAL SOIL ANALYTICAL DATA IN µg/kg UNLESS OTHERWISE NOTED
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. ANALYTICAL DATA SHOWN ONLY FOR DETECTED COCs IN SOIL SAMPLES COLLECTED OUTSIDE EXCAVATED AREA AND ABOVE WATER TABLE.
4. '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 SITE LOCATION AND SOIL COC RESULTS
Boeing Renton Facility
Renton, Washington
By: APS
Date: 07/28/09
Project No. 8888
AMEC Geomatrix
Figure 29
Plot Date: 07/28/09 - 1:09pm Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\ Drawing Name: AOC-090_SOIL_COC-results_062409.dwg

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Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-090_GW_COC-results_062409.dwg

GW182S	8/08/2006	2/15/2007
Trichloroethene	<0.2 U (µg/L)	<0.2 U (µg/L)
cis-1,2-DCE	0.3 (µg/L)	0.4 (µg/L)
Vinyl Chloride	<0.2 U (µg/L)	<0.2 U (µg/L)

GW181I	8/08/2006	2/14/2007
Trichloroethene	<0.2 U (µg/L)	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)	<0.2 U (µg/L)
Vinyl Chloride	0.5 (µg/L)	2.1 (µg/L)

GW180S	8/08/2006	2/15/2007
Trichloroethene	<0.2 U (µg/L)	<0.2 U (µg/L)
cis-1,2-DCE	0.3 (µg/L)	<0.2 U (µg/L)
Vinyl Chloride	0.3 (µg/L)	0.3 (µg/L)

GW179I	2/15/2007
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)

GW175I	2/15/2007
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)

GW176S	2/15/2007
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	0.3 (µg/L)
Vinyl Chloride	0.6 (µg/L)

GW161I	2/15/2007
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)

GW163I	2/15/2007
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)

GW164S	2/21/2007
Trichloroethene	0.2 (µg/L)
cis-1,2-DCE	1.7 (µg/L)
Vinyl Chloride	0.4 (µg/L)

GW165I	2/15/2007
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)

GW166S	2/21/2007
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)

GW178S	2/14/2007
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	0.2 (µg/L)
Vinyl Chloride	0.4 (µg/L)

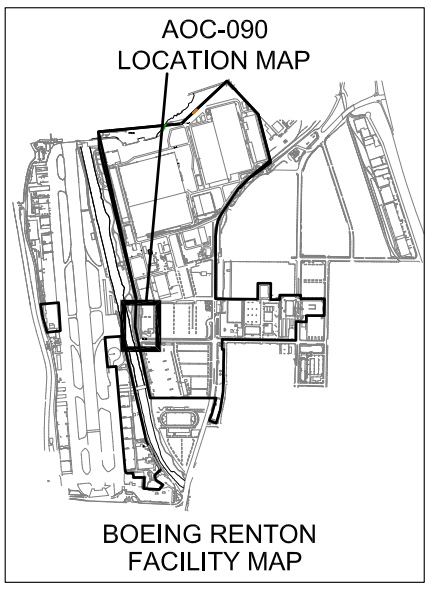
GW177I	2/14/2007
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	0.6 (µg/L)

GW189S	8/08/2006	2/21/2007
Trichloroethene	540 (µg/L)	82 (µg/L)
cis-1,2-DCE	18,000 (µg/L)	310 (µg/L)
Vinyl Chloride	2,700 (µg/L)	9.5 (µg/L)

GW182S
GW181I
GW180S
GW207S
GW179I
GW175I
GW176S
GW163I
GW164S
GW165I
GW166S
GW161I
GW162S
GW189S
IPR3
IPR4
GW178S
GW208S
GW177I
GW144S

CEDAR RIVER WATERWAY
CEDAR RIVER TRAIL PARK
NISHIWAKI LANE
NORTH 6TH STREET
CITY PARK ENTRANCE
STOP

APPROXIMATE SHALLOW ZONE POINT OF COMPLIANCE
APPROXIMATE INTERMEDIATE ZONE POINT OF COMPLIANCE
GENERAL DIRECTION OF INTERMEDIATE ZONE GROUNDWATER FLOW
GENERAL DIRECTION OF SHALLOW ZONE GROUNDWATER FLOW
APPROXIMATE AREA OF SOIL EXCAVATION (SOURCE AREA)
SHEET PILE WALL LOCATION APPROXIMATE



LEGEND

- GW162S — EXISTING MONITORING WELL LOCATION
- IPR4 — EXISTING INJECTION PIPE RISER
- APPROXIMATE LOCATION OF 4-INCH DIAMETER DRAIN PIPE
- FENCE
- APPROXIMATE PROPERTY LINE
- LANDSCAPING
- CONDITIONAL POINT OF COMPLIANCE

cis-1,2-DCE — cis-1,2-Dichloroethene
U — Analyte was not detected above value shown

BLUE TEXT INDICATES GROUNDWATER ANALYTICAL DATA

NOTES

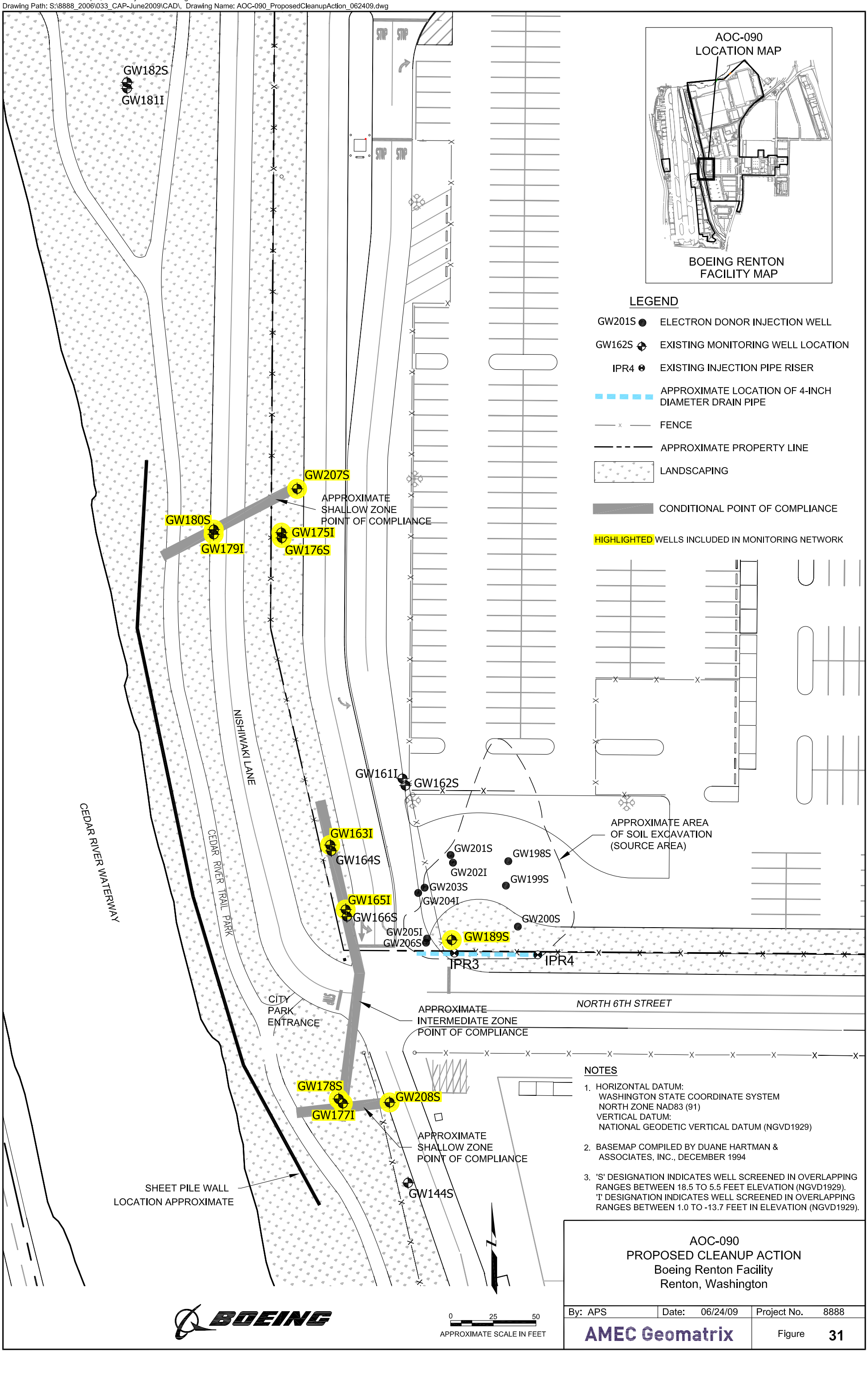
1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED IN OVERLAPPING RANGES BETWEEN 18.5 TO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

0 25 50
APPROXIMATE SCALE IN FEET

AOC-090 SITE LOCATION AND GROUNDWATER COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/24/09	Project No. 8888
AMEC Geomatrix		Figure 30

Plot Date: 06/24/09 - 12:53pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-090_ProposedCleanupAction_062409.dwg



LEGEND

- GW201S — ELECTRON DONOR INJECTION WELL
- GW162S — EXISTING MONITORING WELL LOCATION
- IPR4 — EXISTING INJECTION PIPE RISER
- APPROXIMATE LOCATION OF 4-INCH DIAMETER DRAIN PIPE
- FENCE
- APPROXIMATE PROPERTY LINE
- LANDSCAPING
- CONDITIONAL POINT OF COMPLIANCE
- HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

NOTES

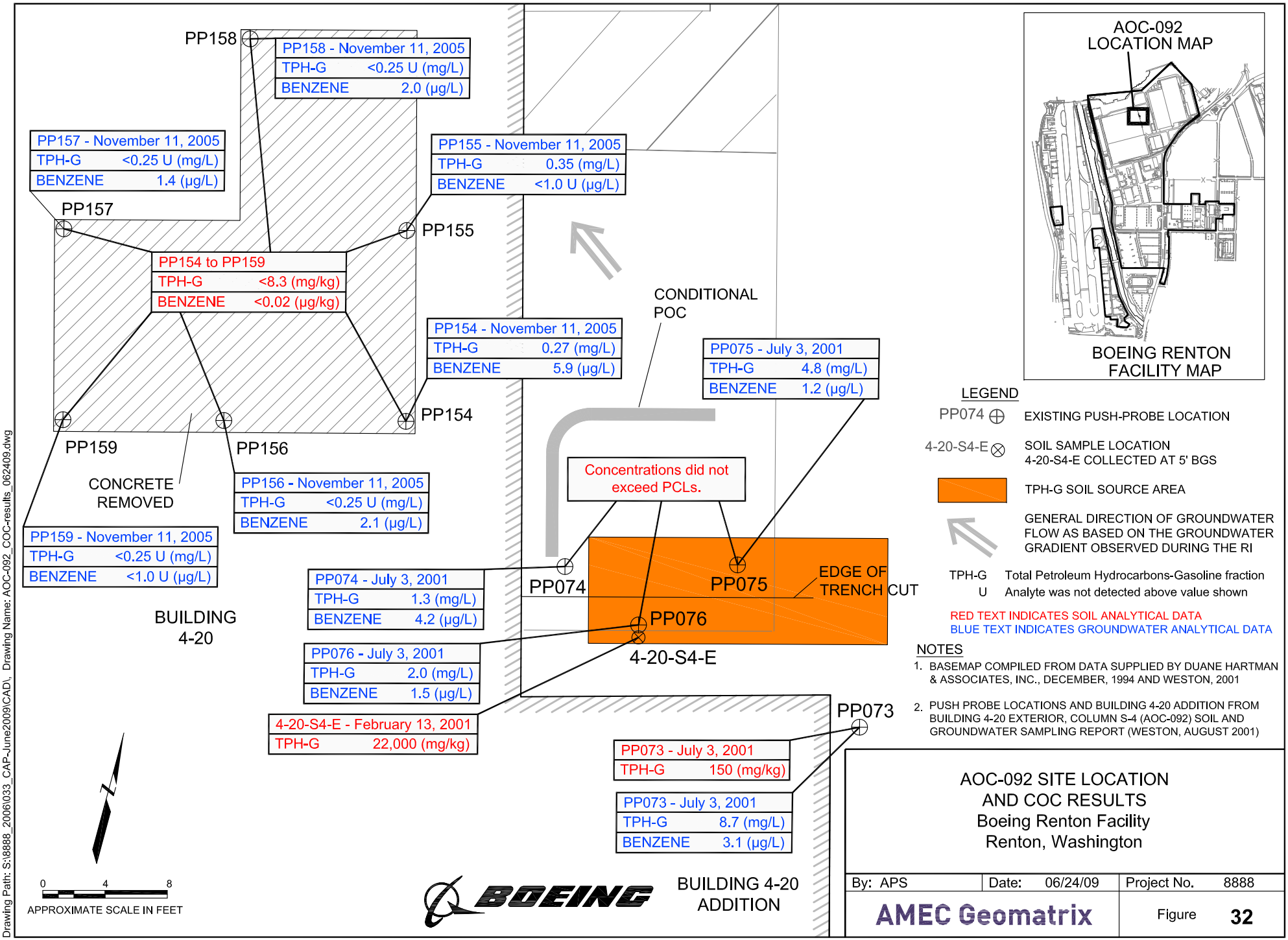
1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED IN OVERLAPPING RANGES BETWEEN 18.5 TO 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
PROPOSED CLEANUP ACTION
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/24/09	Project No. 8888
AMEC Geomatrix		Figure 31



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

By: APS	Date: 06/24/09	Project No. 8888
AMEC Geomatrix	Figure	32

Plot Date: 06/24/09 - 12:58pm, Plotted by: adam.stenberg
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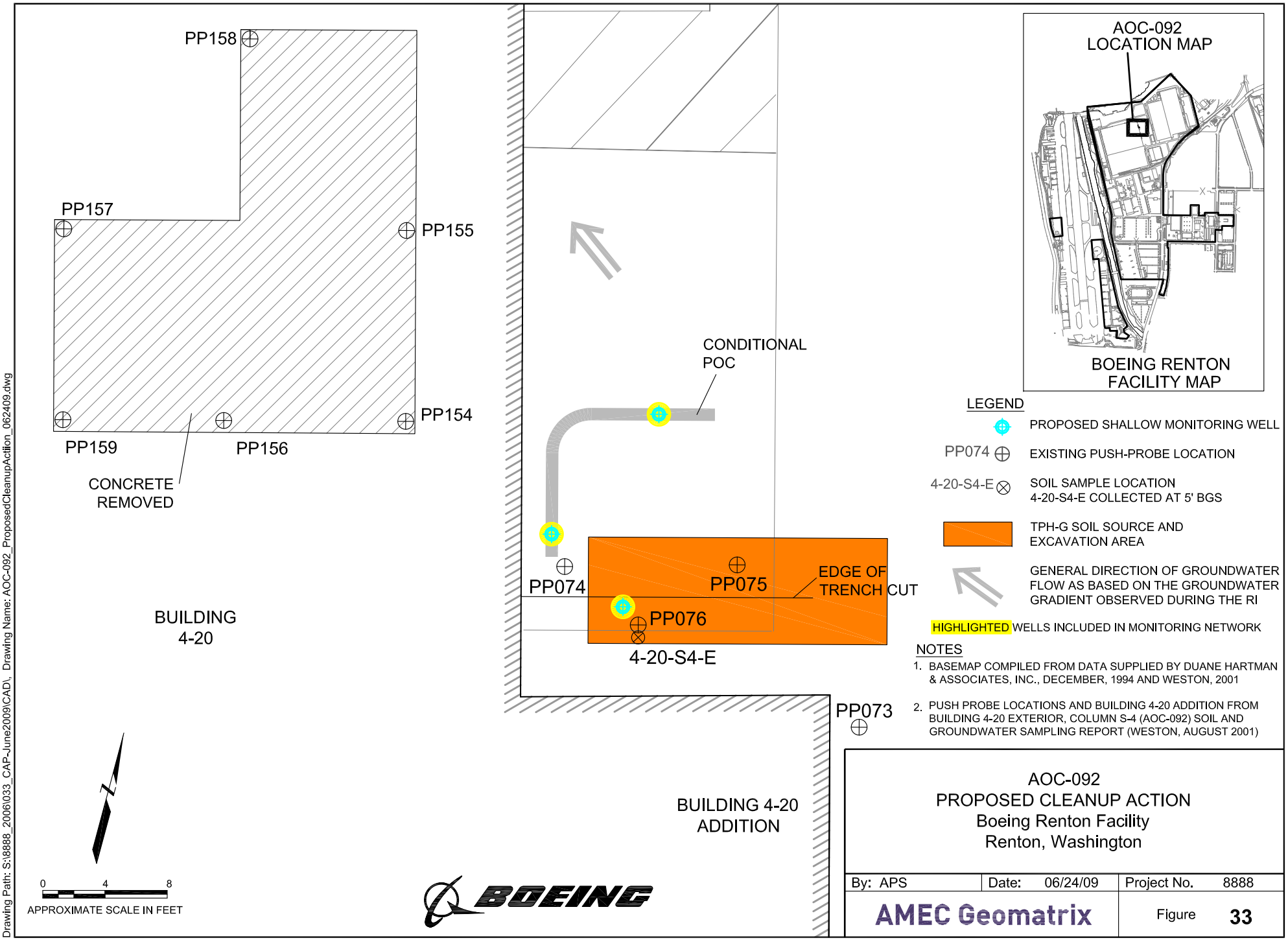
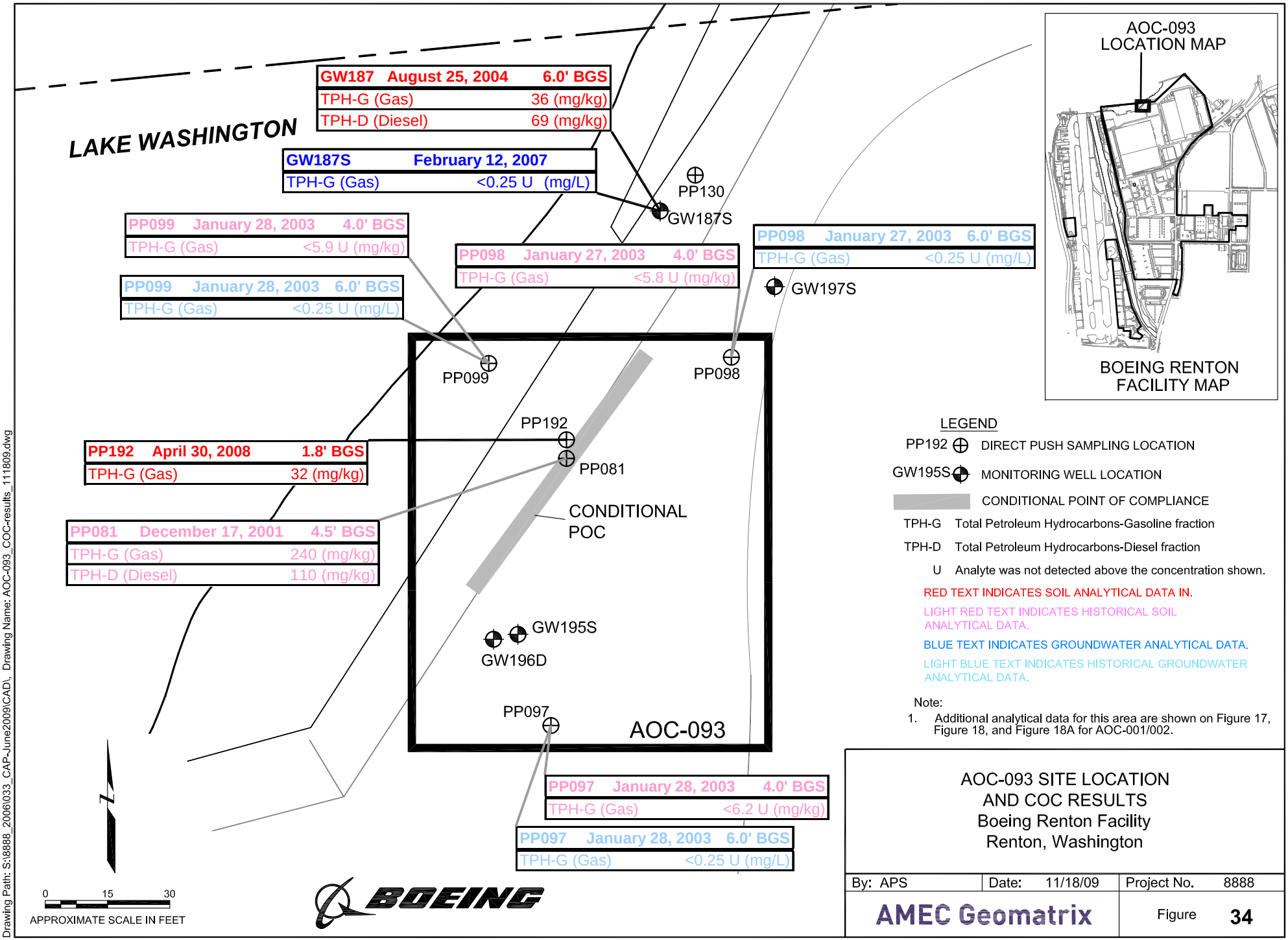


Plot Date: 06/24/09 - 1:00pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-092_ProposedCleanupAction_062409.dwg



AOC-093 SITE LOCATION AND COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 11/18/09	Project No. 8888
AMEC Geomatrix	Figure	34

Plot Date: 11/18/09 - 1:26pm, Plotted by: adam.stenberg
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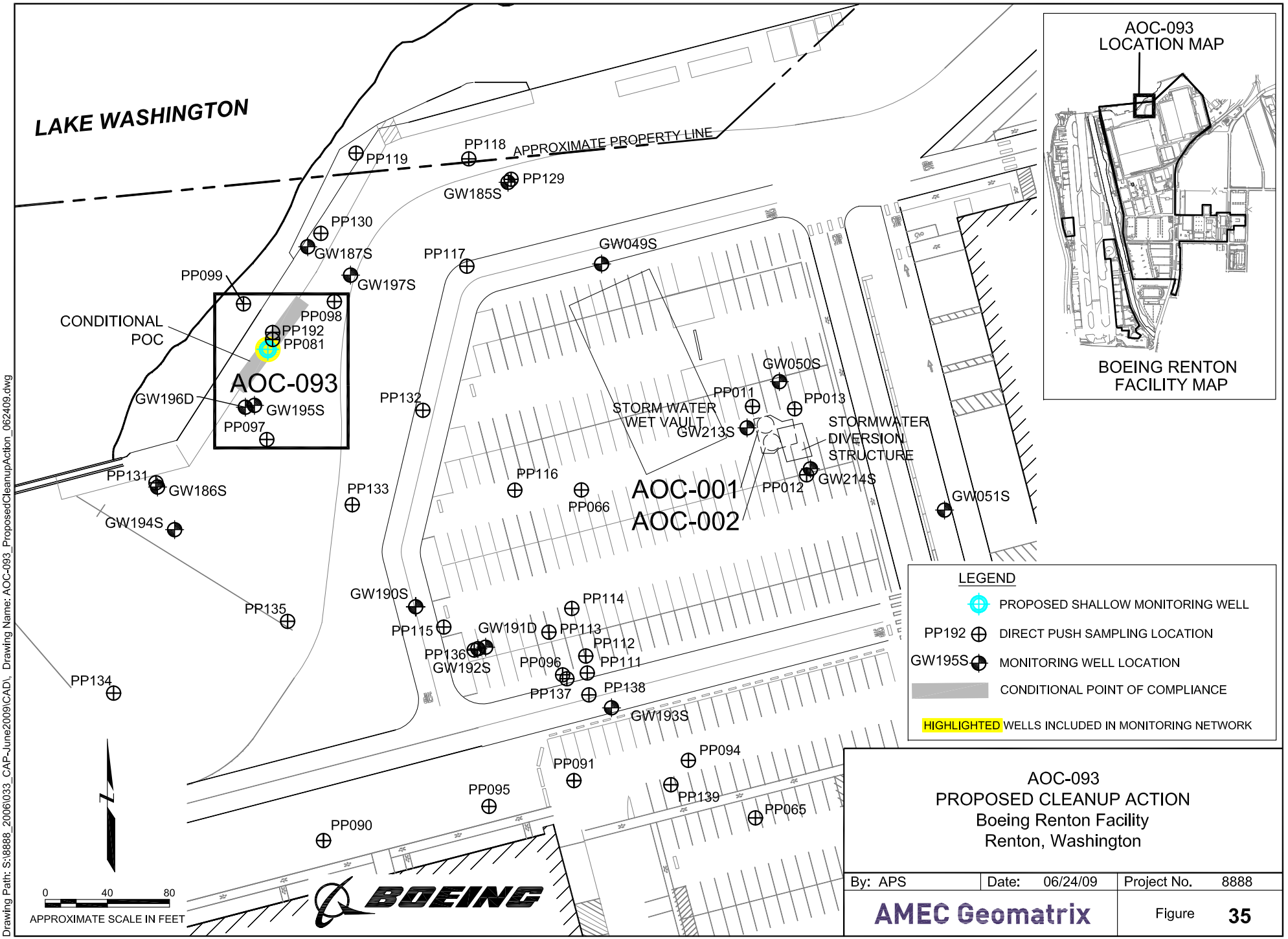


AOC-093
PROPOSED CLEANUP ACTION
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/24/09	Project No. 8888
AMEC Geomatrix		Figure 35

Plot Date: 06/24/09 - 1:04pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\033_CAP-June2009\CAD\, Drawing Name: AOC-093_ProposedCleanupAction_062409.dwg

APPENDIX A

Groundwater Fate and Transport Modeling

GROUNDWATER FATE AND TRANSPORT MODELING
Boeing Renton Facility
Renton, Washington

A-1.0 INTRODUCTION

This appendix describes groundwater fate and transport modeling performed in support of evaluating potential remedial alternatives for the Feasibility Study (FS) and the Cleanup Action Plan (CAP) at the Boeing Renton Facility. Geomatrix Consultants, Inc. (Geomatrix), performed modeling to predict concentrations of groundwater constituents of concern (COCs) at conditional points of compliance (CPOCs) that achieve Model Toxics Control Act (MTCA) cleanup levels protective of surface water. This modeling was done for the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) addressed in the FS. These SWMUs and AOCs include eight sites with groundwater affected by chlorinated volatile organic compounds (VOCs) and five sites with groundwater affected by petroleum hydrocarbons. The modeling was performed to support development and evaluation of remedial alternatives and to establish cleanup levels.

A-1.1 MODELING OBJECTIVES

The objectives of the fate and transport modeling were to:

- Predict the maximum groundwater COC concentrations at the CPOCs that would naturally attenuate to achieve applicable cleanup levels protective of surface waters at the point groundwater enters surface water; and

- Estimate MTCA Method C soil cleanup levels that are protective of groundwater for each SWMU and AOC addressed in the FS.

The groundwater modeling results were used to ensure that the CPOC groundwater cleanup levels established in the FS were protective of surface water (i.e., the CPOC cleanup level cannot exceed the maximum modeled CPOC concentration that would attenuate to MTCA Method A or B criteria at surface water). The groundwater results were then applied during a subsequent stage of modeling to establish the maximum concentrations of COCs in soil that would be protective of the modeled maximum concentration in groundwater. The modeling results were used in the FS to establish the groundwater cleanup levels applicable at the CPOC. This approach used to establish soil and groundwater cleanup levels is described in the FS.

A-1.2 MODEL SELECTION

Natural attenuation modeling was performed using BIOCHLOR (ver. 2.2) and BIOSCREEN (ver. 1.4) software. These modeling programs were developed on behalf of the U.S. Air Force Center for Environmental Excellence by Groundwater Services, Inc., to assess natural attenuation of solutes in

groundwater. The software has been accepted by the U.S. Environmental Protection Agency (EPA) and is available for download from the EPA CLU-IN web site (http://www.clu-in.org/).

BIOCHLOR simulates the natural attenuation of commonly found chlorinated solvents. BIOCHLOR is a Microsoft® Excel programmed spreadsheet that simulates one-dimensional advection, three-dimensional dispersion, linear adsorption, and biotransformation via reductive dechlorination for chlorinated solvents. BIOCHLOR was used to model SWMU/AOC groups in which chlorinated VOCs were the primary COCs.

BIOSCREEN simulates the degradation of dissolved petroleum hydrocarbons. BIOSCREEN is also a Microsoft Excel programmed spreadsheet that simulates one-dimensional advection, three-dimensional dispersion, linear adsorption, and both aerobic and anaerobic biological decay of petroleum hydrocarbons. BIOSCREEN was used to model SWMU/AOC groups in which fuel constituents and benzene were COCs.

A-2.0 MODELING APPROACH

Modeling was performed in four stages:

- Model calibration, where possible.
- Predicting maximum concentrations within the source areas and at the CPOCs that achieve the cleanup levels established in the FS.
- Natural attenuation screening.
- Calculation of MTCA Method C soil cleanup levels protective of groundwater and surface water.

Each of these modeling stages is discussed in the following sections.

A-2.1 STAGE 1 - MODEL CALIBRATION

In the first stage, if sufficient downgradient groundwater quality data were available, models for each SWMU/AOC group were calibrated such that model-predicted concentrations of COCs approximated concentrations measured in samples from site wells and/or push probes. The primary parameters adjusted to improve model calibration were degradation half-lives of the VOC and fuel constituent COCs. BIOCHLOR models for chlorinated VOCs that were calibrated to field data included SWMU-172/174, AOC-001/-002, AOC-060, and AOC-090. The BIOSCREEN model for total petroleum hydrocarbons, gasoline range (TPH-G) and benzene at AOC-092 was also calibrated to field data. Degradation half-lives used in the calibrated models were adjusted within the range of half-lives found in published literature (Table A-1). In two areas (AOC-001/002 and AOC-060) the assumed time since release of COCs to groundwater at a given site was increased from 30 years

before present to 50 years before present to achieve a better calibration. This change was considered reasonable, based on the long operational histories of these areas. Historical information indicates that these areas have been active since the 1940s.

If sufficient downgradient data were not available, model calibration was not performed and default degradation half-lives and release times specified in the Final Feasibility Study Work Plan (FSWP) were used (Geomatrix, 2004). Either the calibrated models or the default parameter value models (if calibration was not performed) were used in subsequent modeling, as described below. Input parameters for the models are provided in Tables A-2, A-3, and A-4. A summary of the measured and predicted concentrations from the calibrated models is presented for BIOCHLOR and BIOSCREEN in Tables A-5 and A-6, respectively.

A-2.2 STAGE 2 – MAXIMUM SOURCE AREA CONCENTRATIONS AND RESULTING CONCENTRATIONS AT THE CPOCS

Stage 2 modeling was done in support of establishing groundwater cleanup levels for the CPOC that are protective of groundwater and to provide a basis for Stage 4 modeling to determine soil cleanup levels protective of groundwater and surface water. The site-specific groundwater cleanup levels applicable at the CPOCs for each of the SWMUs and AOCs were established to achieve two criteria:

- Be protective of surface water by achieving MTCA Method A cleanup levels for TPH or MTCA Method B criteria for specific COCs at the point groundwater enters surface water; and

- Achieve the total risk criteria specified in the MTCA regulations (i.e., total excess cancer risk of 10^{-5} and/or a Hazard Quotient of 1.0) at the CPOC.

Stage 2 modeling results, which determined the maximum concentration at the CPOC that would attenuate to MTCA Method B criteria, were used to determine if the CPOC cleanup levels would attenuate to achieve MTCA Method B criteria protective of surface water. The potential cleanup level was then set initially at the lower of the MTCA Method B criteria or the modeled maximum CPOC concentration protective of surface water. The initial potential cleanup level was then adjusted as appropriate to ensure the Hazard Quotient was not greater than 1.0 and the total cancer risk was not greater than 10^{-5}. The risk-adjusted potential cleanup levels were then compared to the practical quantitation limits (PQLs), and the greater value was established as the cleanup level, in accordance with the MTCA regulations and guidance. Details of the approach used to establish the groundwater cleanup levels applicable at the CPOC are described in Section 3 of the FS. Table 3-2 of the FS summarizes the criteria and approach used to establish the cleanup levels.

Modeling in Stage 2 determined the maximum concentrations in groundwater at the source area and at the CPOC that were protective of MTCA Method A or Method B groundwater cleanup criteria cited in FS Table 3-2. The Method B criteria considered in modeling are as follows: tetrachloroethene

(PCE), 0.08 micrograms per liter (µg/L); trichloroethene (TCE), 0.11 µg/L; *cis*-1,2-dichloroethene (*cis*-1,2-DCE), 70 µg/L; vinyl chloride (VC), 0.025 µg/L; and benzene, 0.8 µg/L. The MTCA Method A cleanup criteria used for Stage 2 modeling are TPH-G with benzene, 800 µg/L; total petroleum hydrocarbons, diesel range (TPH-D), 500 µg/L; and total petroleum hydrocarbons, Jet fuel A range (TPH-Jet A), 500 µg/L. As further noted in Section 3 of the FS, the Method B cleanup criteria were selected as the lowest criterion obtained from the CLARC website, taking into consideration the standard Method B formulae (carcinogens and noncarcinogens) and applicable or relevant and appropriate requirements (ARARs) for fresh surface water, groundwater, and drinking water. The MTCA Method A cleanup criteria are generally applicable to simple sites and are considered protective of surface water. Thus, the Method B and Method A criteria used in this modeling are protective of surface water.

Maximum source area groundwater concentrations protective of surface water were modeled by iteratively adjusting the source area groundwater concentrations input to the calibrated or default parameter models until predicted groundwater concentrations near the surface water receptor met the Method B or Method A cleanup criteria. These results are presented in Tables A-7 and A-8 for chlorinated and nonchlorinated COCs, respectively.

Using the maximum source area concentrations determined to be protective of surface water, the models were used to estimate maximum COC concentrations at the CPOCs (i.e., the modeled concentration at the CPOC using the maximum source area concentration) that are protective of surface water (i.e., would attenuate to the Method A or Method B cleanup criteria at the point groundwater enters surface water). The maximum CPOC concentrations protective of surface water are tabulated in Table A-7 for BIOCHLOR results and in Table A-8 for BIOSCREEN results.

A-2.3 STAGE 3 - NATURAL ATTENUATION SCREENING

The third modeling stage consisted of natural attenuation screening to evaluate whether natural attenuation is likely to reduce current source area groundwater COC concentrations to below groundwater cleanup levels at the site CPOCs. Natural attenuation screening was performed by modeling groundwater COC concentrations at the CPOC locations using existing, measured source area concentrations as inputs into the default or calibrated models for each AOC or SWMU. The predicted COC concentrations at the CPOCs are presented in Tables A-7 and A-8. These predicted values were then compared to the site-specific groundwater cleanup levels at the CPOCs established in Section 3 of the FS to evaluate whether natural attenuation would likely attain the groundwater cleanup levels at the CPOCs. Results of this modeling are tabulated in Tables A-7 and A-8 and discussed further in Section A.4.

A-2.4 STAGE 4 – MTCA METHOD C SOIL CLEANUP LEVELS

Stage 4 modeling was used to determine Method C soil cleanup levels that are protective of groundwater. The soil cleanup levels were determined using partitioning models to calculate the soil concentration that is protective of the maximum protective groundwater concentration, considering attenuation between the source area and surface water.

In order to determine the maximum protective source area concentration, groundwater modeling was used to predict the maximum source area groundwater concentrations that would attenuate to the lower of:

- The CPOC cleanup levels for groundwater; or
- The predicted maximum concentrations at the CPOC that are protective of surface water.

In some cases, the predicted maximum concentration at the CPOC that is protective of surface water (determined in Stage 2 modeling) was lower than the PQL, and the cleanup level was based on the PQL. Stage 4 modeling was used to determine the maximum protective source area groundwater concentration by varying the source concentration iteratively until the predicted CPOC concentration met the lower of the above two criteria. The modeled maximum source area groundwater concentrations protective of groundwater at the CPOC are tabulated in the far right-hand column of Table A-9 and Table A-10. These source area concentrations are predicted to attain the cleanup levels and maximum concentrations protective of surface water at the CPOC.

MTCA Method C soil cleanup levels at each SWMU or AOC that are protective of groundwater at the CPOCs were then determined by partitioning calculations between soil and the maximum source area groundwater concentration protective of groundwater at the CPOCs. These calculations were completed using the MTCA three-phase partitioning model (Washington Administrative Code [WAC] Chapter 173-340-747). Modeling was completed using default values specified in MTCA, except for soil total organic carbon (TOC) content, which was based on site-specific data. TOC data are discussed further in Section A-3.1. The resulting Method C soil cleanup levels are tabulated in Table A-11.

At the Building 4-78/4-79 SWMU/AOC Group, the Former Fuel Farm, AOC-004, AOC-090, and AOC-092, the maximum predicted source area groundwater concentrations of TPH were unrealistically high (greater than 100,000 µg/L). In these cases, the maximum source area groundwater concentration used as input to the three-phase partitioning model was capped at 100,000 µg/L. Although source area soil concentrations for TPH constituents established through modeling and partitioning calculations are as high as 68,000 mg/kg, the soil cleanup levels for TPH constituents must also consider residual saturation, MTCA requirements of no accumulation of free product, and potential human health impacts. The modeled source area concentrations for TPH were considered in

establishing soil cleanup levels in Section 3 of the FS. As noted in Section 3 of the FS, soil cleanup levels for TPH are based on MTCA Method A criteria for industrial properties.

A-3.0 MODEL INPUT PARAMETERS

This section describes selection of model input parameters for the BIOSCREEN and BIOCHLOR models. Input parameters common to both models are described first, followed by input parameters specific to the BIOCHLOR and BIOSCREEN models.

A-3.1 COMMON MODEL INPUT PARAMETERS

BIOCHLOR and BIOSCREEN utilize a number of the same input parameters describing hydrogeologic and chemical transport conditions. These parameters include hydraulic conductivity, hydraulic gradient, porosity, soil bulk density, and soil TOC. Values for these parameters common to both models are presented in Table A-2 and discussed further in the following sections.

A-3.1.1 Hydraulic Conductivity

Hydraulic conductivity values were based on the results of slug tests performed during the RI in wells completed in soil types similar to the predominant soil types at each AOC or SWMU. Table A-2 presents the predominant soil type at each AOC or SWMU and the associated hydraulic conductivity value. The hydraulic conductivity for sand (soil type SP) of 2.15×10^{-3} centimeters per second (cm/s) was calculated from the geometric mean of eight slug tests conducted in this soil type throughout the facility. The hydraulic conductivity for silty sand (soil type SM) of 8.96×10^{-4} cm/s was calculated from the geometric mean of 13 slug tests conducted in this soil type.

A-3.1.2 Hydraulic Gradient

Hydraulic gradient values were calculated based on contoured groundwater elevation data from each AOC or SWMU. Groundwater elevation contours for each AOC and SWMU are shown on Figures A-1 through A-11, and hydraulic gradients used in the models are presented on Table A-2. Except as noted below, groundwater elevation data collected in February 2007 at the Building 4-78/4-79 SWMU/AOC Group, AOC-001/002, AOC-003, AOC-060, and AOC-090 were used to calculate hydraulic gradients at these locations.

Three hydraulic gradient values were used in the models for AOC-090. In the shallow groundwater flow system two hydraulic gradient values were calculated which are representative of the generally northward and southward flow paths from the soil source area to the Cedar River. A third hydraulic gradient value was assigned for the intermediate-depth groundwater flow system based on the groundwater elevation map shown in Figure 16-2 of the FS. This map is taken from the RI and is based on water level measurements collected on August 18, 2000 (Weston, 2001).

Groundwater elevation data are not routinely collected at SWMU-168, SWMU-172/174, AOC-004, AOC-034/035, and AOC-092. September 2000 groundwater elevation contours from the RI Report were used to calculate hydraulic gradients at these locations. With the exception of SWMU-172/174, few or no wells exist at these locations for measurement of groundwater elevations, and groundwater elevation contours are based instead on facility-wide contours of groundwater elevation data.

Due to the effects of an ongoing interim action, including an air sparge system, groundwater elevations measured at the Former Fuel Farm during normal groundwater sampling events are not representative of ambient groundwater conditions at this location. In November 2005 the air sparge system was temporarily shut down until water levels stabilized, and water level measurements were collected. These data are considered to be most representative of ambient groundwater flow conditions at the Former Fuel Farm and were used to calculate hydraulic gradients for this effort.

A-3.1.3 Porosity and Bulk Density

Default values specified in the MTCA three-phase partitioning model (WAC 173-340-747) were assigned for the parameters of soil bulk density (1.5 kilograms per liter [kg/L]) and soil porosity (0.43).

A-3.1.4 Total Organic Carbon

The soil TOC was based on a statistical evaluation of soil TOC values and soil type described in the FSWP (Geomatrix, 2004). Soil TOC values were assigned based on the predominant soil type at each AOC or SWMU, with values of 0.84 percent for silty sand (SM) and 0.46 percent for sand (SP).

A-3.2 BIOCHLOR INPUT PARAMETERS

Input parameters specific to the BIOCHLOR models include source area concentrations, degradation half-lives, model dimensions (source width and thickness, model length, distances to CPOC and surface water), and dispersivity. Values for these parameters are presented on Table A-3 and discussed further in the following sections.

A-3.2.1 Source Area Concentrations

For model calibration and natural attenuation screening, source area concentrations were generally taken as the maximum measured values as presented in the final RI Report (Weston, 2001) or from subsequent investigations reported in the FSWP, site-specific reports, and quarterly monitoring reports. Figures A-1 through A-8 and Table A-3 present source area concentration data from wells and push probes used in the modeling. These data are discussed further in Section A-4. At AOC-001/002 a soil removal interim action completed in 2005 has significantly reduced source area groundwater VOC concentrations. At this location data collected in 2003 and 2004, prior to the interim action, were used to calibrate the model, while February 2007 data were used for natural attenuation screening.

A-3.2.2 Degradation Half-Lives

For the models that were not calibrated, half-lives for PCE, TCE, *cis*-1,2-DCE, and VC were set by default at 1.97, 4.53, 1.00, and 7.88 years, respectively, as specified in the FSWP. The half-lives were adjusted as calibration parameters at SWMU-172/174, AOC-001/002, AOC-060, and AOC-090, where sufficient data were available to perform model calibration. Data used for calibration are shown on Table A-5 and Figures A-2, A-4, A-7, and A-8. Default and final calibrated half-lives (Table A-3) are within the range of published degradation half-lives (Aronson and Howard, 1997; Wiedemeier et al., 1999), as shown on Table A-1. Model calibration to establish calibrated half-lives is discussed further in Section A-4.

A-3.2.3 Model Dimensions

The source area dimensions were based on figures in the final RI Report and final FSWP. Distances to the on-site and off-site CPOCs, as appropriate, and to surface water are based on Figures A-1 through A-11 and were used to establish the model dimensions. The model run time during calibration was generally set to 30 years, based on an assumed time before present when a release to groundwater may have occurred. During calibration, model run time at AOC-001/002 and AOC-060 was increased to 50 years in order to improve the calibration. Both of these areas were active areas of the facility more than 50 years ago, and a 50-year-old potential release date is a reasonable assumption. Predictive simulations for natural attenuation screening, for determining maximum concentrations in source area groundwater protective of surface water, and for determining concentrations at the CPOC protective of surface water used a run time of 1,000 years in order to reach steady-state conditions.

A-3.2.4 Dispersivity

Dispersivity was assigned a value of one-tenth the total flow path length from the source area to the surface water receptor (Table A-3). Within each AOC or SWMU the same dispersivity value was used regardless of whether the model run was used to predict concentrations between the source area and the CPOC or the source area and surface water.

A-3.3 BIOSCREEN INPUT PARAMETERS

Input parameters specific to the BIOSCREEN models include source area concentrations, degradation half-lives, model dimensions (source width and thickness, model length, distances to CPOC), and dispersivity. Values for key parameters are presented on Table A-4 and discussed further in the following sections.

A-3.3.1 Source Area Concentrations

For model calibration and natural attenuation screening, source area concentrations were taken as the maximum measured values as presented in the final RI Report (Weston, 2001) or from

subsequent investigations reported in the final FSWP, site-specific reports, and quarterly monitoring reports. Figure A-3, Figures A-8 through A-11, and Table A-4 present source area concentration data from wells and push probes used in the modeling.

A-3.3.2 Degradation Half-Lives

For the models that were not calibrated, the degradation half-lives were the default values in BIOSCREEN. The half-lives were adjusted as calibration parameters at AOC-092, where sufficient data were available to perform model calibration. Data used in model calibration for AOC-092 are shown on Table A-6 and on Figure A-11.

A-3.3.3 Model Dimensions

The source area dimensions were based on figures in the final RI Report and final FSWP. Distances to the on-site and off-site CPOCs, as appropriate, and to surface water are based on Figures A-3 and A-8 through A-11 and were used to establish the model dimensions. The model run time during calibration was set to 30 years, based on an assumed time before present when a release to groundwater may have occurred. Predictive simulations for natural attenuation screening and determining maximum source area concentrations and cleanup levels at the CPOC protective of surface water used a run time of 1,000 years in order to reach steady-state conditions.

A-3.3.4 Dispersivity

Dispersivity was assigned a value of one-tenth the total flow path length from the source area to the surface water receptor. Within each AOC or SWMU the same dispersivity value was used regardless of whether the model run was used to predict concentrations between the source area and the CPOC or the source area and surface water.

A-4.0 MODEL IMPLEMENTATION AND RESULTS

This section presents results of BIOCHLOR chlorinated VOC and BIOSCREEN TPH and benzene modeling and calculation of source area soil cleanup levels.

A-4.1 BIOCHLOR CHLORINATED VOC MODEL RESULTS

Results of BIOCHLOR model calibration are shown in Table A-5. In general, model calibration significantly improved the accuracy of predicted groundwater concentrations at downgradient wells. Modeled maximum source area groundwater concentrations that are predicted to meet the Method B cleanup criteria at surface water, predicted concentrations at the CPOCs that are protective of surface water, and natural attenuation screening results based on current source area concentrations are presented in Table A-7. BIOCHLOR model implementation and results for each SWMU and AOC are discussed in the following sections.

A-4.1.1 SWMU-168

Downgradient water quality data were not available to calibrate the model for SWMU-168 (Figure A-1). For this site, the default degradation half-lives of 1.97, 4.53, 1.00, and 7.88 years for PCE, TCE, *cis*-1,2-DCE, and VC, respectively, were used in the model. Source area groundwater quality data for natural attenuation screening were selected as the maximum concentration from four push probe groundwater samples collected in 1999. VC, at a concentration of 2.1µg/L, was the only chlorinated VOC detected at SWMU-168.

The CPOC is located approximately 30 feet downgradient from the source area and 95 feet upgradient from the Cedar River Waterway. Model results indicate that a maximum source area VC concentration of 0.23 µg/L and concentration at the CPOC of 0.11 µg/L would attenuate to below Method B cleanup criteria protective of surface water prior to reaching the waterway. The CPOC cleanup level for this SWMU is 0.11 µg/L. The modeling suggests that the source area concentration of 2.1 µg/L is not likely to attenuate to below the cleanup level before reaching the CPOC (Table A-7). Active remedial actions to reduce source area concentrations at this SWMU were developed and evaluated in the FS.

A-4.1.2 SWMU-172/174

Source area concentrations for this model were taken as the maximum of June 1999 and August 2000 data from well GW152 and calibrated using August 2000 data from well GW172 as a downgradient calibration target (Figure A-2). Data from push probes were also reviewed for use as source area (PP006) and downgradient (PP061) water quality data for calibration. PCE concentrations at PP006 (300 µg/L) were higher than at GW152 (53 µg/L). The higher concentrations at PP006 were not used in model calibration, because a higher source area concentration would result in lower calibrated degradation half-lives (i.e., more rapid degradation), which would result in a greater degree of degradation predicted in model runs. As a conservative measure, source area data were instead limited to well GW152. Downgradient push probe PP061 shows higher concentrations than the source area and was not used for model calibration. Wells GW152 and GW172 appear to be on a groundwater flow path, while push probe PP061 is cross-gradient. Based on these data, GW152 was selected as the source area and GW172 as the downgradient calibration target.

Table A-5 presents model calibration results between GW152 and GW172 using default and calibrated degradation half-lives. Table A-3 presents the calibrated degradation half-lives. The default and calibrated models give similar results for *cis*-1,2-DCE and VC; however, the calibrated model significantly improves the match between observed and predicted PCE and TCE groundwater concentrations.

The CPOC is located approximately 85 feet downgradient from the source area and 60 feet upgradient from the Cedar River Waterway. Model results indicate that maximum source area

concentrations of PCE, TCE, *cis*-1,2-DCE, and VC of 0.4, 0.4, 0.4, and 0.5 µg/L, respectively, would attenuate to below Method B cleanup criteria protective of surface water prior to reaching the waterway. Modeled COC concentrations at the CPOC that are protective of surface water range from less than 0.01 µg/L for PCE and TCE to 0.11 µg/L for VC (see Table A-7). The modeling suggests that the current source area concentrations are not likely to attenuate to below these concentrations before reaching the CPOC (Table A-7). Active remedial actions to reduce source area concentrations at SWMU-172/174 were developed and evaluated in the FS.

A-4.1.3 Building 4-78/4-79 SWMU/AOC Group

Available downgradient water quality data were not used to calibrate the model for this SWMU/AOC group (Figure A-3). A hydraulic containment interim action operated at this SWMU/AOC group from 1991 through November 2003, and water quality data collected from the apparent downgradient direction may not be representative of ambient fate and transport conditions at the site. Instead of model calibration, the conservative, default degradation half-lives were used for modeling natural attenuation at this site. Source area groundwater quality data for natural attenuation screening were selected as November 2006 data from well GW033, which has historically shown the highest chlorinated VOC concentrations.

The CPOC is located along the property line approximately 215 feet downgradient from the source area and 185 feet upgradient from the Cedar River Waterway. For modeling purposes, the distance from the CPOC to the source area was set conservatively at 215 feet, given that the highest concentration of chlorinated VOCs was present in samples from GW033. Model results (Table A-7) indicate that maximum source area concentrations of TCE, *cis*-1,2-DCE, and VC of 20, 120, and 120 µg/L, respectively, would attenuate to below Method B cleanup criteria protective of surface water prior to reaching the waterway. Modeled COC concentrations at the CPOC that are predicted to attain Method B cleanup criteria at surface water for TCE, *cis*-1,2-DCE, and VC are 0.8, 0.9, and 0.26 µg/L, respectively. The modeling suggests that current source area concentrations are not likely to attenuate to below these concentrations before reaching the CPOC (Table A-7). Active remedial actions to reduce source area concentrations at this SWMU/AOC group were developed and evaluated in the FS.

A-4.1.4 AOC-001/002

Source area and downgradient concentrations for model calibration were taken from push probe data collected between 2001 and 2004 (Figure A-4), prior to implementation of a soil removal interim action in November 2005. Source area concentrations were taken as the maximum concentrations from push probes completed in or near the soil source area. Push probes PP133 and PP098 lay generally on a flow path from the source area to Lake Washington and were used as downgradient calibration targets.

Table A-5 presents model calibration results between the source area and PP133 and PP098 using default and calibrated degradation half lives. Table A-3 presents the calibrated degradation half-lives. Only minor changes to the default degradation rates for TCE, *cis*-1,2 DCE, and VC were made. The model run time was also increased from 30 years to 50 years to improve the calibration. The calibrated model slightly overpredicts concentrations at PP098 and slightly underpredicts concentrations at PP133.

The CPOC is located approximately 285 feet downgradient from the source area and 60 feet upgradient from Lake Washington. Model results (Table A-7) indicate that maximum source area concentrations of TCE, *cis*-1,2-DCE, and VC of 1, 1, and 2 µg/L, respectively, would attenuate to below Method B cleanup criteria protective of surface water prior to reaching the lake. Modeled COC concentrations at the CPOC that are protective of surface water range from 0.002 µg/L for TCE and *cis*-1,2-DCE to 0.05 µg/L for VC.

Source area concentrations used for natural attenuation screening were selected from post-soil removal interim action water quality data collected from wells in February 2007 (Figure A-5 and Table A-7). These data are expected to be more representative than historic data for predicting future fate and transport at this AOC. Based on the model results (Table A-7), the current source area concentrations are not likely to attenuate to below these concentrations for *cis*-1,2-DCE and VC before reaching the CPOC. Active remedial actions to reduce source area concentrations at AOC-001/002 were developed and evaluated in the FS.

A-4.1.5 AOC-003

At AOC-003 groundwater quality data are limited to four push probes completed in 1999 and one downgradient monitoring well which has been sampled since 2004. Because the downgradient monitoring well was installed 5 years after the push probe data were collected this well was not used for calibration purposes. Instead, the default degradation half-lives were used in this model. Source area groundwater data for natural attenuation screening are shown on Figure A-4.

The CPOC is located approximately 150 feet downgradient from the source area and 635 feet upgradient from Lake Washington. Model results (Table A-7) indicate that maximum source area concentrations of PCE, TCE, *cis*-1,2-DCE, and VC of 50, 50, 20, and 10 µg/L, respectively, would attenuate to below Method B cleanup criteria protective of surface water prior to reaching the lake. Modeled COC concentrations at the CPOC that are protective of surface water for PCE, TCE, *cis*-1,2-DCE, and VC are 0.54, 4.0, 0.78, and 4.6 µg/L, respectively. Existing source area groundwater concentrations of these constituents are expected to attenuate to below these concentrations prior to reaching the CPOC (Table A-7).

A-4.1.6 AOC-034/035

Downgradient water quality data were not available to calibrate the model for AOC-034/035; therefore, the default degradation half-lives were used in this model. Source area concentrations were selected as the maximum values from groundwater samples collected from push probes in December 2006 (Figure A-6). Only *cis*-1,2-DCE (maximum concentration of 0.5 µg/L) and VC (maximum concentration of 2.7 µg/L) were detected above the detection limits in these samples.

The CPOC is located approximately 60 feet downgradient from the source area and 290 feet upgradient from the Cedar River Waterway. Model results (Table A-7) indicate that maximum source area concentrations of *cis*-1,2-DCE and VC of 450 and 500 µg/L, respectively, would attenuate to below Method B cleanup criteria protective of surface water prior to reaching the waterway. Predicted COC concentrations at the CPOC that are protective of surface water for *cis*-1,2-DCE and VC are 0.65 and 80 µg/L, respectively. Existing source area groundwater concentrations of these constituents are expected to attenuate to below these concentrations prior to reaching the CPOC (Table A-7).

A-4.1.7 AOC-060

Source area and downgradient concentrations for model calibration were taken from groundwater samples collected from wells in February 2007 (Figure A-7). Source area concentrations were taken from well GW012, which had the highest COC concentrations. Monitoring wells GW148, GW149, and GW159 lay generally on a flow path from the source area to the Cedar River Waterway and were used as downgradient calibration targets.

Table A-5 presents model calibration results between the source area and downgradient wells GW148, GW149, and GW159 using default and calibrated degradation half-lives. Table A-3 presents the calibrated degradation half-lives. The *cis*-1,2-DCE half-life was increased and the VC half-life was decreased from the default values. The model run time was also increased from 30 years to 50 years to improve the calibration.

The CPOC is located approximately 160 feet downgradient from the source area and 85 feet upgradient from the Cedar River Waterway. Model results (Table A-7) indicate that maximum source area concentrations of TCE, *cis*-1,2-DCE, and VC of 0.3, 10, and 27 µg/L, respectively, would attenuate to below Method B cleanup criteria protective of surface water prior to reaching the waterway. Predicted COC concentrations at the CPOC that are protective of surface water for TCE, *cis*-1,2-DCE, and VC are 0.01, 0.08, and 0.26 µg/L, respectively. The current source area concentrations are likely to attenuate to below these concentrations before reaching the CPOC (Table A-7).

A-4.1.8 AOC-090 - Shallow

For this AOC there are indications of shallow and intermediate groundwater impacts, so two depth intervals (AOC-090 shallow and AOC-090 intermediate) were modeled. In the shallow interval groundwater flow is affected by the presence of a sheet pile wall along the Cedar River Waterway, resulting in a northward flow path and a southward flow path from the source area, around the wall, to the waterway. Source area and downgradient concentrations for model calibration were selected from shallow depth data collected in April 2003 and February 2004, prior to implementation of a soil removal and enhanced bioremediation interim action at the AOC-090 source area (Figure A-8). More recent data were not used for calibration since the interim action has likely altered site conditions. Data from well GW168 were used for the source area concentrations, and downgradient wells GW164 and GW180 along the northward flow path were used as calibration targets.

Table A-5 presents model calibration results between the source area and wells GW164 and GW180 using default and calibrated degradation half-lives. Table A-3 presents the calibrated degradation half-lives. The calibration for this model was poor, due to the very rapid decline in VOC concentrations between the source area near well GW168 and downgradient well GW164; however the calibrated results are a significant improvement over the results using the default half-lives. Calibrated model results overpredict concentrations at GW164, but are consistent with the nondetected concentrations at well GW180.

The calibrated model was used to evaluate maximum source area groundwater concentrations and cleanup levels at the CPOCs for the northward and southward flow paths. Along the northward flow path the CPOC is located approximately 260 feet downgradient from the source area and 150 feet upgradient from the Cedar River Waterway. Model results (Table A-7) indicate that maximum source area concentrations for PCE, TCE, *cis*-1,2-DCE, and VC of 190,000 µg/L each would attenuate to below Method B cleanup criteria protective of surface water prior to reaching the waterway along this flow path. Predicted COC concentrations at the northern CPOC that are protective of surface water for PCE, TCE, *cis*-1,2-DCE, and VC are 0.39, 0.5, 9.5, and 9.9 µg/L, respectively.

Along the southward flow path the CPOC is located approximately 110 feet downgradient from the source area and 125 feet upgradient from the waterway. The hydraulic gradient along this flow path (0.008) is also higher than along the northward flow path (0.005). Model results (Table A-7) indicate that maximum source area concentrations of PCE, TCE, *cis*-1,2-DCE, and VC of 20, 90, 100, and 100 µg/L, respectively, would attenuate to below Method B cleanup criteria protective of surface water prior to reaching the waterway along this flow path. Predicted COC concentrations at the southern CPOC that are protective of surface water for PCE, TCE, *cis*-1,2-DCE, and VC are 0.11, 0.21, 2.4, and 2.1 µg/L, respectively.

Natural attenuation screening (Table A-7) indicates the current source area concentrations are not likely to attenuate to below the site-specific cleanup levels before reaching the southern CPOC, but are likely to attenuate to below these concentrations before reaching the northern CPOC. Active remedial actions to reduce source area concentrations at this AOC were developed and evaluated in the FS.

A-4.1.9 AOC-090 - Intermediate

There are not sufficient downgradient data to calibrate the model for the intermediate interval. Degradation in the intermediate interval was assumed to be the same as the shallow interval even though they have different soil matrices. Source area concentrations for the intermediate interval were assumed to be the same as for the shallow interval model.

For the intermediate interval, the CPOC is located approximately 35 feet downgradient from the source area and 120 feet upgradient from the waterway. Model results (Table A-7) indicate that maximum source area concentrations of PCE, TCE, *cis*-1,2-DCE, and VC of 60, 60, 60, and 100 µg/L, respectively, would attenuate to below Method B cleanup criteria protective of surface water prior to reaching the waterway along this flow path. Predicted COC concentrations at the intermediate depth interval CPOC that are protective of surface water for PCE, TCE, *cis*-1,2-DCE, and VC are 5, 5.9, 19, and 15 µg/L, respectively. Natural attenuation screening (Table A-7) indicates the current source area concentrations are not likely to attenuate to below the site-specific cleanup levels before reaching the CPOC. Active remedial actions to reduce source area concentrations were developed and evaluated in the FS for the intermediate interval.

A-4.2 BIOSCREEN TPH AND BENZENE MODEL RESULTS

Water quality data downgradient from identified source areas were not sufficient to calibrate the BIOSCREEN models, except at AOC-092. Calibration results are shown on Table A-6. Model results for the other AOCs and SWMUs presented in this section are based on default model inputs. Modeled maximum source area groundwater concentrations that are predicted to meet MTCA cleanup criteria at surface water, predicted concentrations at the CPOCs that achieve MTCA cleanup criteria protective of surface water, and natural attenuation screening results based on current source area concentrations are presented in Table A-8. Results for each SWMU and AOC are discussed in the following sections.

A-4.2.1 Building 4-78/4-79 SWMU/AOC Group

Source area groundwater quality data for natural attenuation screening were selected as the maximum TPH-G and benzene concentrations from wells GW031 and GW033 collected in November 2006 (Figure A-3). These wells have historically shown the highest TPH and benzene concentrations.

The CPOC is located approximately 100 feet downgradient from the source area and 300 feet upgradient from the Cedar River Waterway. Model results (Table A-8) indicate that the source area concentration of TPH-G and benzene will attenuate to the cleanup levels before reaching the on-site CPOC. The modeled source area benzene and TPH-G groundwater concentrations expected to attenuate to below cleanup levels before reaching the CPOC are greater than 100,000 µg/L.

A-4.2.2 Former Fuel Farm

Source area groundwater quality data for natural attenuation screening were selected as the maximum TPH-Jet A and TPH-D concentrations from push probes completed in 2002 and 2003 (Figure A-9). Model results (Table A-8) indicate that the source area concentration of TPH-Jet A and TPH-D will attenuate to below cleanup levels before reaching the CPOC. Modeled maximum source area groundwater concentrations of TPH-Jet A and TPH-D expected to attenuate to below cleanup levels before reaching the CPOC are greater than 100,000 µg/L.

A-4.2.3 AOC-004

Source area groundwater quality data for natural attenuation screening were selected as the maximum TPH-G and benzene concentrations from push probes completed in 1999 (Figure A-10). Model results (Table A-8) indicate that the source concentration of TPH-G and benzene will attenuate to below cleanup levels before reaching the CPOC, which is located approximately 40 feet north of the source area. Modeled maximum source area concentrations for TPH-G and benzene expected to attenuate to below cleanup levels before reaching the CPOC are greater than 100,000 µg/L.

A-4.2.4 AOC-090

Model results (Table A-8) indicate that the source area concentration of TPH-G, TPH-D, and benzene will attenuate to below cleanup levels before reaching the CPOC. Modeled source area benzene groundwater concentrations expected to attenuate to below cleanup levels before reaching the CPOC are 3,400 µg/L for shallow southward flow and greater than 100,000 µg/L for shallow northward flow. Calculated source area TPH-G and TPH-D groundwater concentrations expected to attenuate to below cleanup levels before reaching the CPOC are greater than 100,000 µg/L for the southward flow. For the northward flow, the maximum source area concentrations protective of surface water are predicted to be greater than 100,000 µg/L for TPH-G, TPH-D, and benzene. For both flow paths, existing concentrations are predicted to attenuate to below cleanup levels for all three COCs before reaching the CPOCs.

A-4.2.5 AOC-092

Source area and downgradient TPH-G and benzene concentrations for model calibration were taken from push probe data collected in 2001 and 2005 (Figure A-11). Source area concentrations were taken as the maximum concentrations from push probes completed in or near the soil source area

(PP073, PP074, and PP075). Push probes PP155 and PP158 lay generally on a flow path from the source area toward Lake Washington and were used as downgradient calibration targets.

Table A-6 presents model calibration results between the source area and push probes PP155 and PP158 using default and calibrated degradation half-lives. Table A-4 presents the calibrated degradation half-lives. The calibrated model is an improvement over the default degradation half-lives, and either matches or overpredicts concentrations at the downgradient calibration targets.

Model results using the calibrated model (Table A-8) indicate that the source area concentration of TPH-G and benzene will attenuate to below cleanup levels before reaching the CPOC. Modeled maximum source area concentrations of benzene and TPH-G expected to attenuate to below cleanup levels before reaching the CPOC are greater than 100,000 µg/L.

A-4.3 MTCA METHOD C SOIL CLEANUP LEVELS

Source area soil concentrations protective of groundwater at the CPOC were calculated using the predicted maximum source area groundwater concentrations protective of the CPOC. As noted above, the predicted source area groundwater concentrations would attenuate to the lower of the CPOC cleanup levels or CPOC concentrations protective of surface water by the time groundwater reaches the CPOC. The MTCA three-phase partitioning model (WAC 173-340-747) was used for the partitioning calculations. These calculations were performed following the procedures and input parameters outlined in the FSWP for calculating Method C soil cleanup levels protective of groundwater; calculations were done for vadose zone soil for soil COCs for each SWMU and AOC. These soil cleanup levels would be applicable to the source areas for the soil COCs at the SWMUs or AOCs that were modeled.

The maximum, protective source area groundwater concentrations were modeled as described above (Stage 4 modeling). The modeled concentration predicted to attenuate to the lower of the CPOC cleanup level or the predicted CPOC concentration that is protective of surface water was used for the partitioning calculations. The maximum protective source area chlorinated VOC concentrations are shown on Table A-9, and the maximum protective source area TPH and benzene concentrations are shown on Table A-10. In several cases, the predicted maximum source area groundwater concentrations for specific constituents were unrealistically high, particularly with TPH compounds. In cases where predicted maximum source area TPH concentrations in groundwater were greater than 100,000 µg/L, a value of 100,000 µg/L was used in the three-phase partitioning model calculations. The soil concentrations calculated in this way would be protective of groundwater at the designated CPOC. The resulting soil cleanup levels are shown on Table A-11. Finally, the soil concentration protective of groundwater was compared to the MTCA criteria for direct worker contact (see Table A-11); the lower of the concentration protective of groundwater and direct worker contact was selected as the concentration protective of human health and the environment for each area. The source area

soil concentrations that would be protective of groundwater and direct worker contact were considered in establishing the soil cleanup levels in Section 3 of the FS.

A-5.0 REFERENCES

Aronson, Dallas and Philip H. Howard, 1997, Anaerobic Biodegradation of Organic Chemicals in Groundwater: A Summary of Field and Laboratory Studies, November 12.

Geomatrix, 2004, Final Feasibility Study Work Plan, Boeing Renton Plant, Renton, Washington: Prepared for The Boeing Company, April.

Weston, 2001, Remedial Investigation Report, Boeing Renton Plant, Renton, Washington: Prepared for The Boeing Company, Boeing Shared Services Group, Energy and Environmental Affairs, August 10.

Wiedemeier, T.H., C.J. Newell, H.S. Rifai and J.T. Wilson, 1999, Natural Attenuation of Fuels and Chlorinated Solvents in the Subsurface, John Wiley and Sons, Inc., New York, New York.

TABLE A-1

BIODEGRADATION RATE LITERATURE VALUES [1]

Boeing Renton Facility
Renton, Washington

Degradation Parent and Daughter Product	Half-Life in Years		
	Minimum	Maximum	Default
PCE to TCE[2]	0.056	10	1.97
TCE to *cis*- 1,2-DCE[2]	0.31	13.6	4.53
cis -1,2-DCE to VC[3]	0.21	3.8	1.00
VC to ETH[2]	0.022	5.8	7.88

Notes:

1. PCE = tetrachlorethene;
   TCE = trichloroethene;
   cis -1,2-DCE = *cis* -1,2-dichloroethene;
   VC = vinyl chloride;
   ETH = ethene.
2. First-order decay half-lives are the minimum and maximum presented in Aronson & Howard, 1997.
3. First-order decay half-life is the range of representative decay constants for field studies cited in Table 6.6 in Wiedemeier et al., 1999.

TABLE A-2

GENERAL INPUT PARAMETERS
Boeing Renton Facility
Renton, Washington

SWMU/AOC	Predominant Soil Type in Transmissive Zone (USCS)[1]	Hydraulic Conductivity (cm/s)[2]	Total Organic Carbon (percent)[2]	Hydraulic Gradient (unitless)[3]	Porosity (unitless)[4]	Soil Bulk Density (kg/L)[4]
SWMU-168	Silty Sand (SM)	8.96E-04	0.84	0.004	0.43	1.5
SWMU-172/174	Sand (SP)	2.15E-03	0.46	0.004	0.43	1.5
Bldg 4-78/4-79 SWMU/AOC Group	Silty Sand (SM)	8.96E-04	0.84	0.001	0.43	1.5
Former Fuel Farm	Silty Sand (SM)	8.96E-04	0.84	0.003	0.43	1.5
AOC-001/002	Silty Sand (SM)	8.96E-04	0.84	0.003	0.43	1.5
AOC-003	Silty Sand (SM)	8.96E-04	0.84	0.003	0.43	1.5
AOC-004	Silty Sand (SM)	8.96E-04	0.84	0.002	0.43	1.5
AOC-034/035	Silty Sand (SM)	8.96E-04	0.84	0.001	0.43	1.5
AOC-060	Sand (SP)	2.15E-03	0.46	0.001	0.43	1.5
AOC-090 (shallow northward flow)	Silty Sand (SM)	8.96E-04	0.84	0.005	0.43	1.5
AOC-090 (shallow southward flow)	Silty Sand (SM)	8.96E-04	0.84	0.008	0.43	1.5
AOC-090 (intermediate)	Sand (SP)	2.15E-03	0.46	0.002	0.43	1.5
AOC-092	Silty Sand (SM)	8.96E-04	0.84	0.001	0.43	1.5

Notes:
1. Predominant soil types are from the RI Report (Weston, 2001). USCS = Unified Soil Classification System.
2. Hydraulic conductivity (in units of centimeters per second [cm/s]) and total organic carbon for each soil type were specified in the FS Work Plan (Geomatrix, 2004) and updated with more recent data when available.
3. Hydraulic gradients are based on available groundwater elevation data as discussed in Section A-3.1.2.
4. Porosity and bulk density (in units of kilograms per liter [kg/L]) are default values specified in 173-340-747 WAC.

TABLE A-3

BIOCHLOR INPUT PARAMETERS AND SITE MODEL DESCRIPTIONS [1]

Boeing Renton Facility

Renton, Washington

SWMU/AOC	Source Area Concentrations (µg/L)[2]				Half-Lives (Years)[3]				
	PCE	TCE	*cis* -1,2-DCE	VC	PCE to TCE	TCE to *cis*- 1,2-DCE	*cis* -1,2-DCE to VC	VC to ETH	Note
SWMU-168	ND[4]	ND	ND	2.1	NA[5]	NA	NA	7.88	Default
SWMU-172/174	53	93	270	2.8	0.50	0.31	0.49	0.90	Calibrated
Bldg 4-78/4-79 SWMU/AOC Group	ND	20	2,800	750	NA	4.53	1.00	7.88	Default
AOC-001/002	3.6	1,400	52,000	28,000	1.97	3.00	1.60	7.00	Calibrated
AOC-003	8.3	1.3	5.4	5.7	1.97	4.53	1.00	7.88	Default
AOC-034/035	ND	ND	0.5	2.7	NA	NA	1.00	7.88	Default
AOC-060	ND	ND	10	27	NA	4.53	3.00	2.70	Calibrated
AOC-090 (shallow and intermediate)	55	37,000	15,100	392	0.50	0.31	0.60	0.40	Calibrated

SWMU/AOC	Distance to On-Site CPOC (feet)[6]	Distance to Off-Site CPOC (feet)[6]	Distance from Source Area to Surface Waters (feet)	Source Width (feet)	Source Submerged Thickness (feet)	Model Length (feet)	Dispersivity (feet)	Model Width (feet)
SWMU-168	30	NA	125	15	5	125	12.5	50
SWMU-172/174	85	NA	145	30	20	145	14.5	150
Bldg 4-78/4-79 SWMU/AOC Group	215	NA	400	100	20	400	40	100
AOC-001/002	285	NA	345	30	5	345	34.5	100
AOC-003	150	NA	785	30	5	785	78.5	100
AOC-034/035	60	NA	350	20	15	250	25	50
AOC-060	NA	160	245	40	10	245	24.5	150
AOC-090 (shallow northward flow)	NA	260	410	30	15	410	41	100
AOC-090 (shallow southward flow)	NA	110	235	30	15	235	23.5	100
AOC-090 (intermediate)	35	NA	155	30	15	155	15.5	100

Notes:

1. PCE = tetrachlorethene; TCE = trichloroethene; *cis* -1,2-DCE = *cis* -1,2-dichloroethene; VC = vinyl chloride; ETH = ethene.
2. Source area concentrations are from the RI Report (Weston, 2001) or supplemental sampling results presented in the FS Work Plan (Geomatrix, 2004), or more recent m voluntary site cleanup actions. Unit are in micrograms per liter (µg/L).
3. Default half-lives are from Appendix B of Wiedemeier et al., 1999.
4. ND = Not detected.
5. NA = Not applicable.
6. CPOC = conditional point of compliance. Distances to CPOCs are from current site figures. For sites with multiple paths the shortest path to the CPOC and surface wate Source area dimensions and model domain are based on data in the RI Report.

TABLE A-4

BIOSCREEN INPUT PARAMETERS [1]

Boeing Renton Facility
Renton, Washington

SWMU/AOC	Source Area Concentrations[2]				Half-Lives (Years)[3]				Note
	TPH-G (mg/L)	TPH-D (mg/L)	Jet-A (mg/L)	Benzene (µg/L)	TPH-G	TPH-D	Jet-A	Benzene	
Bldg 4-78/4-79 SWMU/AOC Group	0.46	ND[4]	ND	66	2	NA[5]	NA	2	Default
Former Fuel Farm	ND	18	30	ND	NA	2	2	NA	Default
AOC-004	0.93	ND	ND	29	2	NA	NA	2	Default
AOC-090 (shallow)	19	170	ND	12	2	2	NA	2	Default
AOC-092	8.7	ND	ND	5.9	28	NA	NA	22	Calibrated

SWMU/AOC	Distance to On-Site CPOC (feet)[6]	Distance to Off-Site CPOC (feet)[6]	Distance from Source Area to Surface Waters (feet)	Source Width (feet)[7]	Source Submerged Thickness (feet)[7]	Model Length (feet)[7]	Model Width (feet)[7]
Bldg 4-78/4-79 SWMU/AOC Group	100	NA	400	80	10	100	150
Former Fuel Farm[8]	120	NA	220	150	5	120	150
AOC-004	40	NA	1,100	5	5	30	25
AOC-090 (shallow northward flow)	NA	260	410	40	15	410	150
AOC-090 (shallow southward flow)	NA	110	235	40	15	235	150
AOC-092	8	NA	600	8	10	40	15

Notes:

1. TPH-G = total petroleum hydrocarbons, gasoline range; TPH-D = total petroleum hydrocarbons, diesel range; Jet-A = Jet Fuel A.
2. Source area concentrations are from the RI Report (Weston, 2001) or supplemental sampling results presented in the FS Work Plan (Geomatrix, 2004). Source area concentrations are given in milligrams per liter (mg/L) or micrograms per liter (µg/L).
3. Default half-lives are from the FS Work Plan.
4. ND = Not detected.
5. NA = Not applicable.
6. CPOC = conditional point of compliance. Distances to CPOCs are from the FS Work Plan.
7. Source area dimensions and model domain are based on data in the RI Report.
8. A portion of the CPOC for the Former Fuel Farm is off lease.

TABLE A-5

BIOCHLOR MODEL CALIBRATION [1]

Boeing Renton Facility
Renton, Washington

Concentrations are in micrograms per liter (µg/L)

SWMU/AOC	Note	Downgradient Well or Push Probe Used for Calibration	Distance from Source Area (Feet)	Measured Concentration at Downgradient Well or Push Probe (µg/L)				Model Predicted Concentration at Downgradient Well or Push Probe (µg/L)			
				PCE	TCE	*cis*-1,2-DCE	VC	PCE	TCE	*cis*-1,2-DCE	VC
SWMU-172/174	Default Model	GW172	40	8.6	8.6	34	34	25	72	39	36
	Calibrated Model	GW172	40	8.6	8.6	34	34	8.4	13	34	34
AOC-001/002	Default Model	PP133	180	<20 [2]	<20	<20	1,100	0.01	17	11	1,245
	Calibrated Model	PP133	180	<20	<20	<20	1,100	0.01	8	57	1,478
	Default Model	PP098	290	<1	<1	7.7	67	0	0.5	0.1	39
	Calibrated Model	PP098	290	<1	<1	7.7	67	0	0.2	0.8	46
AOC-060	Default Model	GW148	100	<0.2	<0.2	0.4	<0.2	0	0	0.1	4.8
	Calibrated Model	GW148	100	<0.2	<0.2	0.4	<0.2	0	0	0.4	1.4
	Default Model	GW149	150	<0.2	<0.2	<0.2	0.3	0	0	0.01	2.8
	Calibrated Model	GW149	150	<0.2	<0.2	<0.2	0.3	0	0	0.09	0.31
	Default Model	GW159	230	<0.2	<0.2	<0.2	<0.2	0	0	0.001	1.1
	Calibrated Model	GW159	230	<0.2	<0.2	<0.2	<0.2	0	0	0.01	0.02
AOC-090 Northward Flow	Default Model	GW164	80	<1	1.4	5.5	2	6.6	7,976	2,055	4,068
	Calibrated Model	GW164	80	<1	1.4	5.5	2	0.7	136	1,048	670
	Default Model	GW180	260	<1	<1	<1	<1	0.1	198	43	205
	Calibrated Model	GW180	260	<1	<1	<1	<1	0	0.002	0.5	0.6

Notes:

1. PCE = tetrachlorethene; TCE = trichloroethene; *cis*-1,2-DCE = *cis*-1,2-dichloroethene; VC = vinyl chloride.
2. < = Not detected at practical quantitation limit indicated.

TABLE A-6

BIOSCREEN MODEL CALIBRATION

Boeing Renton Facility
Renton, Washington

Concentrations are in micrograms per liter (µg/L)

SWMU/AOC	Note	Downgradient Well or Push Probe Used for Calibration	Distance from Source Area (Feet)	Measured Concentration at Downgradient Well or Push Probe (µg/L)		Model Predicted Concentration at Downgradient Well or Push Probe (µg/L)	
				TPH-G[1]	Benzene	TPH-G	Benzene
AOC-092	Default Model	PP155	24	350	ND[2]	0	0.02
	Default Model	PP158	40	ND	2.0	0	0
	Calibrated Model	PP155	24	350	ND	355	3.2
	Calibrated Model	PP158	40	ND	2.0	95	2.1

Notes:
1. TPH-G = total petroleum hydrocarbons, gasoline range.
2. ND = Not detected.

TABLE A-7

BIOCHLOR NATURAL ATTENUATION MODEL RESULTS [1]

Boeing Renton Facility
Renton, Washington

Concentrations are in micrograms per liter (µg/L)

SWMU/AOC	Note	Source Area Concentrations (µg/L)				Predicted CPOC Concentration Based on Source Area Concentrations (µg/L)				Predicted Maximum Source Concentration Protective of Surface Water (µg/L)				Predicted Maximum CPOC Concentration Protective of Surface Water (µg/L)			
		PCE	TCE	*cis*-1,2-DCE	VC	PCE	TCE	*cis*-1,2-DCE	VC	PCE	TCE	*cis*-1,2-DCE	VC	PCE	TCE	*cis*-1,2-DCE	VC
SWMU-168	Default Half-Lives	ND[2]	ND	ND	2.1	NA[3]	NA	NA	1.0	NA	NA	NA	0.23	NA	NA	NA	0.11
SWMU-172/174	Calibrated Half-Lives	53	93	270	2.8	1.0	0.9	9.1	27.7	0.4	0.4	0.4	0.5	0.008	0.009	0.03	0.11
Bldg 4-78/4-79 SWMU/AOC Group	Default Half-Lives	ND	20	2,800	750	NA	0.02	0.004	20	3	3	20	6	0.35	0.6	0.7	0.26
AOC-001/002[4]	Calibrated Half-Lives	ND	ND	94	310	NA	0	0.003	4.4	NA	1	1	2	NA	0.002	0.002	0.05
AOC-003	Default Half-Lives	8.3	1.3	5.4	5.7	0.09	0.38	0.08	0.92	50	50	20	10	0.54	4.0	0.78	4.6
AOC-034/035	Default Half-Lives	ND	ND	0.5	2.7	NA	NA	0.0007	0.30	NA	NA	450	500	NA	NA	0.65	80
AOC-060	Calibrated Half-Lives	ND	ND	10	27	NA	NA	0.07	0.25	NA	0.3	10	27	NA	0.01	0.08	0.26
AOC-090 (shallow) Northward Flow	Calibrated Half-Lives	55	37,000	15,100	392	0.0	0.0	0.5	0.6	190,000	190,000	190,000	190,000	0.39	0.50	9.5	9.9
AOC-090 (shallow) Southward Flow	Calibrated Half-Lives	55	37,000	15,100	392	0.3	39	598	468	20	90	100	100	0.11	0.21	2.4	2.1
AOC-090 (intermediate)	Calibrated Half-Lives	55	37,000	15,100	392	4.62	1,345	5,800	2,918	60	60	60	100	5	5.9	19	15

Notes:

1. PCE = tetrachloroethene; TCE = trichloroethene; *cis*-1,2-DCE = *cis*-1,2-dichloroethene; VC = vinyl chloride.
   CPOC = Conditional point of compliance.
2. ND = Not detected.
3. NA = Not applicable.
4. Source area concentration data are based on post-interim measure monitoring well samples collected in February 2007.

TABLE A-8

BIOSCREEN NATURAL ATTENUATION MODEL RESULTS [1]

Boeing Renton Facility
Renton, Washington

Concentrations are in micrograms per liter (µg/L)

SWMU/AOC	Note	Source Area Concentrations (µg/L)				Predicted CPOC Concentration based on Source Area Concentrations (µg/L)				Predicted Maximum Source Concentration Protective of Surface Water (µg/L)				Predicted Maximum CPOC Concentration Proctective of Surface Water (µg/L)			
		TPH-G	TPH-D	Jet-A	Benzene	TPH-G	TPH-D	Jet-A	Benzene	TPH-G	TPH-D	Jet-A	Benzene	TPH-G	TPH-D	Jet-A	Benzene
Bldg 4-78/4-79 AOC/SWMU Group	Default Half-Lives	460	ND[2]	ND	66	0	NA[3]	NA	0.00	>100,000 [4]	NA	NA	>100,000	>100,000	NA	NA	>100,000
Former Fuel Farm	Default Half-Lives	ND	18,000	30,000	ND	NA	0	0	NA	NA	>100,000	>100,000	NA	NA	>100,000	>100,000	NA
AOC-004	Default Half-Lives	930	ND	ND	29	0	NA	NA	0.38	>100,000	NA	NA	>100,000	>100,000	NA	NA	>100,000
AOC-090 (shallow northward flow) [5]	Default Half-Lives	19,000	170,000	ND	12	0.0	0.0	NA	0.01	>100,000	>100,000	NA	>100,000	>100,000	>100,000	NA	430
AOC-090 (shallow southward flow)	Default Half-Lives	19,000	170,000	ND	12	0.001	0.0	NA	0.22	>100,000	>100,000	NA	3,400	>100,000	>100,000	NA	61
AOC-092	Calibrated Half-Lives	8,700	ND	ND	5.9	1,696	NA	NA	5.01	>100,000	NA	NA	>100,000	>100,000	NA	NA	>100,000

Notes:

1. TPH-G = total petroleum hydrocarbons, gasoline range; TPH-D = total petroleum hydrocarbons, diesel range; Jet-A = Jet fuel A range.
   CPOC = Conditional point of compliance.
2. ND = Not detected.
3. NA = Not applicable.
4. > = Modeled concentration is greater than value indicated.
5. No modeling was completed for AOC-90 at the intermediate depth as TPH-G, TPH-D, Jet-A, and BTEX were not identified as COCs at the intermediate depth.

TABLE A-9

BIOCHLOR MODEL RESULTS
SOURCE AREA GROUNDWATER CONCENTRATIONS PROTECTIVE OF SURFACE WATER AND THE CPOC [1]
Boeing Renton Facility
Renton, Washington

Concentrations are in micrograms per liter (µg/L)

SWMU/AOC	Note	Predicted Maximum CPOC Concentration Protective of Surface Water (µg/L)				Proposed CPOC Cleanup Level[2] (µg/L)				CPOC Water Quality Criteria for Stage 4 Modeling[3] (µg/L)				Predicted Source Concentration Protective of Groundwater[4] (µg/L)			
		PCE	TCE	*cis*-1,2-DCE	VC	PCE	TCE	*cis*-1,2-DCE	VC	PCE	TCE	*cis*-1,2-DCE	VC	PCE	TCE	*cis*-1,2-DCE	VC
SWMU-168	Default Half-Lives	NA[5]	NA	NA	0.11	NA	NA	NA	0.11	NA	NA	NA	0.11	NA	NA	NA	0.23
SWMU-172/174	Calibrated Half-Lives	0.008	0.009	0.03	0.11	0.02	0.02	0.03	0.11	0.008	0.009	0.03	0.11	0.4	0.4	0.4	0.5
Bldg 4-78/4-79 SWMU/AOC Group	Default Half-Lives	0.35	0.6	0.7	0.26	NA	0.23	0.9	0.20	0.35	0.23	0.7	0.20	3	3	20	6
AOC-001/-002	Calibrated Half-Lives	NA	0.002	0.002	0.05	NA	0.02	0.02	0.05	NA	0.002	0.002	0.05	NA	1	1	2
AOC-003	Default Half-Lives	0.54	4.0	0.78	4.6	0.02	0.16	0.78	0.24	0.02	0.16	0.78	0.24	0.05	4	0.7	1
AOC-034/035	Default Half-Lives	NA	NA	0.65	80	NA	NA	0.65	0.29	NA	NA	0.65	0.29	NA	NA	4.5	4.5
AOC-060	Calibrated Half-Lives	NA	0.01	0.08	0.26	NA	0.02	0.08	0.26	NA	0.01	0.08	0.26	NA	0.3	10	27
AOC-090 (shallow) Northward Flow	Calibrated Half-Lives	0.39	0.50	9.5	9.9	0.05	0.08	2.4	0.13	0.05	0.08	2.4	0.13	2,500	2,500	2,500	2,500
AOC-090 (shallow) Southward Flow	Calibrated Half-Lives	0.11	0.21	2.4	2.1	0.05	0.08	2.4	0.13	0.05	0.08	2.4	0.13	4	4	4	5
AOC-090 (intermediate)	Calibrated Half-Lives	5.0	5.9	19	15	0.05	0.08	2.4	0.13	0.05	0.08	2.4	0.13	0.6	0.6	0.6	0.6

Notes:
1. PCE = tetrachlorethene; TCE = trichloroethene; *cis*-1,2-DCE = *cis*-1,2-dichloroethene; VC = vinyl chloride.
   CPOC = Conditional point of compliance.
2. Proposed cleanup level applicable at the CPOC as presented on Table 3-2, Section 3 of the FS and/or on Table 1 of the CAP.
3. CPOC water quality criteria are the lower of the predicted maximum CPOC concentrations protective of surface water and the proposed CPOC cleanup levels.
4. Maximum source concentration predicted to attenuate to achieve the CPOC water quality criteria at the CPOC.
5. NA = Not applicable.

TABLE A-10

BIOSCREEN MODEL RESULTS
MAXIMUM SOURCE AREA GROUNDWATER CONCENTRATIONS [1]
Boeing Renton Facility
Renton, Washington

Concentrations are in micrograms per liter (µg/L)

SWMU/AOC	Note	Predicted Maximum CPOC Concentration Protective of Surface Water (µg/L)				Proposed CPOC Cleanup Level[2] (µg/L)				CPOC Water Quality Criteria for Stage 4 Modeling[3] (µg/L)				Predicted Source Concentration Protective of Groundwater[4] (µg/L)			
		TPH-G	TPH-D	Jet-A	Benzene	TPH-G	TPH-D	Jet-A	Benzene	TPH-G	TPH-D	Jet-A	Benzene	TPH-G	TPH-D	Jet-A	Benzene
AOC/SWMU Group	Default Half-Lives	>100,000	NA[5]	NA	>100,000	800	NA	NA	0.8	800	0	0	0.8	>100,000	NA	NA	1,200
Former Fuel Farm	Default Half-Lives	NA	>100,000	>100,000	NA	NA	500	500	NA	0	500	500	0	NA	>100,000	>100,000	NA
AOC-004	Default Half-Lives	>100,000	NA	NA	>100,000	800	NA	NA	8	800	0	0	8	>100,000	NA	NA	610
AOC-090 (shallow northward flow)	Default Half-Lives	>100,000	>100,000	NA	430	800	500	NA	0.8	800	500	0	1	>100,000	>100,000	NA	30,000
AOC-090 (shallow southward flow)	Default Half-Lives	>100,000	>100,000	NA	61	800	500	NA	0.8	800	500	0	1	>100,000	>100,000	NA	45
AOC-092	Calibrated Half-Lives	>100,000	NA	NA	>100,000	800	NA	NA	8	800	0	0	8	>100,000	NA	NA	9.5

Notes:
1. TPH-G = total petroleum hydrocarbons, gasoline range; TPH-D = total petroleum hydrocarbons, diesel range; Jet-A = Jet fuel A range.
   CPOC = Conditional point of compliance.
2. Proposed cleanup level applicable at the CPOC as presented on Table 3-2, Section 3 of the FS.
3. CPOC water quality criteria are the lower of the predicted maximum CPOC concentrations protective of surface water and the proposed CPOC cleanup levels.
4. Maximum source concentration predicted to attenuate to achieve the CPOC water quality criteria at the CPOC.
5. NA = Not applicable.

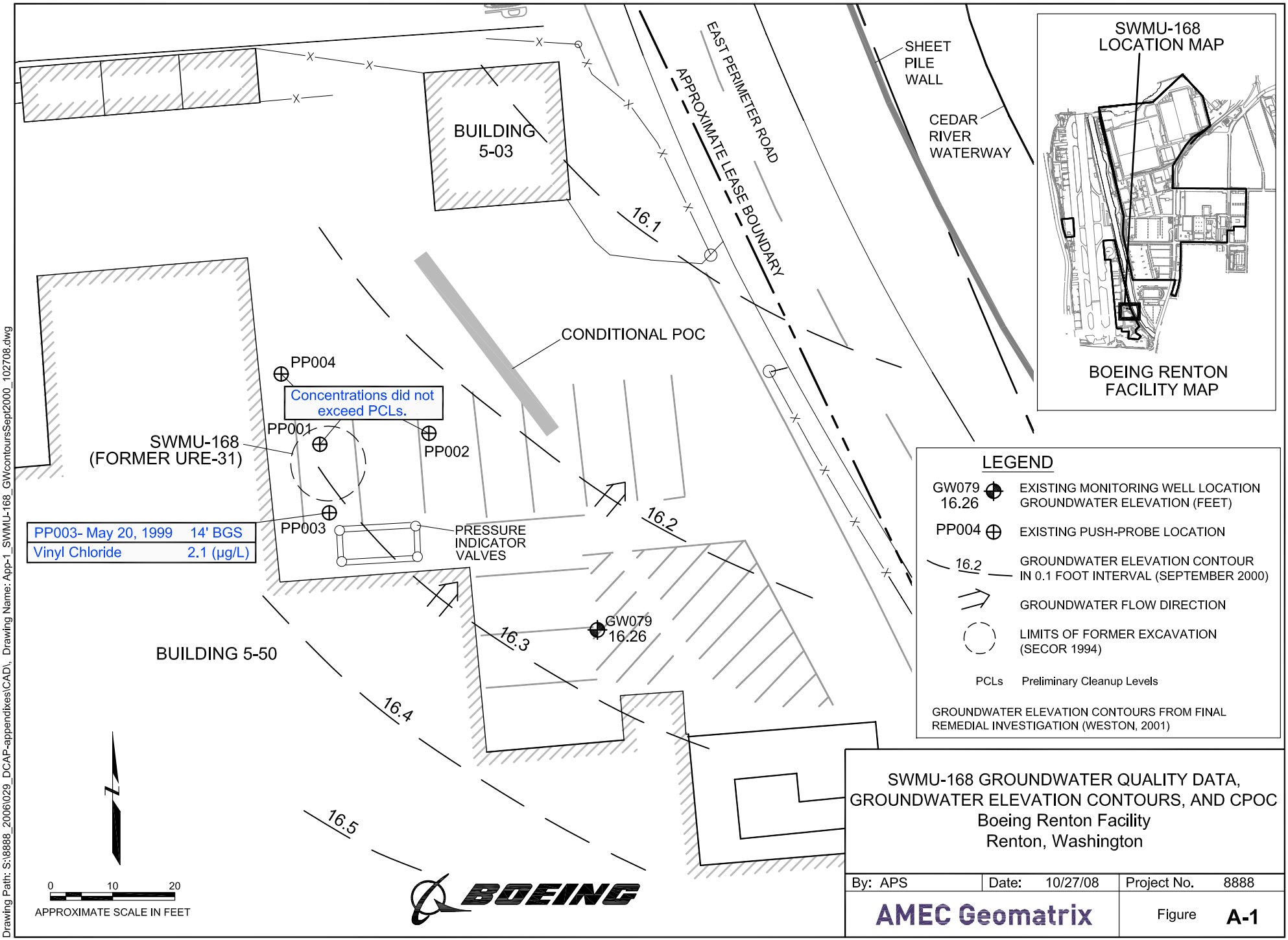
TABLE A-11

SOIL CONCENTRATIONS PROTECTIVE OF GROUNDWATER[1]
Boeing Renton Facility
Renton, Washington

SWMU/AOC	Constituent[2]	Groundwater COC	Maximum Measured Concentration in Source Area Groundwater[3] (µg/L)	Predicted Source Concentration Protective of Groundwater[4] (µg/L)	Basis for Source Area Groundwater Concentration	Calculated Soil Concentration Protective of Groundwater (mg/kg)	MTCA[5,6] Method C Direct Contact Criteria (mg/kg)	Soil Concentration Protective of Groundwater and Direct Contact (mg/kg)
SWMU-172/174	PCE	Yes	53	0.4	Modeled	0.01	240	0.01
	TCE	Yes	93	0.4	Modeled	0.006	330	0.006
	cis-1,2 DCE	Yes	2,800	0.4	Modeled	0.003	35,000[8]	0.003
	VC	Yes	1.0	0.5	Modeled	0.004	88	0.004
Bldg 4-78/4-79 SWMU/AOC Group	Benzene	Yes	66	1,200	Observed	19	2,400	19
	TPH-G w/ benzene	Yes	460	100,000	Observed	14,840	NA[7]	14,840
	PCE	No	50	3	Modeled	0.16	240	0.16
	TCE	Yes	20	3	Modeled	0.1	330	0.1
	cis-1,2 DCE	Yes	2,800	20	Modeled	0.2	35,000[8]	0.2
	VC	Yes	750	6	Modeled	0.1	88	0.1
Former Fuel Farm	TPH-D	Yes	18,000	100,000	Observed	68,840	NA	68,840
	TPH-Jet-A	Yes	30,000	100,000	Observed	68,840	NA	68,840
AOC-001/002	TCE	Yes	0.1	1	Modeled	0.02	330	0.02
	cis-1,2 DCE	Yes	94	1	Modeled	0.01	35,000[8]	0.01
	VC	Yes	310	2	Modeled	0.02	88	0.02
AOC-003	TCE	Yes	1.3	4.0	Modeled	0.09	330	0.09
AOC-004	Benzene	Yes	29	610	Modeled	9.5	2,400	9.5
	TPH-G w/ benzene	Yes	930	100,000	Observed	14,840	NA	14,840
AOC-034/035	*cis*-1,2 DCE	Yes	0.5	4.5	Modeled	0.05	35,000[8]	0.05
	VC	Yes	2.7	4.5	Modeled	0.04	88	0.04
AOC-090[9]	PCE	Yes	55	0.6	Modeled	0.03	240	0.03
	TCE	Yes	37,000	0.6	Modeled	0.01	330	0.01
	cis-1,2 DCE	Yes	15,100	0.6	Modeled	0.006	35,000[8]	0.006
	VC	Yes	392	0.6	Modeled	0.006	88	0.006
	TPH-G	Yes	19,000	100,000	Observed	14,840	NA	14,840
	TPH-D	Yes	170,000	100,000	Observed	68,840	NA	68,840
	Benzene	Yes	12	45	Modeled	0.7	2,400	0.7
AOC-092	TPH-G	Yes	8,700	100,000	Modeled	14,840	NA	14,840
	Benzene	Yes	5.9	9.5	Modeled	0.15	2,400	0.15

Notes:
1. Concentrations are given in micrograms per liter (µg/L) for groundwater or milligrams per kilogram (mg/kg) for soil.
2. PCE = tetrachlorethene; TCE = trichloroethene; TPH-G = total petroleum hydrocarbons, gasoline range; *cis*-1,2 DCE = *cis*-1,2-dichloroethene; VC = vinyl chloride; TPH-D = total petroleum hydrocarbons, diesel range; TPH-Jet A = total petroleum hydrocarbons, Jet fuel A range.
3. For constituents reported as ND, tabulated concentrations are half of the reporting limit.
4. Modeled source area concentration from the last column of Tables A-9 and A-10.
5. MTCA = Model Toxics Control Act.
6. Except where noted, values are for carcinogens, from the CLARC database at https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx, accessed October 2007.
7. NA = Not applicable.
8. Value is for noncarcinogenic *cis*-1,2 DCE from CLARC database at https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx, accessed October 2007
9. Predicted source concentrations protective of groundwater are based on the lowest predicted values from the shallow and intermediate pathways.

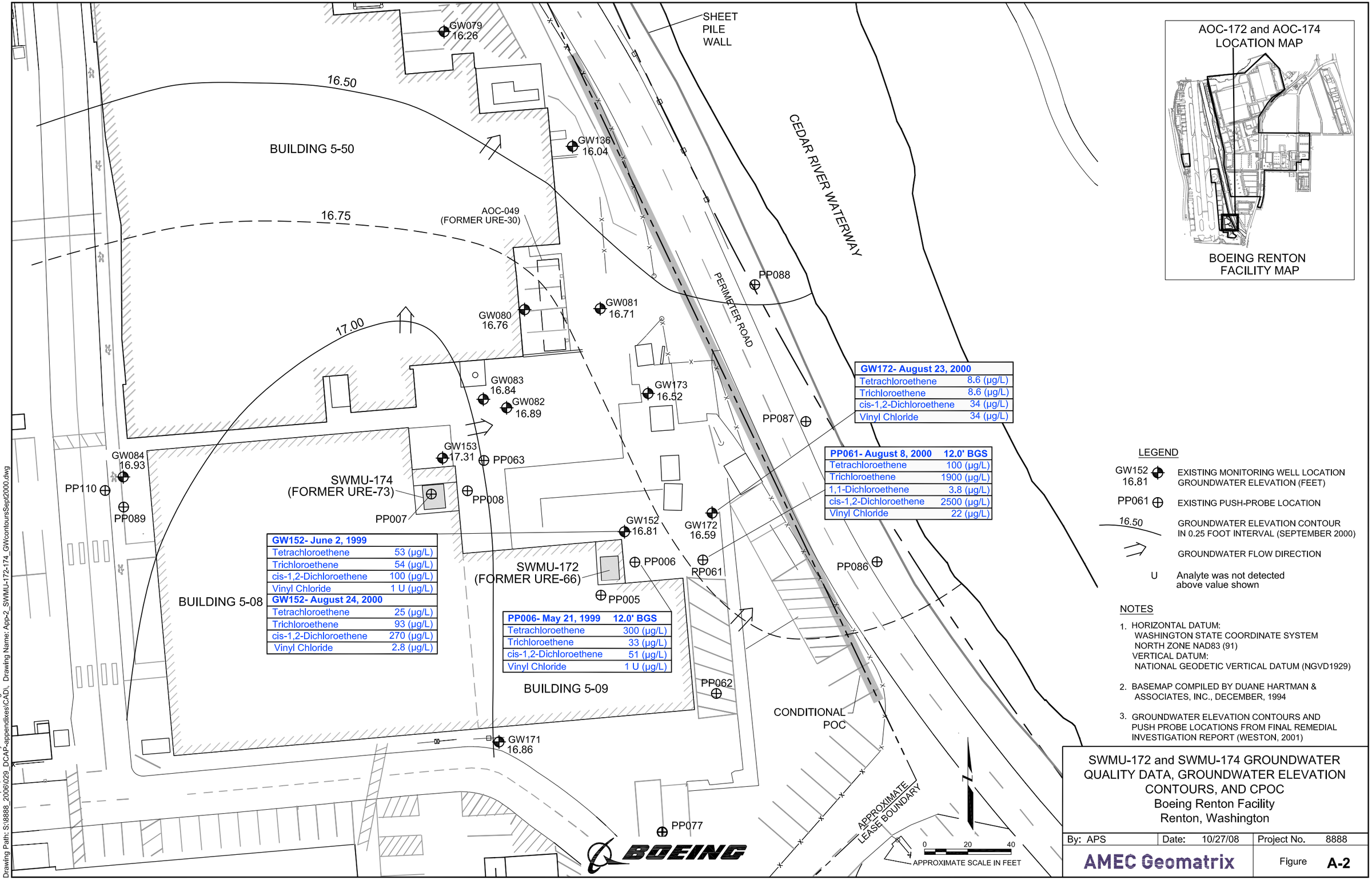
FIGURES



SWMU-168 GROUNDWATER QUALITY DATA, GROUNDWATER ELEVATION CONTOURS, AND CPOC
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/27/08	Project No. 8888
AMEC Geomatrix	Figure	A-1

BOEING


SHEET PILE WALL
CEDAR RIVER WATERWAY
PERIMETER ROAD
BUILDING 5-50
BUILDING 5-08
BUILDING 5-09
16.50
16.75
17.00
GW079 16.26
GW136 16.04
AOC-049 (FORMER URE-30)
GW080 16.76
GW081 16.71
GW083 16.84
GW082 16.89
GW173 16.52
GW084 16.93
GW153 17.31
PP063
PP110
PP089
SWMU-174 (FORMER URE-73)
PP007
PP008
GW152 16.81
GW172 16.59
SWMU-172 (FORMER URE-66)
PP006
PP005
RP061
PP087
PP086
PP062
PP088
GW171 16.86
PP077
CONDITIONAL POC
APPROXIMATE LEASE BOUNDARY
GW172- August 23, 2000
Tetrachloroethene 8.6 (µg/L)
Trichloroethene 8.6 (µg/L)
cis-1,2-Dichloroethene 34 (µg/L)
Vinyl Chloride 34 (µg/L)
PP061- August 8, 2000 12.0' BGS
Tetrachloroethene 100 (µg/L)
Trichloroethene 1900 (µg/L)
1,1-Dichloroethene 3.8 (µg/L)
cis-1,2-Dichloroethene 2500 (µg/L)
Vinyl Chloride 22 (µg/L)
GW152- June 2, 1999
Tetrachloroethene 53 (µg/L)
Trichloroethene 54 (µg/L)
cis-1,2-Dichloroethene 100 (µg/L)
Vinyl Chloride 1 U (µg/L)
GW152- August 24, 2000
Tetrachloroethene 25 (µg/L)
Trichloroethene 93 (µg/L)
cis-1,2-Dichloroethene 270 (µg/L)
Vinyl Chloride 2.8 (µg/L)
PP006- May 21, 1999 12.0' BGS
Tetrachloroethene 300 (µg/L)
Trichloroethene 33 (µg/L)
cis-1,2-Dichloroethene 51 (µg/L)
Vinyl Chloride 1 U (µg/L)
0 20 40
APPROXIMATE SCALE IN FEET
AOC-172 and AOC-174 LOCATION MAP
BOEING RENTON FACILITY MAP
LEGEND
GW152 16.81 EXISTING MONITORING WELL LOCATION GROUNDWATER ELEVATION (FEET)
PP061 EXISTING PUSH-PROBE LOCATION
16.50 GROUNDWATER ELEVATION CONTOUR IN 0.25 FOOT INTERVAL (SEPTEMBER 2000)
GROUNDWATER FLOW DIRECTION
U Analyte was not detected above value shown
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. GROUNDWATER ELEVATION CONTOURS AND PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
SWMU-172 and SWMU-174 GROUNDWATER QUALITY DATA, GROUNDWATER ELEVATION CONTOURS, AND CPOC
Boeing Renton Facility
Renton, Washington
By: APS
Date: 10/27/08
Project No. 8888
AMEC Geomatrix
Figure A-2
Plot Date: 10/27/08 - 2:34pm Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\029_DCAP-appendixes\CAD\ Drawing Name: App-2_SWMU-172-174_GWcontoursSept2000.dwg

BUILDING 4-45

BUILDING 4-79

BUILDING 4-77

SWMU 181
BUILDING 4-78

AOC-037
(URE-25)

AOC-026
(URE-54)

AOC-013
(URE-17)

AOC-015
(URE-24)

AOC-014
(URE-18)

AOC-054
(URE-23)

DISPENSER ISLAND
(REMOVED)

APPROXIMATE PROPERTY LINE

CONDITIONAL
POC

GW022
13.95*

GW023

GW024
13.79

GW026

GW027

GW028

GW029

GW030
13.84

GW031
13.79

GW132
13.48

GW133

GW151

GW033
13.82

GW034
13.80

GW035
13.77

GW036

GW037

GW038
13.80

GW039
13.70

GW040
13.69

GW041
13.68

GW042

GW143
13.67

13.75

13.80

13.70

13.70

13.75

13.80

GW031- November 16, 2006	
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	0.2 (µg/L)
Benzene	35 (µg/L)
TPH-G	0.46 (mg/L)

GW033- November 16, 2006	
Trichloroethene	<20 UJ (µg/L)
cis-1,2-DCE	2,800 J (µg/L)
Vinyl Chloride	750 J (µg/L)
Benzene	66 J (µg/L)
TPH-G	0.34 (mg/L)

GW041- November 16, 2006	
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)
Benzene	<0.2 U (µg/L)
TPH-G	<0.25 U (mg/L)

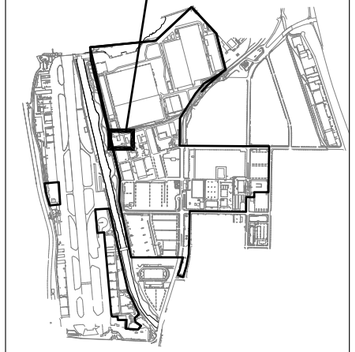
GW040- November 16, 2006	
Trichloroethene	<0.2 UJ (µg/L)
cis-1,2-DCE	<0.2 UJ (µg/L)
Vinyl Chloride	<0.2 UJ (µg/L)
Benzene	3.1 J (µg/L)
TPH-G	<0.25 U (mg/L)

GW034- November 16, 2006	
Trichloroethene	0.6 (µg/L)
cis-1,2-DCE	8 (µg/L)
Vinyl Chloride	13 (µg/L)
Benzene	<0.2 U (µg/L)
TPH-G	<0.25 U (mg/L)

GW039- November 16, 2006	
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)
Benzene	1.0 (µg/L)
TPH-G	<0.25 U (mg/L)

GW143- November 16, 2006	
Trichloroethene	0.4 (µg/L)
cis-1,2-DCE	0.2 (µg/L)
Vinyl Chloride	<0.2 U (µg/L)
Benzene	<0.2 U (µg/L)
TPH-G	<0.25 U (mg/L)

4-78/79 SWMU/AOC GROUP
LOCATION MAP



BOEING RENTON
FACILITY MAP

LEGEND

GW031 13.79 — EXISTING MONITORING WELL LOCATION GROUNDWATER ELEVATION (FEET)

GW042 — EXISTING EXTRACTION WELL LOCATION

* — WELL SCREENED IN LOWER PORTION OF AQUIFER SO WATER LEVEL IS NOT USED FOR CONTOURING

13.80 — GROUNDWATER ELEVATION CONTOUR IN 0.05 FOOT INTERVAL (FEBRUARY 2007)

REMOVED UST (WESTON, 2001)

cis-1,2-DCE — cis-1,2-Dichloroethene

TPH-G — Total Petroleum Hydrocarbons-Gasoline fraction

U — Analyte was not detected above value shown

J — Analyte was positively identified; the value shown is the approximate concentration of the analyte

UJ — Analyte was not detected. Value shown is estimated detection limit

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. UST LOCATIONS AND PRODUCT PIPING LOCATIONS FROM FINAL REMEDIAL INVESTIGATION (WESTON, 2001)

0 20 40
APPROXIMATE SCALE IN FEET

BOEING

BUILDING 4-78/79 SWMU/AOC GROUP GROUNDWATER QUALITY DATA, GROUNDWATER ELEVATION CONTOURS, AND CPOC
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/27/08	Project No. 8888
AMEC Geomatrix		Figure A-3

Plot Date: 10/27/08 - 2:36pm Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\029_DCAP-appendixes\CAD\ Drawing Name: App-3_4-78_79 SWMU_AOC-GWcontoursFeb2007_102708.dwg

PP098 January 28, 2003	4.0' BGS
Tetrachloroethene	1 U (µg/L)
Trichloroethene	1 U (µg/L)
cis-1,2-DCE	7.7 (µg/L)
Vinyl Chloride	67 (µg/L)

PP133 June 30, 2004	3.0' BGS
Tetrachloroethene	20 U (µg/L)
Trichloroethene	20 U (µg/L)
cis-1,2-DCE	20 U (µg/L)
Vinyl Chloride	1,100 (µg/L)

PP138 June 29, 2004	4.0' BGS
Tetrachloroethene	100 U (µg/L)
Trichloroethene	1,400 (µg/L)
cis-1,2-DCE	6,600 (µg/L)
Vinyl Chloride	2,200 (µg/L)

PP136 June 29, 2004	4.0' BGS
Tetrachloroethene	1 U (µg/L)
Trichloroethene	4.4 (µg/L)
cis-1,2-DCE	52,000 (µg/L)
Vinyl Chloride	28,000 (µg/L)

PP091 December 18, 2001	5.0' BGS
Tetrachloroethene	3.6 (µg/L)
Trichloroethene	80 (µg/L)
cis-1,2-DCE	45 (µg/L)
Vinyl Chloride	4.9 (µg/L)

PP016 May 19, 1999	7.0' BGS
Tetrachloroethene	8.3 (µg/L)
Trichloroethene	1.3 (µg/L)
cis-1,2-DCE	5.4 (µg/L)
Vinyl Chloride	5.7 (µg/L)

LAKE WASHINGTON

AOC-093

AOC-001/002 CONDITIONAL POC

AOC-001
AOC-002
(SECONDARY SOURCE AREA)

AOC-003

AOC-003 CONDITIONAL POC

APPROXIMATE LOCATION OF AOC-092

BUILDING 4-81

BUILDING 4-20

BUILDING 4-20 ADDITION

STORM WATER WET VAULT

STORM WATER DIVERSION STRUCTURE

PRIMARY SOURCE AREA

INJECTION LINE

INJECTION LINE

PP119 PP118 PP129 GW185 13.51 PP130 GW187 13.43 PP117 GW049 PP098 PP099 PP081 PP097 PP132 GW050 PP011 PP013 PP012 14.00 GW051 PP133 PP131 GW186 13.55 PP116 PP066 PP135 PP134 GW190 14.18 PP115 PP113 PP114 PP111 PP136 GW191 14.06* PP112 PP145 GW192 14.27 PP096 PP138 PP137 PP151 PP141 PP147 PP152 GW193 15.20** PP140 PP091 PP094 PP095 PP139 PP065 PP090 GW052 PP015 PP016 PP064 PP014 13.50 13.75 14.00 14.25 14.50 14.75

PP136 GW191 GW192 PP150 PP112 PP145 PP111 PP096 PP137 PP138 PP151 PP141 PP147 PP152 GW193 PP142 PP146 PP140 PP153 PP143 PP144

0 20 40
APPROXIMATE SCALE IN FEET

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

0 40 80
APPROXIMATE SCALE IN FEET

AOC-001 AND AOC-002 LOCATION MAP

BOEING RENTON FACILITY MAP

LEGEND

- GW190 14.18 — EXISTING MONITORING WELL LOCATION GROUNDWATER ELEVATION (FEET)
- PP011 — EXISTING PUSH PROBE LOCATION
- * — WELL SCREENED IN LOWER PORTION OF AQUIFER SO WATER LEVEL IS NOT USED FOR CONTOURS
- ** — WATER LEVEL IS ANOMALOUS SO IT WAS NOT INCLUDED WITH CONTOURS
- 14.50 — GROUNDWATER ELEVATION CONTOUR IN 0.25 FOOT INTERVAL (FEBRUARY 2007)
- APPROXIMATE PROPERTY LINE
- APPROXIMATE NOVEMBER 2005 EXCAVATION AREA, SHOWING EXISTING REMEDIATION PORTS AND LINES.
- cis-1,2-DCE — cis-1,2-Dichloroethene
- U — Analyte was not detected above value shown

***ITALICIZED BOLD* = DEEP ZONE**
NORMAL = SHALLOW ZONE

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

AOC-001 AND AOC-002 GROUNDWATER PRE-INTERIM ACTION CONCENTRATIONS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/27/08	Project No. 8888
AMEC Geomatrix		Figure A-4

Plot Date: 10/27/08 - 2:39pm, Plotted by: adam.stenberg
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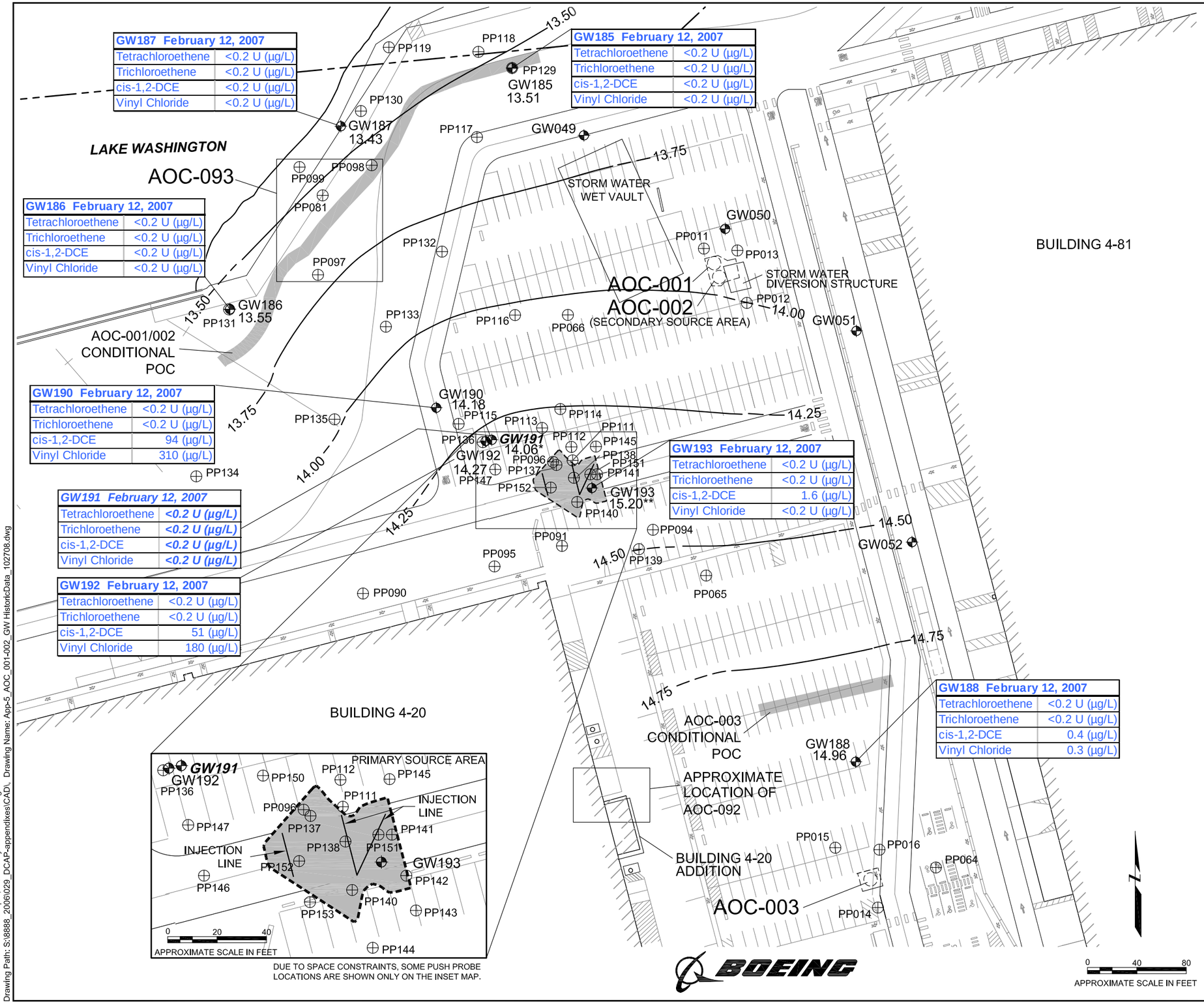

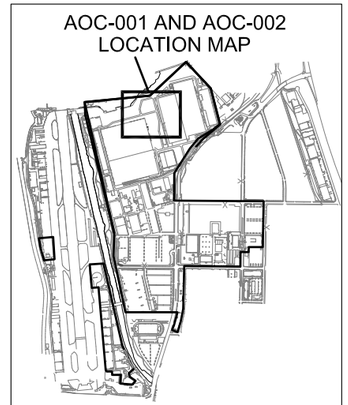

LEGEND

- GW190 14.18 — EXISTING MONITORING WELL LOCATION GROUNDWATER ELEVATION (FEET)
- PP011 — EXISTING PUSH PROBE LOCATION
- * — WELL SCREENED IN LOWER PORTION OF AQUIFER SO WATER LEVEL IS NOT USED FOR CONTOURS
- ** — WATER LEVEL IS ANOMALOUS SO IT WAS NOT INCLUDED WITH CONTOURS
- 14.50 — GROUNDWATER ELEVATION CONTOUR IN 0.25 FOOT INTERVAL (FEBRUARY 2007)
- APPROXIMATE PROPERTY LINE
- APPROXIMATE NOVEMBER 2005 EXCAVATION AREA, SHOWING EXISTING REMEDIATION PORTS AND LINES.

cis-1,2-DCE — cis-1,2-Dichloroethene

U — Analyte was not detected above value shown

***ITALICIZED BOLD* = DEEP ZONE**
NORMAL = SHALLOW ZONE

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

AOC-001/002 AND AOC-003 GROUNDWATER QUALITY DATA, GROUNDWATER ELEVATION CONTOURS, AND CPOC
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/27/08	Project No. 8888
AMEC Geomatrix		Figure A-5

Plot Date: 10/27/08 - 2:42pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\029_DCAP-appendixes\CAD\, Drawing Name: App-5_AOC_001-002_GW HistoricData_102708.dwg

LAKE WASHINGTON

LAKE WASHINGTON

GW001
14.26

GW002

GW003

GW004
14.23

GW005
14.37

GW006
14.58

GW007
14.57

14.4

14.5

14.6

BUILDING
4-41

CONDITIONAL
POC

PILINGS

CEDAR RIVER WATERWAY

PARK DRIVE

AOC-035
(FORMER URE-08)

AOC-034
(FORMER URE-07)

(FORMER URE-07)

DOOR 8A

DOOR 8

DOOR 7

DOOR 6

DOOR 5

PP032

PP160

PP161

PP163

PP162

PP033

PP034

PP164

PP035

PP032 May 18, 1999	9' BGS
Trichloroethene	ND
cis-1,2-DCE	ND
Vinyl Chloride	1.8 (µg/L)

PP033 May 18, 1999	9' BGS
Trichloroethene	ND
cis-1,2-DCE	ND
Vinyl Chloride	ND

PP034 May 18, 1999	9' BGS
Trichloroethene	ND
cis-1,2-DCE	ND
Vinyl Chloride	ND

PP035 May 18, 1999	9' BGS
Trichloroethene	ND
cis-1,2-DCE	ND
Vinyl Chloride	ND

PP161 December 14, 2006	9' BGS
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	0.5 (µg/L)
Vinyl Chloride	2.7 (µg/L)

PP160 December 14, 2006	9' BGS
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	0.2 (µg/L)
Vinyl Chloride	0.6 (µg/L)

PP162 December 14, 2006	9' BGS
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)

PP163 December 14, 2006	9' BGS
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)

PP164 December 14, 2006	9' BGS
Trichloroethene	<0.2 U (µg/L)
cis-1,2-DCE	<0.2 U (µg/L)
Vinyl Chloride	<0.2 U (µg/L)

BOEING

0 25 50
APPROXIMATE SCALE IN FEET

AOC-034 and AOC-035
LOCATION MAP

BOEING RENTON
FACILITY MAP

LEGEND

GW006 14.58 — MONITORING WELL LOCATION GROUNDWATER ELEVATION (FEET)

PP162 — 12/14/2006 PUSH-PROBE SOIL AND GROUNDWATER SAMPLE LOCATION

PP032 — HISTORICAL PUSH-PROBE LOCATION

LIMITS OF PREVIOUS EXCAVATION (HART CROWSER 1987)

FORMER UST LOCATION

FENCE

14.5 — GROUNDWATER ELEVATION CONTOUR IN 0.1 FOOT INTERVAL (SEPTEMBER 2000)

cis-1,2-DCE — cis-1,2-Dichloroethene
U — Analyte was not detected above value shown
ND — Not Detected

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. GROUNDWATER ELEVATION CONTOURS AND HISTORIC PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)

AOC-034 and AOC-035 GROUNDWATER QUALITY DATA, GROUNDWATER ELEVATIONS, AND CPOC
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/27/08	Project No. 8888
AMEC Geomatrix	Figure	A-6

Plot Date: 10/27/08 - 2:46pm, Plotted by: adam.stenberg
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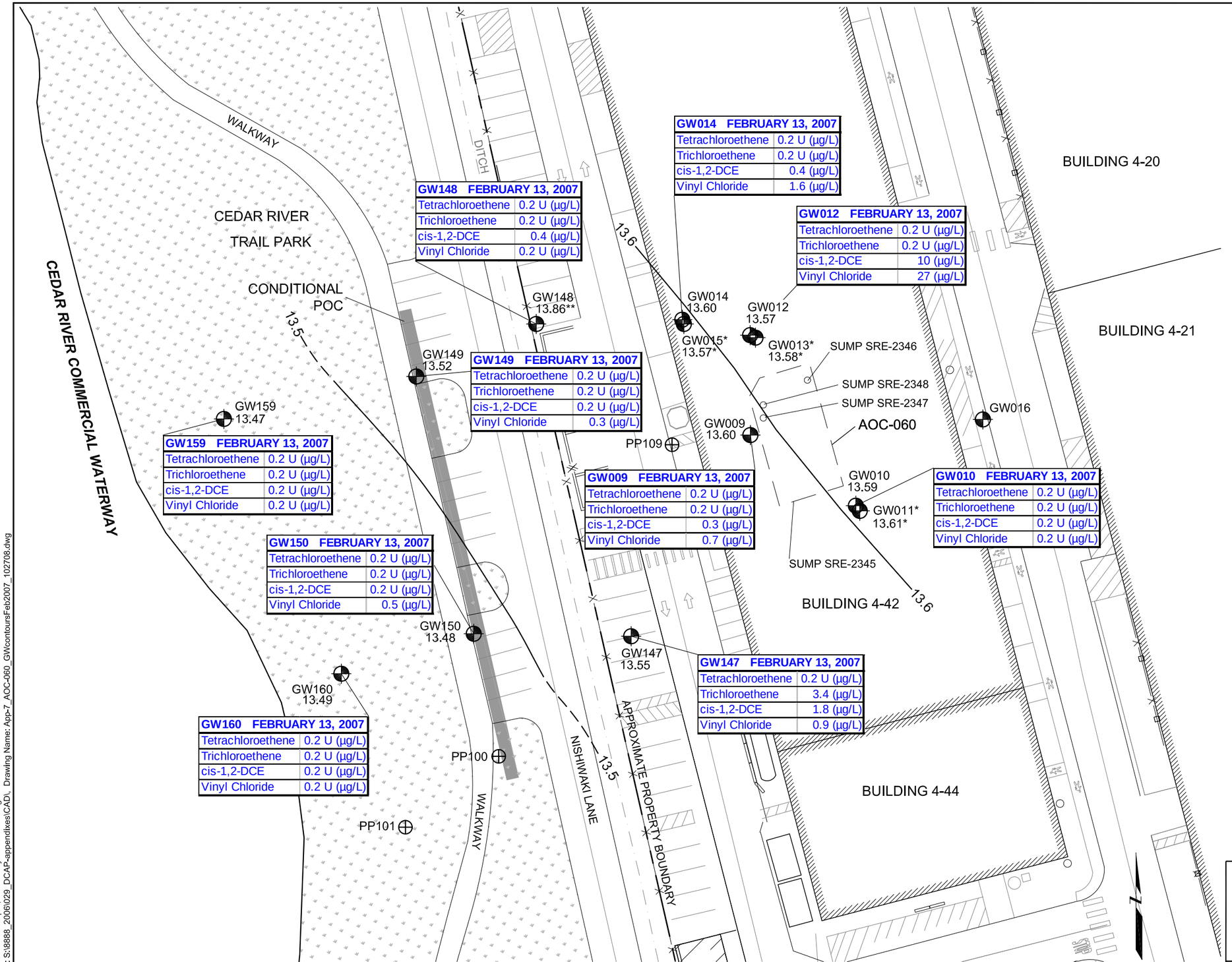

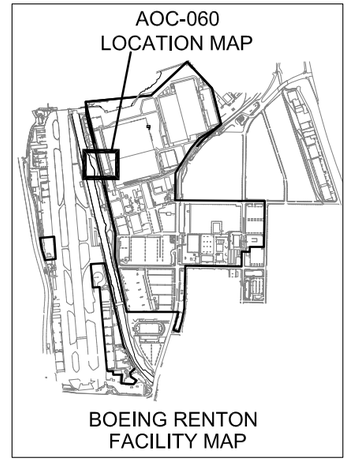

LEGEND

- GW150 13.48 — EXISTING MONITORING WELL LOCATION GROUNDWATER ELEVATION (FEET)
- PP109 — EXISTING SUPPLEMENTAL RI PUSH PROBE
- * — WELL SCREENED IN LOWER PORTION OF AQUIFER SO WATER LEVEL IS NOT USED FOR CONTOURING
- ** — WATER LEVEL IS ANOMALOUS SO IT WAS NOT INCLUDED WITH CONTOURS
- 13.6 — GROUNDWATER ELEVATION CONTOUR IN 0.1 FOOT INTERVAL (FEBRUARY 2007)
- x — FENCE
- APPROXIMATE PROPERTY LINE
- cis-1,2-DCE — cis-1,2-Dichloroethene
- U — Analyte was not detected above value shown

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

AOC-060 (BUILDING 4-42) GROUNDWATER QUALITY DATA, GROUNDWATER ELEVATION CONTOURS, AND CPOC

Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/27/08	Project No. 8888
AMEC Geomatrix		Figure A-7

Plot Date: 10/27/08 - 2:48pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\029_DCAP-appendixes\CAD\, Drawing Name: App-7_AOC-060_GWcontoursFeb2007_102708.dwg

Plot Date: 10/27/08 - 2:50pm, Plotted by: adam.stenberg
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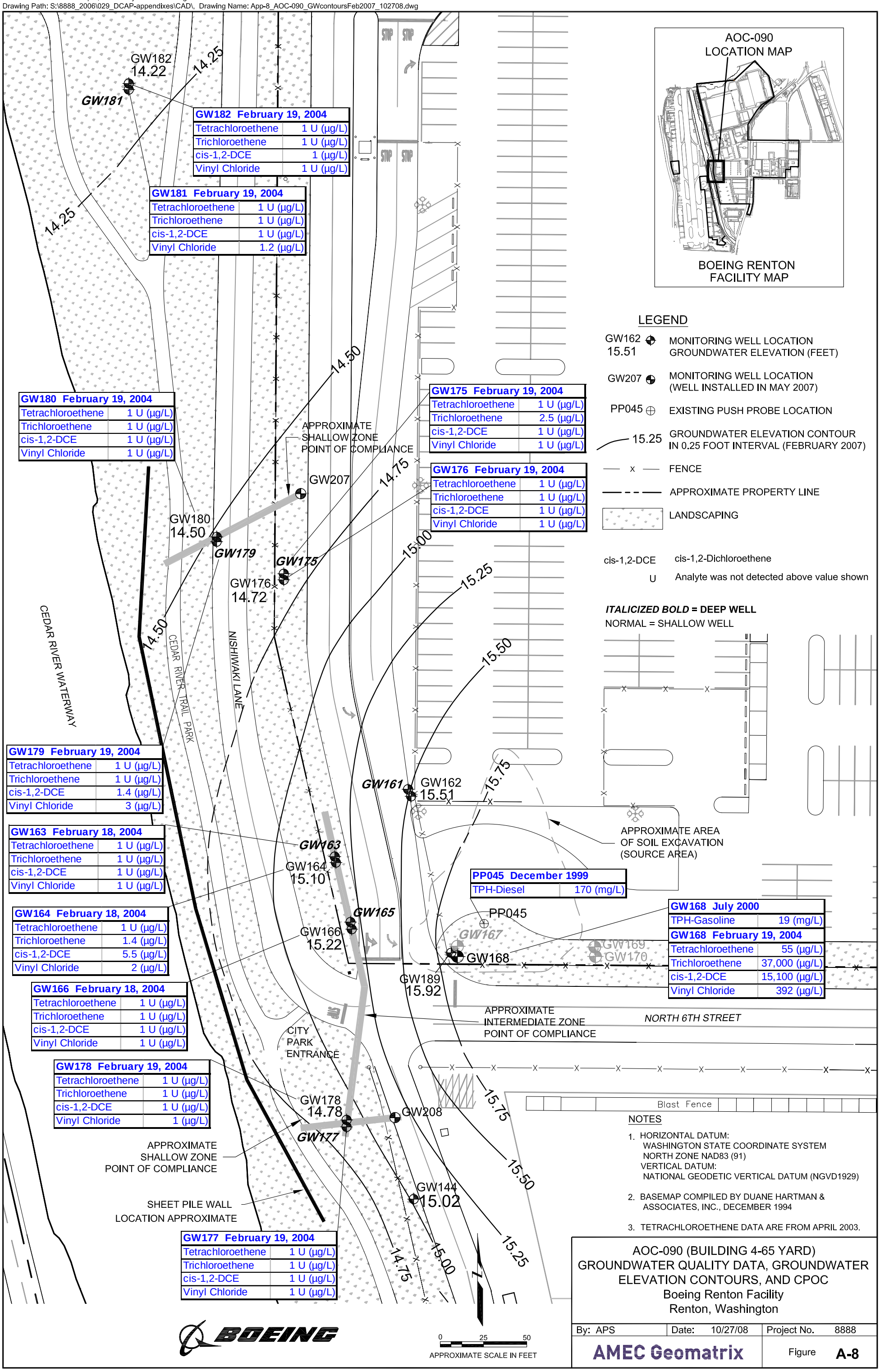


AOC-090
LOCATION MAP

BOEING RENTON
FACILITY MAP

LEGEND

GW162 15.51 — MONITORING WELL LOCATION GROUNDWATER ELEVATION (FEET)

GW207 — MONITORING WELL LOCATION (WELL INSTALLED IN MAY 2007)

PP045 — EXISTING PUSH PROBE LOCATION

15.25 — GROUNDWATER ELEVATION CONTOUR IN 0.25 FOOT INTERVAL (FEBRUARY 2007)

— x — FENCE

— — — APPROXIMATE PROPERTY LINE

LANDSCAPING

cis-1,2-DCE — cis-1,2-Dichloroethene

U — Analyte was not detected above value shown

ITALICIZED BOLD = **DEEP WELL**
NORMAL = SHALLOW WELL

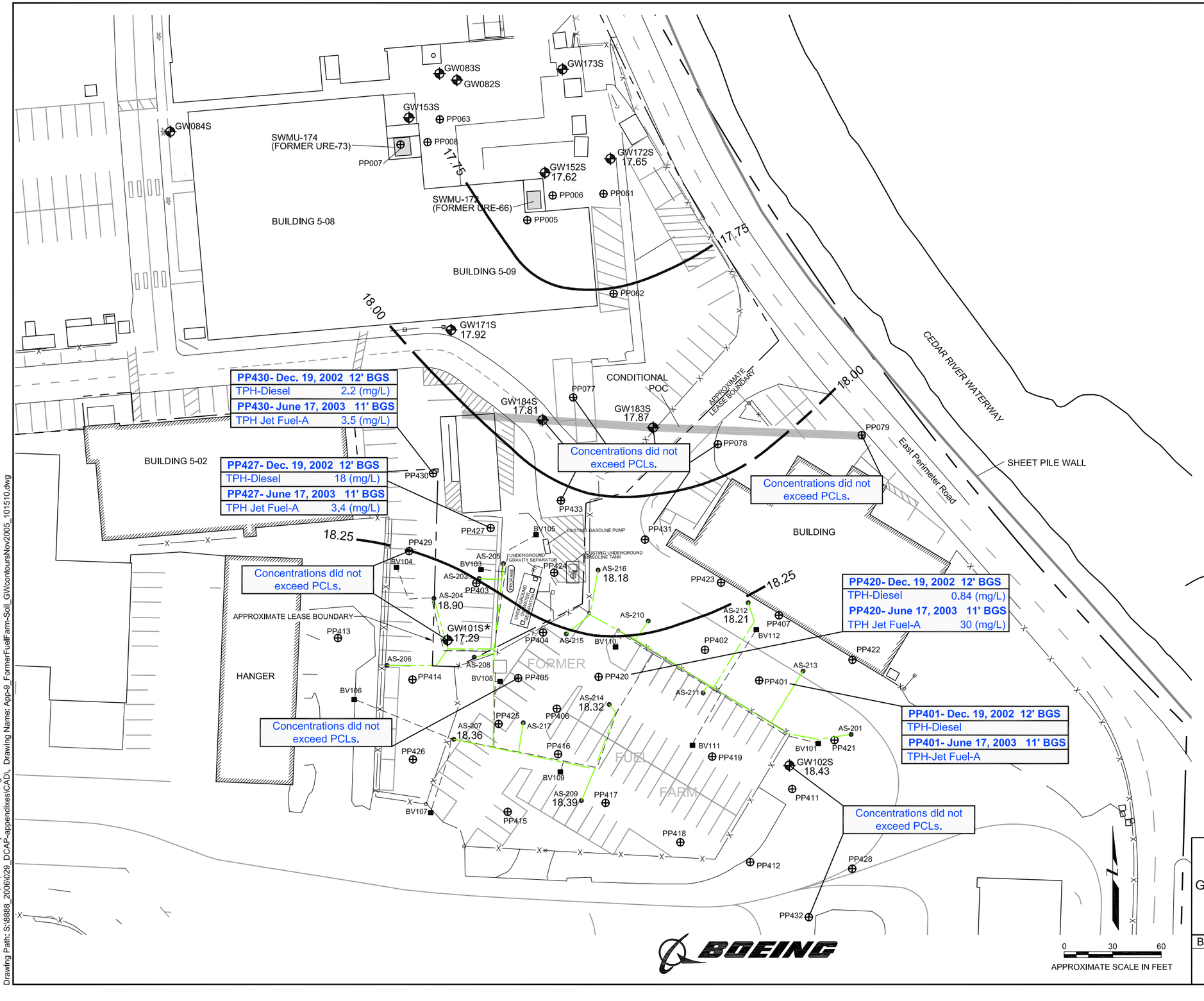
NOTES

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. TETRACHLOROETHENE DATA ARE FROM APRIL 2003.

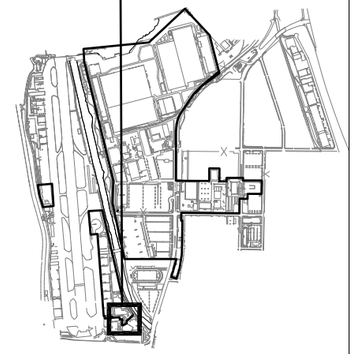
AOC-090 (BUILDING 4-65 YARD) GROUNDWATER QUALITY DATA, GROUNDWATER ELEVATION CONTOURS, AND CPOC

Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/27/08	Project No. 8888
AMEC Geomatrix		Figure A-8



FORMER FUEL FARM AOC GROUP
LOCATION MAP



BOEING RENTON
FACILITY MAP

LEGEND

- GW171S 17.92 ⊕ — EXISTING MONITORING WELL LOCATION GROUNDWATER ELEVATION (FEET) ('S' DESIGNATION INDICATES WELL SCREENED LESS THAN 18 FEET IN DEPTH)
- PP433 ⊕ — EXISTING PUSH PROBE LOCATION
- AS-204 ● — EXISTING UNDERGROUND AIR SPARGING WELL
- BV112 ■ — EXISTING UNDERGROUND BIOVENTING WELL
- UNDERGROUND BIOVENTING LINE
- UNDERGROUND AIR SPARGING LINE
- FENCE
- 18.25 — GROUNDWATER ELEVATION CONTOUR IN 0.25 FOOT INTERVAL (NOVEMBER 7, 2005)
- GW101S * — Anomalous Water Level; Water Level in Monitoring Well influenced by Air Sparge Operation
- TPH — Total Petroleum Hydrocarbons
- PCLs — Preliminary Cleanup Levels

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. PIPING LOCATIONS APPROXIMATE
5. ALL SOIL AND GROUNDWATER DATA FOR THE PUSH PROBES ARE THE MOST RECENT DATA AVAILABLE

FORMER FUEL FARM AOC GROUP GROUNDWATER QUALITY DATA, GROUNDWATER ELEVATION CONTOURS, AND CPOC
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/20/10	Project No. 8888
AMEC Geomatrix	Figure	A-9

Plot Date: 10/20/10 - 4:32pm Plotted by: adam.stenberg
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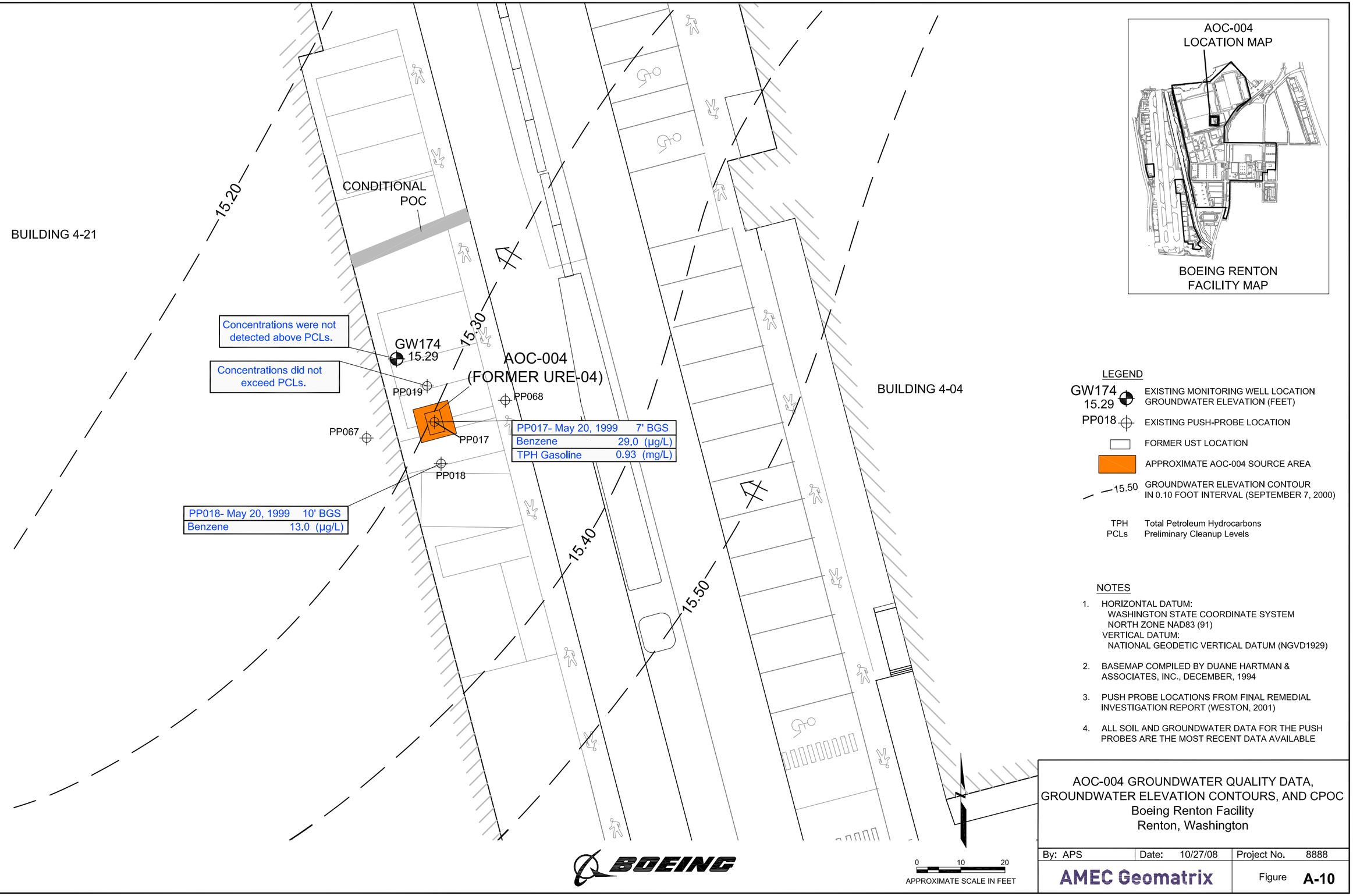

AOC-004 GROUNDWATER QUALITY DATA, GROUNDWATER ELEVATION CONTOURS, AND CPOC
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/27/08	Project No. 8888
AMEC Geomatrix		Figure A-10

Plot Date: 10/27/08 - 2:56pm, Plotted by: adam.stenberg
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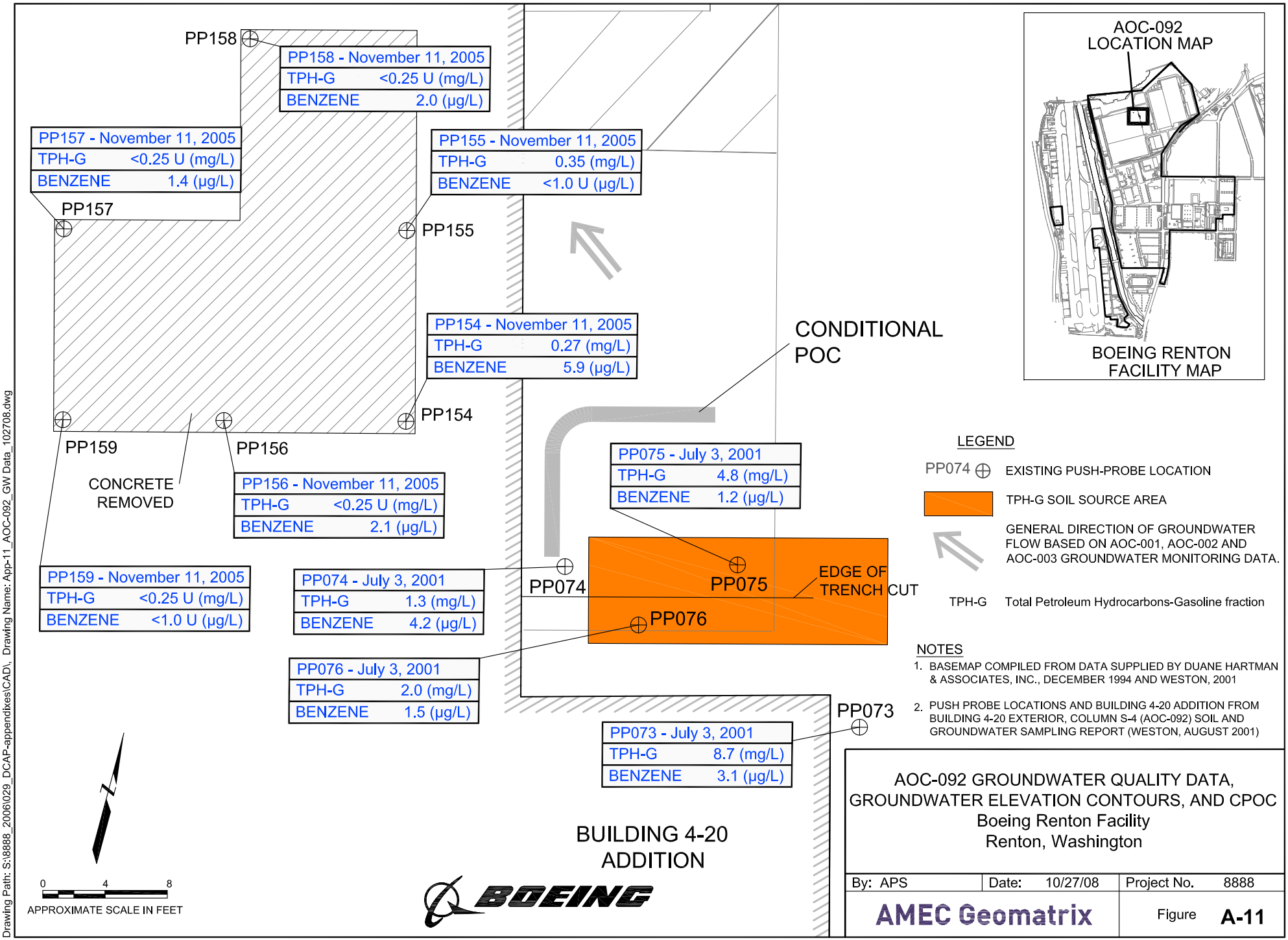

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APPENDIX B

Cost Estimating Summary

COST ESTIMATING SUMMARY

Boeing Renton Facility
Renton, Washington

The cost estimates for the different alternatives for each Area of Concern (AOC) or solid waste management unit (SMWU), referred to hereafter as "site," were developed based on the conceptual designs for the alternatives described in the report. The general approach is based on the U.S. Environmental Protection Agency's (EPA's) "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA, 2000). The subsurface conditions used are those described in the final "Remedial Investigation Report" (Weston, 2001).

There are a total of 12 sites with cost estimates completed for each site. For ease of reference and comparison, the estimated costs of the different alternatives for each site have been presented on separate pages. The cost estimates for each site consist of three separate tables. The first table (e.g., Table B1-1) presents the initial costs of the alternatives, which includes the design and installation of the alternatives. The second table (e.g., Table B1-2) presents the recurring costs, which covers the costs associated with operation and maintenance (e.g., equipment replacement) of the alternatives. The third table for each site (e.g., Table B1-3) presents the Net Present Value (NPV) for all the costs for the duration of the project. The costs on all cost tables are in 2012 dollars. These estimates are summarized below:

FINAL REMEDY COST ESTIMATE SUMMARY
Boeing Renton Facility
Renton, Washington

Selected Remedy	Total Cost	Net Present Value
SWMU-168: Alternative 1 – MNA	$611,100	$549,000
SWMU-172 & 174: Alternative 2 – SVE & EB	$1,313,100	$1,225,000
Building 4-78 & 79 SWMU/AOC Group: Alternative 2 - SVE, EB, & MA	$1,642,300	$1,538,000
Former Fuel Farm: Alternative 3 - MNA	$804,400	$721,000
AOC-001 and AOC-002: Alternative 1 - EB & MA	$839,200	$761,000
AOC-003: Alternative 2 - EB & MA	$657,600	$594,000
AOC-004: Alternative 2 - SVE & EB	$609,200	$553,000
AOC-034 and AOC-035: Alternative 1 - MNA	$546,800	$491,000
AOC-060: Alternative 1 - MNA	$898,400	$798,000
AOC-090: Alternative 2 – EB & MA	$1,091,300	$986,000
AOC-092: Alternative 2 - Source Area Excavation, EB & MA	$597,300	$538,000
AOC-093: Alternative 1 - MNA	$477,200	$428,000
TOTAL	**$10,087,900**	**$9,182,000**

Abbreviations

MNA - Monitored Natural Attenuation
EB - Enhanced Bioremediation
SAE - Source Area Excavation
SVE - Soil Vapor Extraction
MA - Monitored Attenuation
& - and
$ - 2012 US dollars

The Total Cost in the summary tabulation is taken from the third table for each SWMU and AOC, and represents the total estimated costs over 15 years. The Net Present Value represents total present and future costs discounted to present value using a net annual discount rate of 1.4%.

The quantities were estimated based on the anticipated scope of work for each conceptual design using available site data and maps. Reasonable assumptions based on professional judgment were made as appropriate to complete the estimate. The quantities are, therefore, preliminary estimates and are not suitable for final design.

The unit prices for each line item (initial and recurring cost estimates) were taken from "Building Construction Cost Data" (RSMeans, 2005a); Environmental Remediation Cost Data-Unit Price" (RSMeans, 2005b); vendor quotes; or based on actual experience and engineering judgment when the initial feasibility cost estimates were prepared in 2007; costs from the 2005 RSMeans were adjusted as appropriate to 2007 dollars. The original 2007 cost estimates have been adjusted to 2012 dollars using RSMeans index data from "RSMeans Building Construction Cost Data, 70th Annual Edition" (RSMeans, 2012).

In developing the unit prices, the following general assumptions were made and may appear as footnotes to the cost estimate tables.

- Production rates and prices are based on a standard 40-hour work week; no overtime or shift differentials have been included.
- The personal protective equipment (PPE) will be level D, unless otherwise noted.
- The waste generated will be nonhazardous solid waste, except as otherwise noted.
- Surface asphalt and concrete are assumed to have not been impacted and will be recycled.
- No unique or specialty equipment or approaches have been considered unless otherwise noted.
- Costs for power and water have not been estimated, unless otherwise noted.
- No security guards will be required.
- Work will be performed continuously without interruptions or multiple mobilizations and setups.
- The estimates are accurate to +50% and -30%.
- Sales tax rate of 9.5%.
- No prevailing wage or union standby labor have been included.

The initial cost tables present the consultant's cost separately as a percentage of the contractor cost. The specific line items have been divided into investigation, design, permitting, project management, and construction management. The assigned percentages were obtained from the EPA guide (EPA, 2000) and from previous experience.

The recurring costs have also been generalized for simplicity. The unit prices include the cost of the consultant as well as any contractor costs. A separate line item for project management has been added at a fixed unit price of $1,000 per month for all sites and alternatives; the actual project management cost will vary. Project durations of 15 years have been assumed for all sites and alternatives, unless otherwise noted.

Unit costs for initial and recurring costs have been adjusted to present the estimated costs in 2012 dollars. The initial costs have subsequently been escalated to 2012 costs using the historical cost index data from the 2012 edition of RS Means (2012 index of 192.8, 2007 index of 169.4).

The NPV is the calculated project present value based on a net annual discount rate of 1.4%. The net discount rate is the difference between inflation and interest rates, and accounts for both effects in the estimated cost. A column has been included for the recurring cost tables for annualized costs to accommodate NPV calculations.

REFERENCES

EPA, 2000, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study, July.

RSMeans, 2005a, Building Construction Cost Data, Western Edition, 18th Annual Edition.

RSMeans, 2005b, Environmental Remediation Cost Data-Unit Price, 11th Annual Edition.

RSMeans, 2012, Building Construction Cost Data, 70th Annual Edition.

Weston, 2001, Remedial Investigation Report, Boeing Renton Plant, Renton, Washington: Prepared for The Boeing Company, Boeing Shared Services Group, Energy and Environmental Affairs, August 10.

TABLE B1-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
SWMU-168
Boeing Renton Facility
Renton, Washington

		INITIAL COSTS			ALTERNATIVE 1 MNA		ALTERNATIVE 2 SVE, Monitored Attenuation		ALTERNATIVE 3 Enhanced Bioremediation, Monitored Attenuation	
CONTRACTOR			**Unit**	**Unit Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
1	**Mobilization/Demobilization**									
		Mobilization/Demobilization	lump sum	$11,400	0.1	$1,140	0.5	$5,700	0	$1,140
2	**Health and Safety**									
		Health and Safety Officer	hour	$90	4	$360	20	$1,800	4	$360
		Equipment	month	$2,300	0	$0	1	$2,300	0	$0
		PPE	day	$110	1	$110	3	$330	1	$110
3	**Site Preparation**									
		Utility Locates	hour	$100	4	$400	4	$400	4	$400
		Site Security	linear foot	$4.5	100	$450	200	$900	100	$450
		Temporary Facilities	month	$3,400	0	$0	1	$3,400	0	$0
		Traffic Control	lump sum	$1,100	1	$1,100	1	$1,100	1	$1,100
		Erosion Control	linear foot	$5.5	100	$550	200	$1,100	100	$550
		Storm water Management	day	$600	0	$0	1	$600	0	$0
4	**Surveying**									
		Surveying	day	$1,700	1	$1,700	3	$5,100	1	$1,700
5	**Monitoring Wells**									
		Monitoring Well Installation (2" PVC)	linear foot	$90	75	$6,750	75	$6,750	75	$6,750
		Base Price Per Well	each	$570	4	$2,280	4	$2,280	4	$2,280
		Waste Disposal	drum	$170	14	$2,380	14	$2,380	14	$2,380
6	**SVE**									
		Soil Vapor Extraction Well Installation (4" PVC)	linear foot	$110	0	$0	5	$550	0	$0
		Base Price Per Well	each	$340	0	$0	1	$340	0	$0
		Waste Disposal	drum	$170	0	$0	1	$170	0	$0
		Knock out pot	each	$2,300	0	$0	1	$2,300	0	$0
		Vacuum Blower	each	$2,800	0	$0	1	$2,800	0	$0
		Granular Activated Carbon	each	$3,400	0	$0	2	$6,800	0	$0
		Permanganate Unit	each	$1,700	0	$0	1	$1,700	0	$0
		Valves	each	$100	0	$0	1	$100	0	$0
		Gauges	each	$30	0	$0	1	$30	0	$0
		Treatment Center	lump sum	$13,700	0	$0	0.5	$6,850	0.0	$0
		Electrical Service	lump sum	$11,400	0	$0	0.5	$5,700	0.0	$0
		Electrical Connections	lump sum	$5,700	0	$0	1	$5,700	0	$0
7	**Enhanced Bioremediation**									
		Direct Push	day	$2,300	0	$0	0	$0	2	$4,600
		Additive	lb	$5.50	0	$0	0	$0	325	$1,790
		Equipment	day	$450	0	$0	0	$0	2	$900
Subtotal						**$17,200**		**$67,200**		**$24,500**
Sales Tax (9.5%)						**$1,600**		**$6,400**		**$2,300**
Subtotal						**$18,800**		**$73,600**		**$26,800**
Contingency (30%)						**$5,600**		**$22,100**		**$8,000**
Subtotal, Contractor						**$24,400**		**$95,700**		**$34,800**
PROFESSIONAL TECHNICAL SERVICES										
		Investigation (Confirmation Sampling)	lump sum	$8,200	1	$8,200	1.8	$14,400	1.8	$14,400
		Permitting	%	5%	$24,400	$1,200	$95,700	$4,800	$34,800	$1,700
		Engineering design costs	%	20%	$24,400	$4,900	$95,700	$19,100	$34,800	$7,000
		Construction Management	%	15%	$24,400	$3,700	$95,700	$14,400	$34,800	$5,200
		Project Management	%	10%	$24,400	$2,400	$95,700	$9,600	$34,800	$3,500
Subtotal, Professional Services						**$20,400**		**$62,300**		**$31,800**
TOTAL INITIAL COST						**$44,800**		**$158,000**		**$66,600**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level D PPE.
5. Waste disposal is non-hazardous solid waste.
6. Soil 1 cubic yard = 1.6 tons.
7. Concrete/Asphalt 1 cubic yard = 2 tons.
8. Installation of 2 shallow monitoring wells and 1 intermediate monitoring well, all alternatives.
9. Installation of 1 SVE well at location PP001, Alternatives 2 and 3.
10. No pilot test for SVE.
11. Enhanced Bioremediation will require a single application, Alternative 3.
12. Investigation (Confirmation Sampling) will include 3 push probe locations with 3 sample depths per location.

TABLE B1-2

IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
SWMU-168
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS	Unit	Unit Cost	ALTERNATIVE 1 MNA Annual Quantity	ALTERNATIVE 1 MNA Annual Cost	ALTERNATIVE 1 MNA Lifetime Quantity	ALTERNATIVE 1 MNA Lifetime Cost	ALTERNATIVE 2 SVE, Monitored Attenuation Annual Quantity	ALTERNATIVE 2 SVE, Monitored Attenuation Annual Cost	ALTERNATIVE 2 SVE, Monitored Attenuation Lifetime Quantity	ALTERNATIVE 2 SVE, Monitored Attenuation Lifetime Cost	ALTERNATIVE 3 Enhanced Bioremediation, Monitored Attenuation Annual Quantity	ALTERNATIVE 3 Enhanced Bioremediation, Monitored Attenuation Annual Cost	ALTERNATIVE 3 Enhanced Bioremediation, Monitored Attenuation Lifetime Quantity	ALTERNATIVE 3 Enhanced Bioremediation, Monitored Attenuation Lifetime Cost
1	**OPERATION AND MAINTENANCE**														
	Monitoring SVE	annual	$17,100	0	$0	0	$0	1	$17,100	5	$85,500	0	$0	5	$85,500
	Air Sampling SVE	per well	$500	0	$0	0	$0	1	$500	5	$2,500	0	$0	5	$2,500
	Electricity	monthly	$500	0	$0	0	$0	12	$6,000	60	$30,000	0	$0	0	$0
	Carbon Replacement	pound	$2	0	$0	0	$0	600	$1,200	3000	$6,000	0	$0	0	$0
	Permanganate Replacement	pound	$2	0	$0	0	$0	700	$1,400	3500	$7,000	0	$0	0	$0
	Maintenance SVE	lump sum	$5,700	0	$0	0	$0	1	$5,700	5	$28,500	0	$0	5	$28,500
	Monitoring Well Maintenance	per well	$600	3	$1,800	15	$9,000	3	$1,800	15	$9,000	0	$0	15	$9,000
Subtotal					**$1,800**		**$9,000**		**$33,700**		**$168,500**		**$0**		**$125,500**
2	**QUARTERLY GW MONITORING (Years 1,2)**														
	Sampling	each well	$700	16	$11,200	32	$22,400	16	$11,200	32	$22,400	32	$22,400	24	$16,800
	Analysis	each well	$600	16	$9,600	32	$19,200	16	$9,600	32	$19,200	32	$19,200	24	$14,400
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$43,600**		**$87,200**		**$43,600**		**$87,200**		**$64,400**		**$76,800**
3	**SEMIANNUAL GW MONITORING (Years 3-15)**														
	Sampling	each well	$700	8	$5,600	104	$72,800	8	$5,600	104	$72,800	8	$5,600	104	$72,800
	Analysis	each well	$200	8	$1,600	104	$20,800	8	$1,600	104	$20,800	8	$1,600	104	$20,800
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$18,600**		**$241,800**		**$18,600**		**$241,800**		**$18,600**		**$241,800**
4	**FIVE YEAR GW MONITORING (Years 5,10,15)**														
	Sampling	each well	$700	4	$2,800	9	$6,300	4	$2,800	9	$6,300	4	$2,800	9	$6,300
	Analysis	each well	$600	4	$2,400	9	$5,400	4	$2,400	9	$5,400	4	$2,400	9	$5,400
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$10,900**		**$28,800**		**$10,900**		**$28,800**		**$10,900**		**$28,800**
5	**PROJECT MANAGEMENT**														
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.
5. SVE system runs for 5 years, Alternatives 2 and 3.
6. Monitoring Well Operation and Maintenance for 15 years, all alternatives.

TABLE B1-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
SWMU-168
Boeing Renton Facility
Renton, Washington

	ALTERNATIVE 1					ALTERNATIVE 2					ALTERNATIVE 3				
	MNA					SVE, Monitored Attenuation					Enhanced Bioremediation & Monitored Attenuation				
Year	Initial Costs	O&M	PM	GW Mon.	Total	Initial Costs	O&M	PM	GW Mon.	Total	Initial Costs	O&M	PM	GW Mon.	Total
0	$44,800				$44,800	$158,000				$158,000	$66,600				$66,600
1		$1,800	$13,700	$43,600	$59,100		$33,700	$13,700	$43,600	$91,000		$0	$13,700	$64,400	$78,100
2		$1,800	$13,700	$43,600	$59,100		$33,700	$13,700	$43,600	$91,000		$0	$13,700	$64,400	$78,100
3		$1,800	$13,700	$18,600	$34,100		$33,700	$13,700	$18,600	$66,000		$0	$13,700	$18,600	$32,300
4		$1,800	$13,700	$18,600	$34,100		$33,700	$13,700	$18,600	$66,000		$0	$13,700	$18,600	$32,300
5		$1,800	$13,700	$20,200	$35,700		$33,700	$13,700	$20,200	$67,600		$0	$13,700	$20,200	$33,900
6		$1,800	$13,700	$18,600	$34,100		$1,680	$13,700	$18,600	$33,980		$1,680	$13,700	$18,600	$33,980
7		$1,800	$13,700	$18,600	$34,100		$1,680	$13,700	$18,600	$33,980		$1,680	$13,700	$18,600	$33,980
8		$1,800	$13,700	$18,600	$34,100		$1,680	$13,700	$18,600	$33,980		$1,680	$13,700	$18,600	$33,980
9		$1,800	$13,700	$18,600	$34,100		$1,680	$13,700	$18,600	$33,980		$1,680	$13,700	$18,600	$33,980
10		$1,800	$13,700	$20,200	$35,700		$1,680	$13,700	$20,200	$35,580		$1,680	$13,700	$20,200	$35,580
11		$1,800	$13,700	$18,600	$34,100		$1,680	$13,700	$18,600	$33,980		$1,680	$13,700	$18,600	$33,980
12		$1,800	$13,700	$18,600	$34,100		$1,680	$13,700	$18,600	$33,980		$1,680	$13,700	$18,600	$33,980
13		$1,800	$13,700	$18,600	$34,100		$1,680	$13,700	$18,600	$33,980		$1,680	$13,700	$18,600	$33,980
14		$1,800	$13,700	$18,600	$34,100		$1,680	$13,700	$18,600	$33,980		$1,680	$13,700	$18,600	$33,980
15		$1,800	$13,700	$20,200	$35,700		$1,680	$13,700	$20,200	$35,580		$1,680	$13,700	$20,200	$35,580
TOTAL	$44,800	$27,000	$205,500	$333,800	$611,100	$158,000	$185,300	$205,500	$333,800	$882,600	$66,600	$16,800	$205,500	$375,400	$664,300
				Net Present Value	$549,000				**Net Present Value**	$810,000				**Net Present Value**	$601,000

Notes
1. Net annual discount rate of 1.4%.

TABLE B2-1
IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
SWMU-172&174
Boeing Renton Facility
Renton, Washington

	INITIAL COSTS	Unit	Unit Cost	ALTERNATIVE 1 Source Area Excavation, Enhanced Bioremediation Quantity	ALTERNATIVE 1 Source Area Excavation, Enhanced Bioremediation Cost	ALTERNATIVE 2 SVE, Enhanced Bioremediation Quantity	ALTERNATIVE 2 SVE, Enhanced Bioremediation Cost	ALTERNATIVE 3 MNA Quantity	ALTERNATIVE 3 MNA Cost
CONTRACTOR									
1	**Mobilization/Demobilization**								
	Mobilization/Demobilization	lump sum	$11,400	3	$34,200	1.5	$17,100	0.1	$1,140
2	**Health and Safety**								
	Health and Safety Officer	hour	$85	120	$10,200	24	$2,040	4	$340
	Equipment	month	$2,300	1	$2,300	1	$2,300	0	$0
	PPE	day	$110	30	$3,300	10	$1,100	2	$220
3	**Site Preparation**								
	Utility Locates	hour	$100	8	$800	6	$600	2	$200
	Site Security	linear foot	$5	400	$2,000	100	$500	0	$0
	Temporary Facilities	month	$3,400	2	$6,800	1	$3,400	0	$0
	Traffic Control	lump sum	$1,100	2	$2,200	1	$1,100	1	$1,100
	Erosion Control	linear foot	$5.5	400	$2,200	100	$550	0	$0
	Storm water Management	day	$600	20	$12,000	2	$1,200	0	$0
4	**Surveying**								
	Surveying	day	$1,700	4	$6,800	4	$6,800	1	$1,700
5	**Monitoring Wells**								
	Well Abandonment	linear foot	$30	86	$2,580	56	$1,680	56	$1,680
	Base Price Per Well Abandonment	each	$200	5	$1,000	3	$600	3	$600
	Monitoring Well Installation (2" PVC)	linear foot	$85	95	$8,080	95	$8,080	95	$8,080
	Base Price Per Well	each	$600	5	$3,000	5	$3,000	5	$3,000
	Waste Disposal	drum	$200	23	$4,500	23	$4,600	23	$4,600
6	**Source Area Excavation**								
	Saw Cut Asphalt (6")	linear foot	$3.5	300	$1,050	0	$0	0	$0
	Excavation	cubic yard	$15	1,200	$18,000	0	$0	0	$0
	Waste Transportation/Disposal (non-hazardous)	ton	$45	706	$31,790	0	$0	0	$0
	Waste Transportation/Disposal (hazardous)	ton	$200	1,400	$280,000	0	$0	0	$0
	Backfill	ton	$15	1,600	$24,000	0	$0	0	$0
	Groundwater Management	gallon	$3.5	6,000	$21,000	0	$0	0	$0
	Asphalt Paving (6")	square foot	$4.5	4,500	$20,250	0	$0	0	$0
7	**SVE**								
	Pilot Test	lump sum	$22,800	0	$0	1	$22,800	0	$0
	Soil Vapor Extraction Well Installation (4" PVC)	linear foot	$110	0	$0	15	$1,650	0	$0
	Base Price Per Well	each	$340	0	$0	3	$1,020	0	$0
	Waste Disposal	drum	$170	0	$0	4	$680	0	$0
	Knock out pot	each	$2,300	0	$0	1	$2,300	0	$0
	Vacuum Blower	each	$2,800	0	$0	1	$2,800	0	$0
	Granular Activated Carbon	each	$3,400	0	$0	2	$6,800	0	$0
	Permanganate Unit	each	$1,700	0	$0	1	$1,700	0	$0
	Valves	each	$100	0	$0	8	$800	0	$0
	Gauges	each	$30	0	$0	8	$240	0	$0
	Treatment Center	lump sum	$13,700	0	$0	1	$13,700	0	$0
	Electrical Service	lump sum	$11,400	0	$0	1	$11,400	0	$0
	Electrical Connections	lump sum	$5,700	0	$0	2	$11,400	0	$0
8	**Trenching**								
	Saw Cut Asphalt (6")	linear foot	$3.5	0	$0	300	$1,050	0	$0
	Excavation	cubic yard	$11	0	$0	120	$1,320	0	$0
	Waste Transportation/Disposal (non-hazardous)	ton	$45	0	$0	120	$5,400	0	$0
	Waste Transportation/Disposal (hazardous)	ton	$180	0	$0	80	$14,400	0	$0
	Backfill	ton	$14	0	$0	200	$2,800	0	$0
	Piping	linear foot	$30	0	$0	150	$4,500	0	$0
	Asphalt Paving (6")	square foot	$4.5	0	$0	450	$2,030	0	$0
9	**Enhanced Bioremediation**								
	Injection Wells (4" PVC)	linear foot	$110	180	$19,800	180	$19,800	0	$0
	Base Price Per Well	each	$340	12	$4,080	12	$4,080	0	$0
	Waste Disposal	drum	$170	18	$3,060	18	$3,060	0	$0
Subtotal					**$525,000**		**$190,400**		**$22,700**
Sales Tax (9.5%)					**$49,900**		**$18,100**		**$2,200**
Subtotal					**$574,900**		**$208,500**		**$24,900**
Contingency (30%)					**$172,500**		**$62,600**		**$7,500**
Subtotal, Contractor					**$747,400.0**		**$271,100**		**$32,400**
PROFESSIONAL TECHNICAL SERVICES									
	Permitting	%	5%	$747,400	$37,370	$271,100	$13,560	$32,400	$1,600
	Engineering design costs	%	20%	$747,400	$149,480	$271,100	$54,220	$32,400	$6,500
	Construction Management	%	15%	$747,400	$112,110	$271,100	$40,670	$32,400	$4,900
	Project Management	%	10%	$747,400	$74,740	$271,100	$27,110	$32,400	$3,200
Subtotal, Professional Services					**$373,700**		**$135,560**		**$16,200**
TOTAL INITIAL COST					**$1,121,100**		**$406,700**		**$48,600**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level C PPE.
5. Waste disposal 40% hazardous and 60% non-hazardous solid waste.
6. Soil 1 cubic yard = 1.6 tons
7. Concrete/Asphalt 1 cubic yard = 2 tons
8. Backfill costs assume delivered and placed.
9. Install 4 shallow monitoring wells and 3 intermediate monitoring wells, all alternatives.
10. Install 12 injection wells for enhanced bioremediation, Alternatives 1 and 2.
11. Install 3 soil vapor extraction wells, Alternative 2.
12. Excavation would require abandonment of GW153 and GW152, Alternative 1.

TABLE B2-2
IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
SWMU-172&174
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS	Unit	Unit Cost	ALTERNATIVE 1 Source Area Excavation, Enhanced Bioremediation				ALTERNATIVE 2 SVE, Enhanced Bioremediation				ALTERNATIVE 3 MNA			
				Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost
1	**ENHANCED BIOREMEDIATION (Years 1,2,3)**														
	Additive	lb	$6	1600	$9,600	3,200	$19,200	2,000	$12,000	4,000	$24,000	0	$0	0	$0
	Application (labor and equipment)	per well	$800	24	$19,200	48	$38,400	24	$19,200	48	$38,400	0	$0	0	$0
	Well abandonment (Year 3)	linear foot	$30	180	$5,400	180	$5,400	180	$5,400	180	$5,400	0	$0	0	$0
	Base Price per Well abandonment (Year 3)	each	$230	12	$2,760	12	$2,760	12	$2,760	12	$2,760	0	$0	0	$0
	Waste Disposal (Year 3)	drum	$170	18	$3,060	18	$3,060	18	$3,060	18	$3,060	0	$0	0	$0
Subtotal					**$40,000**		**$68,800**		**$42,400**		**$73,600**		**$0**		**$0**
2	**OPERATION AND MAINTENANCE**														
	Monitoring SVE	annual	$17,100	0	$0	0	$0	1	$17,100	2	$34,200	0	$0	0	$0
	Air Sampling SVE	per well	$500	0	$0	0	$0	4	$2,000	8	$4,000	0	$0	0	$0
	Electricity	monthly	$450	0	$0	0	$0	12	$5,400	24	$10,800	0	$0	0	$0
	Maintenance SVE	lump sum	$5,700	0	$0	0	$0	1	$5,700	2	$11,400	0	$0	0	$0
	Monitoring Well Maintenance	per well	$600	8	$4,800	120	$72,000	8	$4,800	120	$72,000	8	$4,800	120	$72,000
Subtotal					**$4,800**		**$72,000**		**$35,000**		**$132,400**		**$4,800**		**$72,000**
3	**GRANULAR ACTIVATED CARBON (Years 1,2)**														
	Carbon Replacement	pound	$2	0	$0	0	$0	1200	$2,400	18,000	$36,000	0	$0	0	$0
	Permanganate Replacement	pound	$2	0	$0	0	$0	1400	$2,800	21,000	$42,000	0	$0	0	$0
Subtotal					**$0**		**$0**		**$5,200**		**$78,000**		**$0**		**$0**
4	**SVE Confirmation Sampling (Year 3)**														
	Analytical	each	$230	0	$0	0	$0		$0	15	$3,450	0	$0	0	$0
	Drill Rig	day	$2,300	0	$0	0	$0		$0	2	$4,600	0	$0	0	$0
	Labor	hr	$100	0	$0	0	$0		$0	26	$2,600	0	$0	0	$0
Subtotal					**$0**		**$0**		**$0**		**$10,700**		**$0**		**$0**
5	**SVE Well Abandonment (Year 3)**														
	Well abandonment	linear foot	$30	0	$0	0	$0	15	$450	15	$450	0	$0	0	$0
	Base Price per Well abandonment	each	$230	0	$0	0	$0	3	$690	3	$690	0	$0	0	$0
	Waste Disposal	drum	$170	0	$0	0	$0	4	$680	4	$680	0	$0	0	$0
Subtotal					**$0**		**$0**		**$1,800**		**$1,800**		**$0**		**$0**
6	**QUARTERLY GW MONITORING (Years 1,2)**														
	Sampling	each well	$700	44	$30,800	88	$61,600	52	$36,400	104	$72,800	52	$36,400	104	$72,800
	Analysis	each well	$600	44	$26,400	64	$38,400	52	$31,200	104	$62,400	52	$31,200	104	$62,400
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$80,000**		**$145,600**		**$90,400**		**$180,800**		**$90,400**		**$180,800**
7	**SEMIANNUAL GW MONITORING (Years 3-15)**														
	Sampling	each well	$680	10	$6,800	130	$88,400	10	$6,800	130	$88,400	10	$6,800	130	$88,400
	Analysis	each well	$230	10	$2,300	130	$29,900	10	$2,300	130	$29,900	10	$2,300	130	$29,900
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$20,500**		**$266,500**		**$20,500**		**$266,500**		**$20,500**		**$266,500**
8	**FIVE YEAR GW MONITORING (Years 5,10,15)**														
	Sampling	each well	$700	11	$7,700	33	$23,100	13	$9,100	39	$27,300	13	$9,100	39	$27,300
	Analysis	each well	$570	11	$6,300	33	$18,800	13	$7,400	39	$22,200	13	$7,400	39	$22,200
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$19,700**		**$59,000**		**$22,200**		**$66,600**		**$22,200**		**$66,600**
9	**PROJECT MANAGEMENT**														
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.
5. Enhanced Bioremediation using 500 gallons of sodium lactate per event, Alternatives 1 and 2.
6. Enhanced Bioremediation 4 injections over 2 years (the first injection included as initial cost), Alternatives 1 and 2.
7. Emissions Control 2 years with Rented Catalytic Oxidizer and the following years with Granular Activated Carbon with Permanganate Unit, Alternative 2.

TABLE B2-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
SWMU-172&174
Boeing Renton Facility
Renton, Washington

	ALTERNATIVE 1						ALTERNATIVE 2								ALTERNATIVE 3				
	Source Area Excavation, Enhanced Bioremediation						SVE, Enhanced Bioremediation								MNA				
Year	Initial Costs	O&M	Enh. Bio.	PM	GW Mon.	Total	Initial Costs	O&M	Enh. Bio.	SVE Emissions Control	SVE Conf. and Aband.	PM	GW Mon.	Total	Initial Costs	O&M	PM	GW Mon.	Total
0	$1,121,100					$1,121,100	$406,700							$406,700	$48,600				$48,600
1		$4,800	$28,800	$13,700	$80,000	$127,300		$35,000	$28,800	$5,200		$13,700	$90,400	$173,100		$4,800	$13,700	$90,400	$108,900
2		$4,800	$28,800	$13,700	$80,000	$127,300		$35,000	$28,800	$5,200		$13,700	$90,400	$173,100		$4,800	$13,700	$90,400	$108,900
3		$4,800	$11,200	$13,700	$20,500	$50,200		$4,300	$11,200		$12,500	$13,700	$20,500	$62,200		$4,800	$13,700	$20,500	$39,000
4		$4,800		$13,700	$20,500	$39,000		$4,300				$13,700	$20,500	$38,500		$4,800	$13,700	$20,500	$39,000
5		$4,800		$13,700	$30,000	$48,500		$4,300				$13,700	$32,500	$50,500		$4,800	$13,700	$32,500	$51,000
6		$4,800		$13,700	$20,500	$39,000		$4,300				$13,700	$20,500	$38,500		$4,800	$13,700	$20,500	$39,000
7		$4,800		$13,700	$20,500	$39,000		$4,300				$13,700	$20,500	$38,500		$4,800	$13,700	$20,500	$39,000
8		$4,800		$13,700	$20,500	$39,000		$4,300				$13,700	$20,500	$38,500		$4,800	$13,700	$20,500	$39,000
9		$4,800		$13,700	$20,500	$39,000		$4,300				$13,700	$20,500	$38,500		$4,800	$13,700	$20,500	$39,000
10		$4,800		$13,700	$30,000	$48,500		$4,300				$13,700	$32,500	$50,500		$4,800	$13,700	$32,500	$51,000
11		$4,800		$13,700	$20,500	$39,000		$4,300				$13,700	$20,500	$38,500		$4,800	$13,700	$20,500	$39,000
12		$4,800		$13,700	$20,500	$39,000		$4,300				$13,700	$20,500	$38,500		$4,800	$13,700	$20,500	$39,000
13		$4,800		$13,700	$20,500	$39,000		$4,300				$13,700	$20,500	$38,500		$4,800	$13,700	$20,500	$39,000
14		$4,800		$13,700	$20,500	$39,000		$4,300				$13,700	$20,500	$38,500		$4,800	$13,700	$20,500	$39,000
15		$4,800		$13,700	$30,000	$48,500		$4,300				$13,700	$32,500	$50,500		$4,800	$13,700	$32,500	$51,000
TOTAL	$1,121,100	$72,000	$68,800	$205,500	$455,000	$1,922,400	$406,700	$125,900	$68,800	$10,400	$12,500	$205,500	$483,300	$1,313,100	$48,600	$72,000	$205,500	$483,300	$809,400
					Net Present Value	$1,828,000							**Net Present Value**	$1,225,000				**Net Present Value**	$731,000

Notes
1. Net annual discount rate of 1.4%.

TABLE B3-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
Building 4-78/79
Boeing Renton Facility
Renton, Washington

	INITIAL COSTS	Unit	Unit Cost	ALTERNATIVE 1 Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation		ALTERNATIVE 2 SVE, Enhanced Bioremediation, Monitored Attenuation		ALTERNATIVE 3 Source Area Excavation, MNA	
CONTRACTOR				**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
1	**Mobilization/Demobilization**								
	Mobilization/Demobilization	lump sum	$11,400	4	$45,600	1	$11,400	4	$45,600
2	**Health and Safety**								
	Health and Safety Officer	hour	$85	80	$6,800	20	$1,700	80	$6,800
	Equipment	month	$2,300	2	$4,600	1	$2,300	2	$4,600
	PPE	day	$110	20	$2,200	10	$1,100	20	$2,200
3	**Site Preparation**								
	Utility Locates	hour	$100	20	$2,000	20	$2,000	16	$1,600
	Site Security	linear foot	$5	1,000	$5,000	1,000	$5,000	1,000	$5,000
	Temporary Facilities	month	$3,400	1	$3,400	1	$3,400	1	$3,400
	Traffic Control	lump sum	$1,100	3	$3,300	3	$3,300	3	$3,300
	Erosion Control	linear foot	$6	1,000	$6,000	500	$3,000	1,000	$6,000
	Storm water Management	day	$570	10	$5,700	5	$2,850	10	$5,700
4	**Surveying**								
	Surveying	day	$1,700	3	$5,100	3	$5,100	3	$5,100
5	**Monitoring Wells**								
	Well Abandonment	linear foot	$45	40	$1,800	0	$0	40	$1,800
	Base Price Per Well Abandonment	each	$230	2	$460	0	$0	2	$460
	Monitoring Well Installation (2" PVC)	linear foot	$85	210	$17,850	210	$17,850	210	$17,850
	Base Price Per Well	each	$570	9	$5,130	9	$5,130	9	$5,130
	Waste Disposal	drum	$170	24	$4,080	20	$3,400	24	$4,080
6	**Source Area Excavation**								
	Saw Cut Asphalt (6")	linear foot	$3.5	1,100	$3,850	0	$0	1,100	$3,850
	Excavation	cubic yard	$14	1,150	$16,100	0	$0	1,150	$16,100
	Waste Transportation/Disposal (non-hazardous)	ton	$45	1,900	$85,500	0	$0	1,900	$85,500
	Backfill	ton	$11	1,900	$20,900	0	$0	1,900	$20,900
	Groundwater Management	gallon	$1	6,000	$6,000	0	$0	6,000	$6,000
	ORC into Excavation	pound	$15	800	$12,000	0	$0	0	$0
	Asphalt Paving (6")	square foot	$4.5	5,500	$24,750	0	$0	5,500	$24,750
7	**SVE**								
	Pilot Test	lump sum	$22,800	0	$0	1	$22,800	0	$0
	Soil Vapor Extraction Well Installation (4" PVC)	linear foot	$100	0	$0	240	$24,000	0	$0
	Base Price Per Well	each	$350	0	$0	16	$5,600	0	$0
	Waste Disposal	drum	$170	0	$0	40	$6,800	0	$0
	Knock out pot	each	$2,300	0	$0	1	$2,300	0	$0
	Vacuum Blower	each	$4,000	0	$0	3	$12,000	0	$0
	Granular Activated Carbon	each	$3,400	0	$0	1	$3,400	0	$0
	Permanganate Unit	each	$1,700	0	$0	1	$1,700	0	$0
	Valves	each	$100	0	$0	20	$2,000	0	$0
	Gauges	each	$30	0	$0	20	$600	0	$0
	Treatment Center	lump sum	$13,700	0	$0	1	$13,700	0	$0
	Electrical Service	lump sum	$11,400	0	$0	1	$11,400	0	$0
	Electrical Connections	lump sum	$5,700	0	$0	3	$17,100	0	$0
8	**Trenching**								
	Saw Cut Asphalt (6")	linear foot	$3.5	0	$0	900	$3,150	0	$0
	Excavation	cubic yard	$1	0	$0	130	$130	0	$0
	Waste Transportation/Disposal (non-hazardous)	ton	$45	0	$0	205	$9,230	0	$0
	Backfill	ton	$15	0	$0	205	$3,080	0	$0
	Piping	linear foot	$30	0	$0	450	$13,500	0	$0
	Asphalt Paving (6")	square foot	$4.5	0	$0	1,530	$6,890	0	$0
9	**Enhanced Bioremediation**								
	Injection Wells (4" PVC)	linear foot	$100	210	$21,000	210	$21,000	0	$0
	Base Price Per Well	each	$350	7	$2,450	7	$2,450	0	$0
	Waste Disposal	drum	$170	35	$5,950	35	$5,950	0	$0
	Additive	lb	$6	600	$3,600	600	$3,600	0	$0
	Application (labor and equipment)	per well	$800	7	$5,600	7	$5,600	0	$0
Subtotal					**$326,700**		**$265,500**		**$275,700**
Sales Tax (9.5%)					**$31,000**		**$25,200**		**$26,200**
Subtotal					**$357,700**		**$290,700**		**$301,900**
Contingency (30%)					**$107,300**		**$58,100**		**$90,600**
Subtotal, Contractor					**$465,000**		**$348,800**		**$392,500**
PROFESSIONAL TECHNICAL SERVICES									
	Soil Confirmation Sampling	lump sum	$30,500	1	$30,500	0	$0	1	$30,500
	Permitting	%	5%	$465,000	$23,300	$348,800	$17,400	$392,500	$19,600
	Engineering design costs	%	20%	$465,000	$93,000	$348,800	$69,800	$392,500	$78,500
	Construction Management	%	15%	$465,000	$69,800	$348,800	$52,300	$392,500	$58,900
	Project Management	%	10%	$465,000	$46,500	$348,800	$34,900	$392,500	$39,300
Subtotal, Professional Services					**$263,100**		**$174,400**		**$226,800**
TOTAL INITIAL COST					**$728,100**		**$523,200**		**$619,300**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level C PPE.
5. Waste disposal is non-hazardous solid waste.
6. Soil 1 cubic yard = 1.6 tons
7. Concrete/Asphalt 1 cubic yard = 2 tons
8. Backfill costs assume delivered and placed.
9. Install 3 shallow monitoring wells, 4 intermediate monitoring wells, 1 deep monitoring well, all alternatives.
10. Install 7 injection wells for enhanced bioremediation, Alternatives 1 and 2.
11. SVE would require 16 SVE wells, Alternative 2.
12. Excavation would require abandonment of GW040 and GW031, Alternatives 1 and 3.
13. Excavation costs include AOC-013, AOC-015, AOC-026, AOC-054, and pipeline area, Alternatives 1 and 3.
14. The contingency for Alternative 2 was reduced to 20% to reflect the lower level of uncertainty in this estimate.

TABLE B3-2
IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
Building 4-78/79
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS	Unit	Unit Cost	ALTERNATIVE 1 Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation				ALTERNATIVE 2 SVE, Enhanced Bioremediation, Monitored Attenuation				ALTERNATIVE 3 Source Area Excavation, MNA			
				Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost
1	**ENHANCED BIOREMEDIATION (Years 1,2,3)**														
	Additive	lb	$6	1200	$7,200	2,400	$14,400	1200	$7,200	2,400	$14,400	0	$0	0	$0
	Application (labor and equipment)	per well	$800	14	$11,200	28	$22,400	14	$11,200	28	$22,400	0	$0	0	$0
	Well abandonment (Year 3)	linear foot	$30	210	$6,300	210	$6,300	210	$6,300	210	$6,300	0	$0	0	$0
	Base Price per Well abandonment (Year 3)	each	$230	7	$1,610	7	$1,610	7	$1,610	7	$1,610	0	$0	0	$0
	Waste Disposal (Year 3)	drum	$170	35	$5,950	35	$5,950	35	$5,950	35	$5,950	0	$0	0	$0
Subtotal					**$32,300**		**$50,700**		**$32,300**		**$50,700**		**$0**		**$0**
2	**OPERATION AND MAINTENANCE**														
	Monitoring SVE	annual	$17,100	0	$0	0	$0	1	$17,100	5	$85,500	0	$0	0	$0
	Air Sampling SVE	per well	$500	0	$0	0	$0	10	$5,000	50	$25,000	0	$0	0	$0
	Electricity	monthly	$450	0	$0	0	$0	12	$5,400	60	$27,000	0	$0	0	$0
	Carbon Replacement	pound	$2.5	0	$0	0	$0	600	$1,500	3,000	$7,500	0	$0	0	$0
	Permanganate Replacement	pound	$2	0	$0	0	$0	700	$1,400	3,500	$7,000	0	$0	0	$0
	Maintenance SVE	lump sum	$5,700	0	$0	0	$0	1	$5,700	5	$28,500	0	$0	0	$0
	Monitoring Well Maintenance	per well	$600	12	$7,200	180	$108,000	12	$7,200	180	$108,000	12	$7,200	180	$108,000
Subtotal					**$7,200**		**$108,000**		**$43,300**		**$288,500**		**$7,200**		**$108,000**
3	**SVE Confirmation Sampling (Year 6)**														
	Analytical	lump	$10,200	0	$0	0	$0	1	$10,200	1	$10,200	0	$0	0	$0
	Drill Rig	day	$2,300	0	$0	0	$0	3	$6,900	3	$6,900	0	$0	0	$0
	Labor	hr	$100	0	$0	0	$0	48	$4,800	48	$4,800	0	$0	0	$0
Subtotal					**$0**		**$0**		**$21,900**		**$21,900**		**$0**		**$0**
4	**SVE Well Abandonment (Year 6)**														
	Well abandonment	linear foot	$30	0	$0	0	$0	240	$7,200	240	$7,200	0	$0	0	$0
	Base Price per Well abandonment	each	$230	0	$0	0	$0	16	$3,680	16	$3,680	0	$0	0	$0
	Waste Disposal	drum	$170	0	$0	0	$0	40	$6,800	40	$6,800	0	$0	0	$0
Subtotal					**$0**		**$0**		**$17,680**		**$17,680**		**$0**		**$0**
5	**QUARTERLY GW MONITORING (Years 1,2)**														
	Sampling	each well	$700	56	$39,200	112	$78,400	56	$39,200	112	$78,400	56	$39,200	112	$78,400
	Analysis	each well	$600	56	$33,600	112	$67,200	56	$33,600	112	$67,200	56	$33,600	112	$67,200
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$95,600**		**$191,200**		**$95,600**		**$191,200**		**$95,600**		**$191,200**
6	**SEMIANNUAL GW MONITORING (Years 3-15)**														
	Sampling	each well	$700	6	$4,200	78	$54,600	6	$4,200	78	$54,600	6	$4,200	78	$54,600
	Analysis	each well	$250	6	$1,500	78	$19,500	6	$1,500	78	$19,500	6	$1,500	78	$19,500
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$17,100**		**$222,300**		**$17,100**		**$222,300**		**$17,100**		**$222,300**
7	**FIVE YEAR GW MONITORING (Years 5,10,15)**														
	Sampling	each well	$700	14	$9,800	42	$29,400	14	$9,800	42	$29,400	14	$9,800	42	$29,400
	Analysis	each well	$570	14	$8,000	42	$23,900	14	$8,000	42	$23,900	14	$8,000	42	$23,900
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$23,500**		**$70,400**		**$23,500**		**$70,400**		**$23,500**		**$70,400**
8	**PROJECT MANAGEMENT**														
	Project Management	year	$13,700	1.0	$13,700	15	$205,500	2.0	$27,400	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$27,400**		**$205,500**		**$13,700**		**$205,500**

Notes
1. Based on 2012 Dollars.
2. Costs are +50% -30%.
3. Assumed 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.
5. Enhanced Biodegradation four injections over two years, first event is in implementation costs, Alternatives 1 and 2.

TABLE B3-3
IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
Building 4-78/79
Boeing Renton Facility
Renton, Washington

	ALTERNATIVE 1						ALTERNATIVE 2							ALTERNATIVE 3				
	Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation						SVE, Enhanced Bioremediation, Monitored Attenuation							Source Area Excavation, MNA				
Year	Initial Costs	O&M	Enh. Bio.	PM	GW Mon.	Total	Initial Costs	O&M	SVE Conf. & Aband.	Enh. Bio.	PM	GW Mon.	Total	Initial Costs	O&M	PM	GW Mon.	Total
0	$728,100					$728,100	$523,200						$523,200	$619,300				$619,300
1		$7,200	$18,400	$13,700	$95,600	$134,900		$43,300		$18,400	$27,400	$95,600	$184,700		$7,200	$13,700	$95,600	$116,500
2		$7,200	$18,400	$13,700	$95,600	$134,900		$43,300		$18,400	$27,400	$95,600	$184,700		$7,200	$13,700	$95,600	$116,500
3		$7,200	$13,900	$13,700	$17,100	$51,900		$43,300		$13,900	$27,400	$17,100	$101,700		$7,200	$13,700	$17,100	$38,000
4		$7,200		$13,700	$17,100	$38,000		$43,300			$27,400	$17,100	$87,800		$7,200	$13,700	$17,100	$38,000
5		$7,200		$13,700	$32,100	$53,000		$43,300			$27,400	$32,100	$102,800		$7,200	$13,700	$32,100	$53,000
6		$7,200		$13,700	$17,100	$38,000		$6,600	$39,600		$27,400	$17,100	$90,700		$7,200	$13,700	$17,100	$38,000
7		$7,200		$13,700	$17,100	$38,000		$6,600			$13,700	$17,100	$37,400		$7,200	$13,700	$17,100	$38,000
8		$7,200		$13,700	$17,100	$38,000		$6,600			$13,700	$17,100	$37,400		$7,200	$13,700	$17,100	$38,000
9		$7,200		$13,700	$17,100	$38,000		$6,600			$13,700	$17,100	$37,400		$7,200	$13,700	$17,100	$38,000
10		$7,200		$13,700	$32,100	$53,000		$6,600			$13,700	$32,100	$52,400		$7,200	$13,700	$32,100	$53,000
11		$7,200		$13,700	$17,100	$38,000		$6,600			$13,700	$17,100	$37,400		$7,200	$13,700	$17,100	$38,000
12		$7,200		$13,700	$17,100	$38,000		$6,600			$13,700	$17,100	$37,400		$7,200	$13,700	$17,100	$38,000
13		$7,200		$13,700	$17,100	$38,000		$6,600			$13,700	$17,100	$37,400		$7,200	$13,700	$17,100	$38,000
14		$7,200		$13,700	$17,100	$38,000		$6,600			$13,700	$17,100	$37,400		$7,200	$13,700	$17,100	$38,000
15		$7,200		$13,700	$32,100	$53,000		$6,600			$13,700	$32,100	$52,400		$7,200	$13,700	$32,100	$53,000
TOTAL	$728,100	$108,000	$50,700	$205,500	$458,500	$1,550,800	$523,200	$282,500	$39,600	$50,700	$287,700	$458,500	$1,642,200	$619,300	$108,000	$205,500	$458,500	$1,391,300
					Net Present Value	$1,461,000						**Net Present Value**	$1,538,000				**Net Present Value**	$1,305,000

Notes
1. Net annual discount rate of 1.4%.

TABLE B4-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

		INITIAL COSTS			ALTERNATIVE 1 Existing BS/BV, Monitored Attenuation		ALTERNATIVE 2 Upgrade Existing System, Monitored Attenuation		ALTERNATIVE 3 MNA	
CONTRACTOR			**Unit**	**Unit Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
1	**Mobilization/Demobilization**									
		Mobilization/Demobilization	lump sum	$11,400	0.1	$1,140	1	$11,400	0.1	$1,140
2	**Health and Safety**									
		Health and Safety Officer	hour	$85	4	$340	8	$680	4	$340
		Equipment	month	$2,300	0	$0	1	$2,300	0	$0
		PPE	day	$110	2	$220	8	$880	2	$220
3	**Site Preparation**									
		Utility Locates	hour	$100	4	$400	12	$1,200	4	$400
		Site Security	linear foot	$4.5	100	$450	250	$1,130	100	$450
		Temporary Facilities	month	$3,400	0	$0	1	$3,400	0	$0
		Traffic Control	lump sum	$1,100	1	$1,100	3	$3,300	1	$1,100
		Erosion Control	linear foot	$6	0	$0	250	$1,500	0	$0
		Storm water Management	day	$570	0	$0	4	$2,280	0	$0
4	**Surveying**									
		Surveying	day	$1,700	2	$3,400	2	$3,400	2	$3,400
5	**Monitoring Wells**									
		Monitoring Well Installation (2" PVC)	linear foot	$85	115	$9,780	115	$9,780	115	$9,780
		Base Price Per Well	each	$570	7	$3,990	7	$3,990	7	$3,990
		Waste Disposal	drum	$170	22	$3,740	22	$3,740	22	$3,740
6	**Upgrade Existing System**									
		Air Sparge Installation (2" PVC)	linear foot	$110	0	$0	195	$21,450	0	$0
		Base Price Per Well	each	$340	0	$0	13	$4,420	0	$0
		Waste Disposal	drum	$170	0	$0	46	$7,740	0	$0
		Blower	each	$5,700	0	$0	1	$5,700	0	$0
		Saw Cut Asphalt (6")	linear foot	$3.5	0	$0	600	$2,100	0	$0
		Excavation	cubic yard	$10	0	$0	370	$3,700	0	$0
		Waste Transportation/Disposal (non-hazardous)	ton	$45	0	$0	450	$20,250	0	$0
		Backfill	ton	$15	0	$0	450	$6,750	0	$0
		Piping	linear foot	$30	0	$0	300	$9,000	0	$0
		Asphalt Paving (6")	square foot	$4.5	0	$0	1,000	$4,500	0	$0
Subtotal						**$24,600**		**$134,600**		**$24,600**
Sales Tax (9.5%)						**$2,300**		**$12,800**		**$2,300**
Subtotal						**$26,900**		**$147,400**		**$26,900**
Contingency (30%)						**$8,100**		**$44,200**		**$8,100**
Subtotal, Contractor						**$35,000**		**$191,600**		**$35,000**
PROFESSIONAL TECHNICAL SERVICES										
		Permitting	%	5%	$35,000	$1,750	$191,600	$9,580	$35,000	$1,800
		Engineering design costs	%	20%	$35,000	$7,000	$191,600	$38,320	$35,000	$7,000
		Construction Management	%	15%	$35,000	$5,250	$191,600	$28,740	$35,000	$5,300
		Project Management	%	10%	$35,000	$3,500	$191,600	$19,160	$35,000	$3,500
Subtotal, Professional Services						**$17,500**		**$95,800**		**$17,600**
TOTAL INITIAL COST						**$52,500**		**$287,400**		**$52,600**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level D PPE
5. Waste disposal is non-hazardous solid waste.
6. Boeing providing water.
7. Soil 1 cubic yard = 1.6 tons
8. Concrete/Asphalt 1 cubic yard = 2 tons
9. Backfill costs assume delivered and placed.
10. Installation of 1 new shallow monitoring well and 1 new intermediate monitoring well.

TABLE B4-2

IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS	Unit	Unit Cost	ALTERNATIVE 1 Existing BS/BV, Monitored Attenuation				ALTERNATIVE 2 Upgrade Existing System, Monitored Attenuation				ALTERNATIVE 3 MNA			
				Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost
1	**OPERATION AND MAINTENANCE**														
	BS/BV Operation and Maintenance	year	$51,200	1	$51,200	15	$768,000	1	$51,200	15	$768,000	0	$0	0	$0
	Monitoring Well Maintenance	per well	$600	9	$5,400	135	$81,000	9	$5,400	135	$81,000	9	$5,400	135	$81,000
Subtotal					**$56,600**		**$849,000**		**$56,600**		**$849,000**		**$5,400**		**$81,000**
2	**FIVE YEAR REPLACEMENT COSTS**														
	Blower	each	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100	0	$0	0	$0
Subtotal					**$5,700**		**$17,100**		**$5,700**		**$17,100**		**$0**		**$0**
3	**TEN YEAR REPLACEMENT COSTS**														
	Piping	linear foot	$30	200	$6,000	200	$6,000	300	$9,000	300	$9,000	0	$0	0	$0
Subtotal					**$6,000**		**$6,000**		**$9,000**		**$9,000**		**$0**		**$0**
4	**QUARTERLY GW MONITORING (Years 1,2)**														
	Sampling	each well	$680	28	$19,040	56	$38,080	28	$19,040	56	$38,080	28	$19,040	56	$38,080
	Analysis	each well	$570	28	$15,960	56	$31,920	28	$15,960	56	$31,920	28	$15,960	56	$31,920
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$57,800**		**$115,600**		**$57,800**		**$115,600**		**$57,800**		**$115,600**
5	**SEMIANNUAL GW MONITORING (Years 3-15)**														
	Sampling	each well	$680	16	$10,880	208	$141,440	16	$10,880	208	$141,440	16	$10,880	208	$141,440
	Analysis	each well	$230	16	$3,680	208	$47,840	16	$3,680	208	$47,840	16	$3,680	208	$47,840
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$26,000**		**$337,500**		**$26,000**		**$337,500**		**$26,000**		**$337,500**
6	**FIVE YEAR GW MONITORING (Years 5,10,15)**														
	Sampling	each well	$680	9	$6,100	27	$18,400	9	$6,100	27	$18,400	9	$6,100	27	$18,400
	Analysis	each well	$570	9	$5,100	27	$15,400	9	$5,100	27	$15,400	9	$5,100	27	$15,400
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$16,900**		**$50,900**		**$16,900**		**$50,900**		**$16,900**		**$50,900**
7	**PROJECT MANAGEMENT**														
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.

TABLE B4-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

	ALTERNATIVE 1						ALTERNATIVE 2						ALTERNATIVE 3				
	Existing BS/BV, Monitored Attenuation						Upgrade Existing System, Monitored Attenuation						MNA				
Year	Initial Costs	O&M	Five and Ten Year Replacement Costs	PM	GW Mon.	Total	Initial Costs	O&M	Five and Ten Year Replacement Costs	PM	GW Mon.	Total	Initial Costs	O&M	PM	GW Mon.	Total
0	$52,500					$52,500	$287,400					$287,400	$52,600				$52,600
1		$56,600		$13,700	$57,800	$128,100		$56,600		$13,700	$57,800	$128,100		$5,400	$13,700	$57,800	$76,900
2		$56,600		$13,700	$57,800	$128,100		$56,600		$13,700	$57,800	$128,100		$5,400	$13,700	$57,800	$76,900
3		$56,600		$13,700	$26,000	$96,300		$56,600		$13,700	$26,000	$96,300		$5,400	$13,700	$26,000	$45,100
4		$56,600		$13,700	$26,000	$96,300		$56,600		$13,700	$26,000	$96,300		$5,400	$13,700	$26,000	$45,100
5		$56,600	$5,700	$13,700	$29,900	$105,900		$56,600	$5,700	$13,700	$29,900	$105,900		$5,400	$13,700	$29,900	$49,000
6		$56,600		$13,700	$26,000	$96,300		$56,600		$13,700	$26,000	$96,300		$5,400	$13,700	$26,000	$45,100
7		$56,600		$13,700	$26,000	$96,300		$56,600		$13,700	$26,000	$96,300		$5,400	$13,700	$26,000	$45,100
8		$56,600		$13,700	$26,000	$96,300		$56,600		$13,700	$26,000	$96,300		$5,400	$13,700	$26,000	$45,100
9		$56,600		$13,700	$26,000	$96,300		$56,600		$13,700	$26,000	$96,300		$5,400	$13,700	$26,000	$45,100
10		$56,600	$14,700	$13,700	$29,900	$114,900		$56,600	$14,700	$13,700	$29,900	$114,900		$5,400	$13,700	$29,900	$49,000
11		$56,600		$13,700	$26,000	$96,300		$56,600		$13,700	$26,000	$96,300		$5,400	$13,700	$26,000	$45,100
12		$56,600		$13,700	$26,000	$96,300		$56,600		$13,700	$26,000	$96,300		$5,400	$13,700	$26,000	$45,100
13		$56,600		$13,700	$26,000	$96,300		$56,600		$13,700	$26,000	$96,300		$5,400	$13,700	$26,000	$45,100
14		$56,600		$13,700	$26,000	$96,300		$56,600		$13,700	$26,000	$96,300		$5,400	$13,700	$26,000	$45,100
15		$56,600	$5,700	$13,700	$29,900	$105,900		$56,600	$5,700	$13,700	$29,900	$105,900		$5,400	$13,700	$29,900	$49,000
TOTAL	$52,500	$849,000		$205,500	$465,300	$1,598,400	$287,400	$849,000	$26,100	$205,500	$465,300	$1,833,300	$52,600	$81,000	$205,500	$465,300	$804,400
					Net Present Value	$1,423,000					**Net Present Value**	$1,654,000				**Net Present Value**	$721,000

Notes
1. Net annual discount rate of 1.4%

TABLE B5-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
AOC-001,002
Boeing Renton Facility
Renton, Washington

INITIAL COSTS					ALTERNATIVE 1 Enhanced Bioremediation, Monitored Attenuation		ALTERNATIVE 2 Monitored Natural Attenuation	
CONTRACTOR			**Unit**	**Unit Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
1	**Mobilization/Demobilization**							
		Mobilization/Demobilization	lump sum	$11,400	1	$11,400	0.5	$5,700
2	**Health and Safety**							
		Health and Safety Officer	hour	$85	8	$680	4	$340
		Equipment	month	$2,300	0.5	$1,150	0	$0
		PPE	day	$110	5	$550	0	$0
3	**Site Preparation**							
		Utility Locates	hour	$100	8	$800	8	$800
		Site Security	linear foot	$4.5	100	$450	100	$450
		Temporary Facilities	month	$3,400	0	$0	0	$0
		Traffic Control	lump sum	$1,100	0	$0	0	$0
		Erosion Control	linear foot	$6	100	$600	100	$600
		Storm water Management	day	$570	0	$0	0	$0
4	**Surveying**							
		Surveying	day	$1,700	1	$1,700	1	$1,700
5	**Monitoring Wells**							
		Concrete Coring	day	$1,700	1	$1,700	1	$1,700
		Monitoring Well Installation (2" PVC)	linear foot	$85	120	$10,200	120	$10,200
		Base Price Per Well	each	$570	4	$2,280	4	$2,280
		Waste Disposal	drum	$170	16	$2,720	16	$2,720
6	**Enhanced Bioremediation**							
		Injection Wells (4" PVC)	linear foot	$110	50	$5,500	0	$0
		Base Price Per Well	each	$340	3	$1,020	0	$0
		Waste Disposal	drum	$170	8	$1,360	0	$0
Subtotal						**$42,100**		**$26,500**
Sales Tax (9.5%)						**$4,000**		**$2,500**
Subtotal						**$46,100**		**$29,000**
Contingency (30%)						**$13,800**		**$8,700**
Subtotal, Contractor						**$59,900**		**$37,700**
PROFESSIONAL TECHNICAL SERVICES								
		Investigation	lump sum	$10,200	0	$0	0	$0
		Permitting	%	5%	$59,900	$3,000	$37,700	$1,890
		Engineering design costs	%	20%	$59,900	$11,980	$37,700	$7,540
		Construction Management	%	15%	$59,900	$8,990	$37,700	$5,660
		Project Management	%	10%	$59,900	$5,990	$37,700	$3,770
Subtotal, Professional Services						**$30,000**		**$18,900**
TOTAL INITIAL COST						**$89,900**		**$56,600**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level B PPE.
5. Waste disposal is 60% hazardous and 40% non-hazardous solid waste.
6. Soil 1 cubic yard = 1.6 tons
7. Concrete/Asphalt 1 cubic yard = 2 tons
8. Backfill costs assume delivered and placed.
9. Installation of 2 shallow monitoring wells and 4 deep monitoring wells, all alternatives.

TABLE B5-2

IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
AOC-001,002
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS	Unit	Unit Cost	ALTERNATIVE 1 Enhanced Bioremediation, Monitored Attenuation: Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	ALTERNATIVE 2 Monitored Natural Attenuation: Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost
1	**ENHANCED BIOREMEDIATION (Years 1,2,3, and 4)**										
	Additive (wells)	lbs	$5	3,600	$18,000	3,600	$18,000	0	$0	0	$0
	Application (labor and equipment)	per well	$800	3	$2,400	9	$7,200	0	$0	0	$0
	Additive (horizontal pipes)	lbs	$5	400	$2,000	1,200	$6,000	0	$0	0	$0
	Application (labor and equipment)	per well	$800	4	$3,200	4	$3,200	0	$0	0	$0
	Injection Well Abandonment (year 4)	linear ft	$30	50	$1,500	50	$1,500	0	$0	0	$0
	Base price per well abandonment (year 4)	each	$300	3	$900	3	$900	0	$0	0	$0
	Waste Disposal (year 4)	drum	$200	8	$1,600	8	$1,600	0	$0	0	$0
Subtotal					**$29,600**		**$38,400**		**$0**		**$0**
2	**OPERATION AND MAINTENANCE**										
	Monitoring Well Maintenance	per well	$600	9	$5,400	135	$81,000	9	$5,400	135	$81,000
Subtotal					**$5,400**		**$81,000**		**$5,400**		**$81,000**
3	**QUARTERLY GW MONITORING (Years 1-2)**										
	Sampling	each well	$680	36	$24,480	72	$48,960	36	$24,480	72	$48,960
	Analysis	each well	$570	36	$20,520	72	$41,040	36	$20,520	72	$41,040
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$67,800**		**$135,600**		**$67,800**		**$135,600**
4	**SEMIANNUAL GW MONITORING (Years 3-15)**										
	Sampling	each well	$680	10	$6,800	130	$88,400	10	$6,800	130	$88,400
	Analysis	each well	$230	10	$2,300	130	$29,900	10	$2,300	130	$29,900
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$20,500**		**$266,500**		**$20,500**		**$266,500**
5	**FIVE YEAR GW MONITORING (Years 5,10,15)**										
	Sampling	each well	$700	9	$6,300	27	$18,900	9	$6,300	27	$18,900
	Analysis	each well	$570	9	$5,100	27	$15,400	9	$5,100	27	$15,400
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$17,100**		**$51,400**		**$17,100**		**$51,400**
6	**PROJECT MANAGEMENT**										
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.
5. Enhanced Biodegradation 10 injections over 5 years (first injection as part of implementation costs), Alternative 1.

TABLE B5-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
AOC-001,002
Boeing Renton Facility
Renton, Washington

	ALTERNATIVE 1						ALTERNATIVE 2				
	Enhanced Bioremediation, Monitored Attenuation						Monitored Natural Attenuation				
Year	Initial Costs	O&M	Enh. Bio.	PM	GW Mon.	Total	Initial Costs	O&M	PM	GW Mon.	Total
0	$89,900					$89,900	$56,600				$56,600
1		$5,400	$25,600	$13,700	$67,800	$112,500		$5,400	$13,700	$67,800	$86,900
2		$5,400	$5,200	$13,700	$67,800	$92,100		$5,400	$13,700	$67,800	$86,900
3		$5,400	$5,200	$13,700	$20,500	$44,800		$5,400	$13,700	$20,500	$39,600
4		$5,400	$4,000	$13,700	$20,500	$43,600		$5,400	$13,700	$20,500	$39,600
5		$5,400		$13,700	$27,400	$46,500		$5,400	$13,700	$27,400	$46,500
6		$5,400		$13,700	$20,500	$39,600		$5,400	$13,700	$20,500	$39,600
7		$5,400		$13,700	$20,500	$39,600		$5,400	$13,700	$20,500	$39,600
8		$5,400		$13,700	$20,500	$39,600		$5,400	$13,700	$20,500	$39,600
9		$5,400		$13,700	$20,500	$39,600		$5,400	$13,700	$20,500	$39,600
10		$5,400		$13,700	$27,400	$46,500		$5,400	$13,700	$27,400	$46,500
11		$5,400		$13,700	$20,500	$39,600		$5,400	$13,700	$20,500	$39,600
12		$5,400		$13,700	$20,500	$39,600		$5,400	$13,700	$20,500	$39,600
13		$5,400		$13,700	$20,500	$39,600		$5,400	$13,700	$20,500	$39,600
14		$5,400		$13,700	$20,500	$39,600		$5,400	$13,700	$20,500	$39,600
15		$5,400		$13,700	$27,400	$46,500		$5,400	$13,700	$27,400	$46,500
TOTAL	$89,900	$81,000	$40,000	$205,500	$422,800	$839,200	$56,600	$81,000	$205,500	$422,800	$765,900
					Net Present Value	$761,000				**Net Present Value**	$690,000

Notes
1. Net annual discount rate of 1.4%.

TABLE B6-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
AOC-003
Boeing Renton Facility
Renton, Washington

	INITIAL COSTS				ALTERNATIVE 1 MNA		ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation	
CONTRACTOR			**Unit**	**Unit Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
1	**Mobilization/Demobilization**							
		Mobilization/Demobilization	lump sum	$11,400	0.1	$1,140	0.3	$3,420
2	**Health and Safety**							
		Health and Safety Officer	hour	$85	0	$0	8	$680
		PPE	day	$110	0	$0	2	$220
3	**Site Preparation**							
		Utility Locates	hour	$100	4	$400	4	$400
		Site Security	linear foot	$4.5	0	$0	100	$450
		Erosion Control	linear foot	$6	0	$0	100	$600
4	**Surveying**							
		Surveying	day	$1,700	1	$1,700	1	$1,700
5	**Monitoring Wells**							
		Concrete Coring	day	$1,700	1	$1,700	1	$1,700
		Monitoring Well Installation (2"	linear foot	$85	58	$4,930	58	$4,930
		Base Price Per Well	each	$570	3	$1,710	2	$1,140
		Waste Disposal	drum	$170	8	$1,360	8	$1,360
6	**Enhanced Bioremediation**							
		Concrete Coring	day	$1,700	0	$0	1	$1,700
		Injection Wells (2" PVC)	linear foot	$110	0	$0	80	$8,800
		Base Price Per Well	each	$570	0	$0	4	$2,280
		Waste Disposal	drum	$170	0	$0	8	$1,360
		Additive	lbs	$6	0	$0	330	$1,980
		Application (labor and equipment)	per well	$800	0	$0	4	$3,200
Subtotal						**$12,900**		**$35,900**
Sales Tax (9.5%)						**$1,200**		**$3,400**
Subtotal						**$14,100**		**$39,300**
Contingency (30%)						**$4,200**		**$11,800**
Subtotal, Contractor						**$18,300**		**$51,100**
PROFESSIONAL TECHNICAL SERVICES								
		Permitting	%	5%	$18,300	$900	$51,100	$2,600
		Engineering design costs	%	20%	$18,300	$3,700	$51,100	$10,200
		Construction Management	%	15%	$18,300	$2,700	$51,100	$7,700
		Project Management	%	10%	$18,300	$1,800	$51,100	$5,100
Subtotal, Professional Services						**$9,100**		**$25,600**
TOTAL INITIAL COST						**$27,400**		**$76,700**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level D PPE.
5. Waste disposal is solid waste.
6. Soil 1 cubic yard = 1.6 tons
7. Concrete/Asphalt 1 cubic yard = 2 tons
8. Backfill costs assume delivered and placed.
9. Install 1 shallow monitoring well and 1 intermediate monitoring well, all alternatives.
10. Assume no pilot test for enhanced biodegradation, Alternative 2.

TABLE B6-2

IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
AOC-003
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS			ALTERNATIVE 1 MNA				ALTERNATIVE 2 Attenuation			
		Unit	Unit Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost
1	**ENHANCED BIODEGRADATION (Years 1,2,3)**										
	Additive	lbs	$6	0	$0	0	$0	330	$1,980	660	$3,960
	Application (labor and equipment	per well	$800	0	$0	0	$0	4	$3,200	8	$6,400
	Well abandonment (year 3)	linear foot	$30	0	$0	0	$0	80	$2,400	80	$2,400
	Base price per well abandonment (year 3)	each	$230	0	$0	0	$0	4	$920	4	$920
	Waste Disposal (year 3)	drum	$170	0	$0	0	$0	8	$1,360	8	$1,360
Subtotal					**$0**		**$0**		**$9,900**		**$15,000**
2	**OPERATION AND MAINTENANCE**										
	Monitoring Well Maintenance	per well	$570	3	$1,710	45	$25,650	3	$1,710	45	$25,650
Subtotal					**$1,700**		**$25,700**		**$1,700**		**$25,700**
3	**QUARTERLY GW MONITORING (Years 1,2)**										
	Sampling	each well	$700	16	$11,200	32	$22,400	16	$11,200	32	$22,400
	Analysis	each well	$570	16	$9,120	32	$18,240	16	$9,120	32	$18,240
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$43,100**		**$86,200**		**$43,100**		**$86,200**
4	**SEMIANNUAL GW MONITORING (Years 3-15)**										
	Sampling	each well	$700	8	$5,600	104	$72,800	8	$5,600	104	$72,800
	Analysis	each well	$230	8	$1,840	104	$23,920	8	$1,840	104	$23,920
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$18,800**		**$244,900**		**$18,800**		**$244,900**
5	**FIVE YEAR GW MONITORING (Years 5,10,15)**										
	Sampling	each well	$700	4	$2,800	12	$8,400	4	$2,800	12	$8,400
	Analysis	each well	$570	4	$2,300	12	$6,800	4	$2,300	12	$6,800
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$10,800**		**$32,300**		**$10,800**		**$32,300**
6	**PROJECT MANAGEMENT**										
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.
5. Single application of Enhanced Biodegradation, Alternative 2.

TABLE B6-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
AOC-003
Boeing Renton Facility
Renton, Washington

	ALTERNATIVE 1					ALTERNATIVE 2					
	MNA					Enhanced Bioremediation, Monitored Attenuation					
Year	Initial Costs	O&M	PM	GW Mon.	Total	Initial Costs	O&M	Enh. Bio.	PM	GW Mon.	Total
0	$27,400				$27,400	$76,700					$76,700
1		$1,700	$13,700	$43,100	$58,500		$1,700	$5,200	$13,700	$43,100	$63,700
2		$1,700	$13,700	$43,100	$58,500		$1,700	$5,200	$13,700	$43,100	$63,700
3		$1,700	$13,700	$18,800	$34,200		$1,700	$4,700	$13,700	$18,800	$38,900
4		$1,700	$13,700	$18,800	$34,200		$1,700		$13,700	$18,800	$34,200
5		$1,700	$13,700	$20,200	$35,600		$1,700		$13,700	$20,200	$35,600
6		$1,700	$13,700	$18,800	$34,200		$1,700		$13,700	$18,800	$34,200
7		$1,700	$13,700	$18,800	$34,200		$1,700		$13,700	$18,800	$34,200
8		$1,700	$13,700	$18,800	$34,200		$1,700		$13,700	$18,800	$34,200
9		$1,700	$13,700	$18,800	$34,200		$1,700		$13,700	$18,800	$34,200
10		$1,700	$13,700	$20,200	$35,600		$1,700		$13,700	$20,200	$35,600
11		$1,700	$13,700	$18,800	$34,200		$1,700		$13,700	$18,800	$34,200
12		$1,700	$13,700	$18,800	$34,200		$1,700		$13,700	$18,800	$34,200
13		$1,700	$13,700	$18,800	$34,200		$1,700		$13,700	$18,800	$34,200
14		$1,700	$13,700	$18,800	$34,200		$1,700		$13,700	$18,800	$34,200
15		$1,700	$13,700	$20,200	$35,600		$1,700		$13,700	$20,200	$35,600
TOTAL	$27,400	$25,500	$205,500	$334,800	$593,200	$76,700	$25,500	$15,100	$205,500	$334,800	$657,600
				Net Present Value	$531,000					**Net Present Value**	$594,000

Notes
1. Net annual discount rate of 1.4%.

TABLE B7-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
AOC-004
Boeing Renton Facility
Renton, Washington

		INITIAL COSTS			ALTERNATIVE 1 MNA		ALTERNATIVE 2 Enhanced Bioremediation and Monitored Attenuation	
CONTRACTOR			**Unit**	**Unit Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
1	**Mobilization/Demobilization**							
		Mobilization/Demobilization	lump sum	$11,400	0.1	$1,140	0.5	$5,700
2	**Health and Safety**							
		Health and Safety Officer	hour	$85	0	$0	8	$680
		Equipment	month	$2,300	0	$0	1	$2,300
		PPE	day	$110	0	$0	8	$880
3	**Site Preparation**							
		Utility Locates	hour	$100	4	$400	8	$800
		Site Security	linear foot	$4.5	100	$450	200	$900
		Temporary Facilities	month	$3,400	0	$0	0.5	$1,700
		Traffic Control	lump sum	$1,100	0	$0	2	$2,200
		Erosion Control	linear foot	$6	100	$600	200	$1,200
		Storm water Management	day	$570	0	$0	2	$1,140
4	**Source Area Excavation**							
		Saw Cut Concrete (12")	linear foot	$8	40	$320	40	$320
		Excavation	cubic yard	$14	15	$210	15	$210
		Waste Transportation/Disposal	ton	$45	26	$1,170	26	$1,170
		Backfill	ton	$14	26	$360	26	$360
		Groundwater Management	gallon	$3.5	1,000	$3,500	1,000	$3,500
		Concrete (12") with rebar	square foot	$17	100	$1,700	100	$1,700
5	**Surveying**							
		Surveying	day	$1,700	1	$1,700	2	$3,400
6	**Monitoring Wells**							
		Monitoring Well Installation (2" PVC)	linear foot	$85	55	$4,680	55	$4,680
		Base Price Per Well	each	$570	3	$1,710	3	$1,710
		Waste Disposal	drum	$170	12	$2,040	12	$1,800
7	**Enhanced Bioremediation**							
		Direct Push Rig	day	$2,300	0	$0	1	$2,300
		Coring	day	$1,700	0	$0	2	$3,400
		Chemical	pound	$17	0	$0	300	$5,100
		Application (equipment)	day	$570	0	$0	1	$570
Subtotal						**$20,000**		**$47,700**
Sales Tax (9.5%)						**$1,900**		**$4,530**
Subtotal						**$21,900**		**$52,230**
Contingency (30%)						**$6,600**		**$15,700**
Subtotal, Contractor						**$28,500**		**$67,900**
PROFESSIONAL TECHNICAL SERVICES								
		Permitting	%	5%	$28,500	$1,400	$67,900	$3,400
		Engineering design costs	%	20%	$28,500	$5,700	$67,900	$13,600
		Construction Management	%	15%	$28,500	$4,300	$67,900	$10,200
		Project Management	%	10%	$28,500	$2,900	$67,900	$6,800
Subtotal, Professional Services						**$14,300**		**$34,000**
TOTAL INITIAL COST						**$42,800**		**$101,900**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Leve D PPE.
5. Waste disposal is solid waste.
6. Soil 1 cubic yard = 1.6 tons
7. Concrete/Asphalt 1 cubic yard = 2 tons
8. Backfill costs assume delivered and placed.
9. Installation of 2 shallow monitoring wells and 1 intermediate monitoring well, all alternatives.

TABLE B7-2

IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
AOC-004
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS	Unit	Unit Cost	ALTERNATIVE 1 MNA Annual Quantity	ALTERNATIVE 1 MNA Annual Cost	ALTERNATIVE 1 MNA Lifetime Quantity	ALTERNATIVE 1 MNA Lifetime Cost	ALTERNATIVE 2 Enhanced Bioremediation and Monitored Attenuation Annual Quantity	ALTERNATIVE 2 Enhanced Bioremediation and Monitored Attenuation Annual Cost	ALTERNATIVE 2 Enhanced Bioremediation and Monitored Attenuation Lifetime Quantity	ALTERNATIVE 2 Enhanced Bioremediation and Monitored Attenuation Lifetime Cost
1	**OPERATION AND MAINTENANCE**										
	Monitoring Well Maintenance	per well	$570	3	$1,710	45	$25,650	3	$1,710	45	$25,650
Subtotal					**$1,700**		**$25,700**		**$1,700**		**$25,700**
2	**QUARTERLY GW MONITORING (Years 1,2)**										
	Sampling	each well	$680	12	$8,160	24	$16,320	12	$8,160	24	$16,320
	Analysis	each well	$570	12	$6,840	24	$13,680	12	$6,840	24	$13,680
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$37,800**		**$75,600**		**$37,800**		**$75,600**
3	**SEMIANNUAL GW MONITORING (Years 3-15)**										
	Sampling	each well	$680	4	$2,720	52	$35,360	4	$2,720	52	$35,360
	Analysis	each well	$230	4	$920	52	$11,960	4	$920	52	$11,960
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$15,000**		**$195,500**		**$15,000**		**$195,500**
4	**FIVE YEAR GW MONITORING (Years 5,10,15)**										
	Sampling	each well	$680	3	$2,000	9	$6,100	3	$2,000	9	$6,100
	Analysis	each well	$570	3	$1,700	9	$5,100	3	$1,700	9	$5,100
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$9,400**		**$28,300**		**$9,400**		**$28,300**
5	**PROJECT MANAGEMENT**										
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.

TABLE B7-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
AOC-004
Boeing Renton Facility
Renton, Washington

Year	ALTERNATIVE 1 – MNA					ALTERNATIVE 2 – Enhanced Bioremediation and Monitored Attenuation				
	Initial Costs	O&M	PM	GW Mon.	Total	Initial Costs	O&M	PM	GW Mon.	Total
0	$42,800				$42,800	$101,900				$101,900
1		$1,700	$13,700	$37,800	$53,200		$1,700	$13,700	$37,800	$53,200
2		$1,700	$13,700	$37,800	$53,200		$1,700	$13,700	$37,800	$53,200
3		$1,700	$13,700	$15,000	$30,400		$1,700	$13,700	$15,000	$30,400
4		$1,700	$13,700	$15,000	$30,400		$1,700	$13,700	$15,000	$30,400
5		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
6		$1,700	$13,700	$15,000	$30,400		$1,700	$13,700	$15,000	$30,400
7		$1,700	$13,700	$15,000	$30,400		$1,700	$13,700	$15,000	$30,400
8		$1,700	$13,700	$15,000	$30,400		$1,700	$13,700	$15,000	$30,400
9		$1,700	$13,700	$15,000	$30,400		$1,700	$13,700	$15,000	$30,400
10		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
11		$1,700	$13,700	$15,000	$30,400		$1,700	$13,700	$15,000	$30,400
12		$1,700	$13,700	$15,000	$30,400		$1,700	$13,700	$15,000	$30,400
13		$1,700	$13,700	$15,000	$30,400		$1,700	$13,700	$15,000	$30,400
14		$1,700	$13,700	$15,000	$30,400		$1,700	$13,700	$15,000	$30,400
15		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
TOTAL	$42,800	$25,500	$205,500	$276,300	$550,100	$101,900	$25,500	$205,500	$276,300	$609,200
				Net Present Value	$494,000				**Net Present Value**	$553,000

Notes
1. Net annual discount rateo of 1.4%.

TABLE B8-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
AOC-034/035
Boeing Renton Facility
Renton, Washington

INITIAL COSTS			Unit	Unit Cost	ALTERNATIVE 1 MNA Quantity	ALTERNATIVE 1 MNA Cost	ALTERNATIVE 2 Bioremediation, Monitored Attenuation Quantity	ALTERNATIVE 2 Bioremediation, Monitored Attenuation Cost
CONTRACTOR								
1	**Mobilization/Demobilization**							
		Mobilization/Demobilization	lump sum	$11,400	0.1	$1,140	0.3	$3,420
2	**Health and Safety**							
		Health and Safety Officer	hour	$85	4	$340	8	$680
		PPE	day	$110	1	$110	2	$220
3	**Site Preparation**							
		Utility Locates	hour	$100	4	$400	4	$400
		Site Security	linear foot	$4.5	100	$450	100	$450
		Erosion Control	linear foot	$6	100	$600	100	$600
4	**Surveying**							
		Surveying	day	$1,700	1	$1,700	1	$1,700
5	**Monitoring Wells**							
		Concrete Coring	day	$1,700	1	$1,700	1	$1,700
		Monitoring Well Installation (2" PVC)	linear foot	$85	60	$5,100	60	$5,100
		Base Price Per Well	each	$570	4	$2,280	4	$2,280
		Waste Disposal	drum	$170	14	$2,380	14	$2,380
6	**Enhanced Bioremediation**							
		Concrete Coring	day	$1,700	0	$0	2	$3,400
		Injection Wells (2" PVC)	linear foot	$110	0	$0	60	$6,600
		Base Price Per Well	each	$570	0	$0	4	$2,280
		Waste Disposal	drum	$170	0	$0	8	$1,360
Subtotal						**$16,200**		**$32,600**
Sales Tax (9.5%)						**$1,500**		**$3,100**
Subtotal						**$17,700**		**$35,700**
Contingency (30%)						**$5,300**		**$10,700**
Subtotal, Contractor						**$23,000**		**$46,400**
PROFESSIONAL TECHNICAL SERVICES								
		Permitting	%	5%	$23,000	$1,200	$46,400	$2,300
		Engineering design costs	%	20%	$23,000	$4,600	$46,400	$9,300
		Construction Management	%	15%	$23,000	$3,500	$46,400	$7,000
		Project Management	%	10%	$23,000	$2,300	$46,400	$4,600
Subtotal, Professional Services						**$11,600**		**$23,200**
TOTAL INITIAL COST						**$34,600**		**$69,600**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level D PPE.
5. Waste disposal is solid waste.
6. Soil 1 cubic yard = 1.6 tons
7. Concrete/Asphalt 1 cubic yard = 2 tons
8. Backfill costs assume delivered and placed.
9. Install 1 shallow monitoring well and 1 intermediate monitoring well, all alternatives.
10. Assume no pilot test for enhanced biodegradation, Alternative 2.

TABLE B8-2

IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
AOC-034/035
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS	Unit	Unit Cost	ALTERNATIVE 1 MNA Annual Quantity	ALTERNATIVE 1 MNA Annual Cost	ALTERNATIVE 1 MNA Lifetime Quantity	ALTERNATIVE 1 MNA Lifetime Cost	ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation Annual Quantity	ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation Annual Cost	ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation Lifetime Quantity	ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation Lifetime Cost
1	**ENHANCED BIODEGRADATION (Years 1,2,3)**										
	Additive	lbs	$6	0	$0	0	$0	330	$1,980	660	$3,960
	Application (labor and equipment	per well	$800	0	$0	0	$0	4	$3,200	8	$6,400
	Well abandonment (year 3)	linear foot	$30	0	$0	0	$0	60	$1,800	60	$1,800
	Base price per well abandonment (year 3)	each	$230	0	$0	0	$0	4	$920	4	$920
	Waste Disposal (year 3)	drum	$170	0	$0	0	$0	8	$1,360	8	$1,360
Subtotal					**$0**		**$0**		**$9,300**		**$14,400**
2	**OPERATION AND MAINTENANCE**										
	Monitoring Well Maintenance	per well	$570	2	$1,140	30	$17,100	2	$1,140	30	$17,100
Subtotal					**$1,100**		**$17,100**		**$1,100**		**$17,100**
3	**QUARTERLY GW MONITORING (Years 1,2)**										
	Sampling	each well	$680	16	$10,880	32	$21,760	16	$10,880	32	$21,760
	Analysis	each well	$570	16	$9,120	32	$18,240	16	$9,120	32	$18,240
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$42,800**		**$85,600**		**$42,800**		**$85,600**
4	**SEMIANNUAL GW MONITORING (Years 3-15)**										
	Sampling	each well	$680	4	$2,720	52	$35,360	4	$2,720	52	$35,360
	Analysis	each well	$230	4	$920	52	$11,960	4	$920	52	$11,960
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$15,000**		**$195,500**		**$15,000**		**$195,500**
5	**FIVE YEAR GW MONITORING (Years 5,10,15)**										
	Sampling	each well	$680	4	$2,700	12	$8,200	4	$2,700	12	$8,200
	Analysis	each well	$570	4	$2,300	12	$6,800	4	$2,300	12	$6,800
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$10,700**		**$32,100**		**$10,700**		**$32,100**
6	**PROJECT MANAGEMENT**										
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.
5. Single application of Enhanced Biodegradation, Alternative 2.

TABLE B8-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
AOC-034/035
Boeing Renton Facility
Renton, Washington

Year	ALTERNATIVE 1 MNA					ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation					
	Costs	O&M	PM	GW Mon.	Total	Costs	O&M	Enh. Bio.	PM	GW Mon.	Total
0	$34,600				$34,600	$69,600					$69,600
1		$1,100	$13,700	$42,800	$57,600		$1,100	$5,200	$13,700	$42,800	$62,800
2		$1,100	$13,700	$42,800	$57,600		$1,100	$5,200	$13,700	$42,800	$62,800
3		$1,100	$13,700	$15,000	$29,800		$1,100	$4,100	$13,700	$15,000	$33,900
4		$1,100	$13,700	$15,000	$29,800		$1,100		$13,700	$15,000	$29,800
5		$1,100	$13,700	$18,200	$33,000		$1,100		$13,700	$18,200	$33,000
6		$1,100	$13,700	$15,000	$29,800		$1,100		$13,700	$15,000	$29,800
7		$1,100	$13,700	$15,000	$29,800		$1,100		$13,700	$15,000	$29,800
8		$1,100	$13,700	$15,000	$29,800		$1,100		$13,700	$15,000	$29,800
9		$1,100	$13,700	$15,000	$29,800		$1,100		$13,700	$15,000	$29,800
10		$1,100	$13,700	$18,200	$33,000		$1,100		$13,700	$18,200	$33,000
11		$1,100	$13,700	$15,000	$29,800		$1,100		$13,700	$15,000	$29,800
12		$1,100	$13,700	$15,000	$29,800		$1,100		$13,700	$15,000	$29,800
13		$1,100	$13,700	$15,000	$29,800		$1,100		$13,700	$15,000	$29,800
14		$1,100	$13,700	$15,000	$29,800		$1,100		$13,700	$15,000	$29,800
15		$1,100	$13,700	$18,200	$33,000		$1,100		$13,700	$18,200	$33,000
TOTAL	$34,600	$16,500	$205,500	$290,200	$546,800	$69,600	$16,500	$14,500	$205,500	$290,200	$596,300
Net Present Value					$491,000	**Net Present Value**					$540,000

Notes
1. Net annual disounct rate of 1.4%.

TABLE B9-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
AOC-060
Boeing Renton Facility
Renton, Washington

		INITIAL COSTS			ALTERNATIVE 1 MNA		ALTERNATIVE 2 Bioremediation, Monitored Attenuation		ALTERNATIVE 3 Air Sparge, SVE, Monitored Attenuation	
CONTRACTOR			**Unit**	**Unit Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
1	**Mobilization/Demobilization**									
		Mobilization/Demobilization	lump sum	$11,400	0.2	$2,280	0.5	$5,700	2	$22,800
2	**Health and Safety**									
		Health and Safety Officer	hour	$85	4	$340	8	$680	16	$1,360
		Equipment	month	$2,300	0	$0	0	$0	1	$2,300
		PPE	day	$110	2	$220	4	$440	10	$1,100
3	**Site Preparation**									
		Utility Locates	hour	$100	4	$400	8	$800	8	$800
		Site Security	linear foot	$4.5	100	$450	200	$900	250	$1,130
		Temporary Facilities	month	$3,400	0	$0	0	$0	1	$3,400
		Traffic Control	lump sum	$1,100	0	$0	0	$0	3	$3,300
		Erosion Control	linear foot	$6	100	$600	200	$1,200	250	$1,500
		Storm water Management	day	$570	0	$0	0	$0	4	$2,280
4	**Surveying**									
		Surveying	day	$1,700	1	$1,700	2	$3,400	3	$5,100
5	**Monitoring Wells**									
		Monitoring Well Installation (2" PVC)	linear foot	$85	60	$5,100	60	$5,100	60	$5,100
		Base Price Per Well	each	$570	3	$1,710	3	$1,710	3	$1,710
		Waste Disposal	drum	$170	12	$2,040	12	$2,040	12	$2,040
6	**AS and SVE**									
		Pilot Test	lump sum	$39,800	0	$0	0	$0	1	$39,800
		Air Sparge Well Installation (2" PVC)	linear foot	$85	0	$0	0	$0	80	$6,800
		Soil Vapor Extraction Well Installation (4" PVC)	linear foot	$110	0	$0	0	$0	30	$3,300
		Base Price Per Well	each	$340	0	$0	0	$0	9	$3,060
		Waste Disposal	drum	$170	0	$0	0	$0	25	$4,250
		Compressor	each	$6,800	0	$0	0	$0	1	$6,800
		Knock out pot	each	$2,300	0	$0	0	$0	1	$2,300
		Vacuum Blower	each	$4,000	0	$0	0	$0	1	$4,000
		Granular Activated Carbon	each	$3,400	0	$0	0	$0	1	$3,400
		Permanganate Unit	each	$1,700	0	$0	0	$0	1	$1,700
		Valves	each	$100	0	$0	0	$0	20	$2,000
		Gauges	each	$30	0	$0	0	$0	20	$600
		Treatment Center	lump sum	$13,700	0	$0	0	$0	1	$13,700
		Electrical Service	lump sum	$11,400	0	$0	0	$0	1	$11,400
		Electrical Connections	lump sum	$5,700	0	$0	0	$0	4	$22,800
7	**Trenching**									
		Saw Cut Asphalt (6")	linear foot	$3.5	0	$0	0	$0	300	$1,050
		Excavation	cubic yard	$11	0	$0	0	$0	120	$1,320
		Spoils Disposal	ton	$45	0	$0	0	$0	200	$9,000
		Backfill	ton	$11	0	$0	0	$0	200	$2,200
		Piping	linear foot	$30	0	$0	0	$0	200	$6,000
		Asphalt Paving (6")	square foot	$4.5	0	$0	0	$0	500	$2,250
8	**Enhanced Bioremediation**									
		Injection Wells (4" PVC)	linear foot	$110	0	$0	160	$17,600	0	$0
		Base Price Per Well	each	$570	0	$0	8	$4,560	0	$0
		Waste Disposal	drum	$170	0	$0	30	$5,100	0	$0
		Additive	lbs	$6	0	$0	700	$4,200	0	$0
		Application (labor and equipment)	per well	$800	0	$0	8	$6,400	0	$0
Subtotal						**$14,800**		**$59,800**		**$201,700**
Sales Tax (9.5%)						**$1,400**		**$5,700**		**$19,200**
Subtotal						**$16,200**		**$65,500**		**$220,900**
Contingency (30%)						**$4,900**		**$19,700**		**$66,300**
Subtotal, Contractor						**$21,100**		**$85,200**		**$287,200**
PROFESSIONAL TECHNICAL SERVICES										
		Investigation	lump sum	$10,200	0.5	$5,100	0.5	$5,100	2	$20,400
		Permitting	%	5%	$21,100	$1,100	$85,200	$4,300	$287,200	$14,400
		Engineering design costs	%	20%	$21,100	$4,200	$85,200	$17,000	$287,200	$57,400
		Construction Management	%	15%	$21,100	$3,200	$85,200	$12,800	$287,200	$43,100
		Project Management	%	10%	$21,100	$2,100	$85,200	$8,500	$287,200	$28,700
Subtotal, Professional Services						**$15,700**		**$47,700**		**$164,000**
TOTAL INITIAL COST						**$36,800**		**$132,900**		**$451,200**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level D PPE
5. Waste disposal is non-hazardous solid waste.
6. Soil 1 cubic yard = 1.6 tons
7. Concrete/Asphalt 1 cubic yard = 2 tons
8. Backfill costs assume delivered and placed.
9. Installation of 2 shallow monitoring wells and 1 intermediate monitoring well, all alternatives.
10. 8 injection wells for enhanced bioremediation, Alternative 2.
11. 5 soil vapor extraction wells and 3 air sparging wells, Alternative 3.

TABLE B9-2

IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
AOC-060
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS			ALTERNATIVE 1 MNA				ALTERNATIVE 2 Attenuation				ALTERNATIVE 3 Air Sparge, SVE, Monitored Attenuation			
		Unit	Unit Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost
1	**ENHANCED BIODEGRADATION (Years 1,2,3)**														
	Additive	lbs	$6	0	$0	0	$0	700	$4,200	1,400	$8,400	0	$0	0	$0
	Application (labor and equipment)	per well	$800	0	$0	0	$0	8	$6,400	16	$12,800	0	$0	0	$0
	Well abandonment (year 3)	linear foot	$30	0	$0	0	$0	0	$0	160	$4,800	0	$0	0	$0
	Base price per well abandonment (year 3)	each	$570	0	$0	0	$0	0	$0	8	$4,560	0	$0	0	$0
	Waste Disposal	drum	$170	0	$0	0	$0	0	$0	30	$5,100	0	$0	0	$0
Subtotal					**$0**		**$0**		**$10,600**		**$35,700**		**$0**		**$0**
2	**OPERATION AND MAINTENANCE**														
	Monitoring AS/SVE	annual	$17,100	0	$0	0	$0	0	$0	0	$0	1	$17,100	5	$85,500
	Air Sampling AS/SVE	per well	$500	0	$0	0	$0	0	$0	0	$0	9	$4,500	45	$22,500
	Electricity	monthly	$460	0	$0	0	$0	0	$0	0	$0	12	$5,520	60	$27,600
	Carbon Replacement	pound	$2.5	0	$0	0	$0	0	$0	0	$0	600	$1,500	3000	$7,500
	Permanganate Replacement	pound	$2.5	0	$0	0	$0	0	$0	0	$0	700	$1,750	3500	$8,750
	Maintenance AS/SVE	lump sum	$5,700	0	$0	0	$0	0	$0	0	$0	1	$5,700	5	$28,500
	Monitoring Well Maintenance	per well	$570	13	$7,410	195	$111,150	13	$7,410	195	$111,150	13	$7,410	195	$111,150
Subtotal					**$7,400**		**$111,200**		**$7,400**		**$111,200**		**$43,500**		**$291,500**
3	**Air Sparge Well Abandonment (Year 5)**														
	Well abandonment	linear foot	$30	0	$0	0	$0	0	$0	0	$0	80	$2,400	80	$2,400
	Base Price per Well abandonment	each	$230	0	$0	0	$0	0	$0	0	$0	4	$920	4	$920
	Waste Disposal	drum	$170	0	$0	0	$0	0	$0	0	$0	15	$2,550	15	$2,550
Subtotal					**$0**		**$0**		**$0**		**$0**	**15**	**$5,900**		**$5,900**
4	**SVE Well Abandonment (Year 5)**														
	Well abandonment	linear foot	$30	0	$0	0	$0	0	$0	0	$0	30	$900	30	$900
	Base Price per Well abandonment	each	$230	0	$0	0	$0	0	$0	0	$0	5	$1,150	5	$1,150
	Waste Disposal	drum	$170	0	$0	0	$0	0	$0	0	$0	10	$1,700	10	$1,700
Subtotal					**$0**		**$0**		**$0**		**$0**		**$3,750**		**$3,750**
7	**QUARTERLY GW MONITORING (Years 1,2)**														
	Sampling	each well	$680	12	$8,160	24	$16,320	12	$8,160	24	$16,320	12	$8,160	24	$16,320
	Analysis	each well	$570	12	$6,840	24	$13,680	12	$6,840	24	$13,680	12	$6,840	24	$13,680
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$37,800**		**$75,600**		**$37,800**		**$75,600**		**$37,800**		**$75,600**
8	**SEMIANNUAL GW MONITORING (Years 3-15)**														
	Sampling	each well	$680	26	$17,680	338	$229,840	26	$17,680	338	$229,840	26	$17,680	338	$229,840
	Analysis	each well	$230	26	$5,980	338	$77,740	26	$5,980	338	$77,740	26	$5,980	338	$77,740
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$35,100**		**$455,800**		**$35,100**		**$455,800**		**$35,100**		**$455,800**
9	**FIVE YEAR GW MONITORING (Years 5,10,15)**														
	Sampling	each well	$680	13	$8,800	39	$26,500	13	$8,800	39	$26,500	13	$8,800	39	$26,500
	Analysis	each well	$570	13	$7,400	39	$22,200	13	$7,400	39	$22,200	13	$7,400	39	$22,200
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$21,900**		**$65,800**		**$21,900**		**$65,800**		**$21,900**		**$65,800**
10	**PROJECT MANAGEMENT**														
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.
5. Enhanced Biodegradation has three applications (first application is in implementation cost), Alternative 2.

TABLE B9-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
AOC-060
Boeing Renton Facilty
Renton, Washington

	ALTERNATIVE 1					ALTERNATIVE 2						ALTERNATIVE 3					
	MNA					Enhanced Biodegradation, Monitored Attenuation						Air Sparge, SVE, Monitored Attenuation					
Year	Initial Costs	O&M	PM	GW Mon.	Total	Initial Costs	O&M	Enh. Bio.	PM	GW Mon.	Total	Initial Costs	O&M	Air Sparge and SVE Well Abandon.	PM	GW Mon.	Total
0	$36,800				$36,800	$132,900					$132,900	$451,200					$451,200
1		$7,400	$13,700	$37,800	$58,900		$7,400	$10,600	$13,700	$37,800	$69,500		$43,500		$13,700	$37,800	$95,000
2		$7,400	$13,700	$37,800	$58,900		$7,400	$10,600	$13,700	$37,800	$69,500		$43,500		$13,700	$37,800	$95,000
3		$7,400	$13,700	$35,100	$56,200		$7,400	$14,500	$13,700	$35,100	$70,700		$43,500		$13,700	$35,100	$92,300
4		$7,400	$13,700	$35,100	$56,200		$7,400		$13,700	$35,100	$56,200		$43,500		$13,700	$35,100	$92,300
5		$7,400	$13,700	$39,500	$60,600		$7,400		$13,700	$39,500	$60,600		$43,500	$9,700	$13,700	$39,500	$106,400
6		$7,400	$13,700	$35,100	$56,200		$7,400		$13,700	$35,100	$56,200		$7,100		$13,700	$35,100	$55,900
7		$7,400	$13,700	$35,100	$56,200		$7,400		$13,700	$35,100	$56,200		$7,100		$13,700	$35,100	$55,900
8		$7,400	$13,700	$35,100	$56,200		$7,400		$13,700	$35,100	$56,200		$7,100		$13,700	$35,100	$55,900
9		$7,400	$13,700	$35,100	$56,200		$7,400		$13,700	$35,100	$56,200		$7,100		$13,700	$35,100	$55,900
10		$7,400	$13,700	$39,500	$60,600		$7,400		$13,700	$39,500	$60,600		$7,100		$13,700	$39,500	$60,300
11		$7,400	$13,700	$35,100	$56,200		$7,400		$13,700	$35,100	$56,200		$7,100		$13,700	$35,100	$55,900
12		$7,400	$13,700	$35,100	$56,200		$7,400		$13,700	$35,100	$56,200		$7,100		$13,700	$35,100	$55,900
13		$7,400	$13,700	$35,100	$56,200		$7,400		$13,700	$35,100	$56,200		$7,100		$13,700	$35,100	$55,900
14		$7,400	$13,700	$35,100	$56,200		$7,400		$13,700	$35,100	$56,200		$7,100		$13,700	$35,100	$55,900
15		$7,400	$13,700	$39,500	$60,600		$7,400		$13,700	$39,500	$60,600		$7,100		$13,700	$39,500	$60,300
TOTAL	$36,800	$111,000	$205,500	$545,100	$898,400	$132,900	$111,000	$35,700	$205,500	$545,100	$1,030,200	$451,200	$288,500	$9,700	$205,500	$545,100	$1,500,000
				Net Present Value	$798,000					**Net Present Value**	$927,000					**Net Present Value**	$1,384,000

Notes
1. Net annual discount rate of 1.4%.

TABLE B10-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
AOC-090
Boeing Renton Facility
Renton, Washington

	INITIAL COSTS	Unit	Unit Cost	ALTERNATIVE 1 MA Quantity	ALTERNATIVE 1 MA Cost	ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation Quantity	ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation Cost	ALTERNATIVE 3 SVE, Monitored Attenuation Quantity	ALTERNATIVE 3 SVE, Monitored Attenuation Cost
CONTRACTOR									
1	**Mobilization/Demobilization**								
	Mobilization/Demobilization	lump sum	$11,400	0.0	$0	0.5	$5,700	0.75	$8,550
2	**Health and Safety**								
	Health and Safety Officer	hour	$85	0	$0	12	$1,020	12	$1,020
	Equipment	month	$2,300	0	$0	1	$2,300	1	$2,300
	PPE	day	$110	0	$0	8	$880	8	$880
3	**Site Preparation**								
	Utility Locates	hour	$100	0	$0	4	$400	0	$0
	Site Security	linear foot	$4.5	0	$0	100	$450	250	$1,130
	Temporary Facilities	month	$3,400	0	$0	0	$0	1	$3,400
	Traffic Control	lump sum	$1,100	0	$0	1	$1,100	1	$1,100
	Erosion Control	linear foot	$6	0	$0	100	$600	0	$0
	Storm water Management	day	$570	0	$0		$0	0	$0
4	**Surveying**								
	Surveying	day	$1,700	0	$0	0	$0	0	$0
5	**Monitoring Wells**								
	Monitoring Well Installation (2" PVC)	linear foot	$85	0	$0	0	$0	0	$0
	Base Price Per Well	each	$570	0	$0	0	$0	0	$0
	Waste Disposal	drum	$170	0	$0	0	$0	0	$0
6	**SVE**								
	Knock out pot	each	$2,300	0	$0	0	$0	1	$2,300
	Vacuum Blower	each	$4,000	0	$0	0	$0	1	$4,000
	Granular Activated Carbon	each	$3,400	0	$0	0	$0	1	$3,400
	Permanganate Unit	each	$1,700	0	$0	0	$0	1	$1,700
	Valves	each	$100	0	$0	0	$0	10	$1,000
	Gauges	each	$30	0	$0	0	$0	10	$300
	Treatment Center	lump sum	$13,700	0	$0	0	$0	1	$13,700
	Electrical Service	lump sum	$11,400	0	$0	0	$0	1	$11,400
	Electrical Connections	lump sum	$5,700	0	$0	0	$0	2	$11,400
7	**Enhanced Bioremediation**								
	Additive	lbs	$6	0	$0	2,000	$12,000	0	$0
	Application (labor and equipment)	per well	$800	0	$0	7	$5,600	0	$0
Subtotal					**$0**		**$30,100**		**$67,600**
Sales Tax (9.5%)					**$0**		**$2,900**		**$6,400**
Subtotal					**$0**		**$33,000**		**$74,000**
Contingency (30%)					**$0**		**$9,900**		**$22,200**
Subtotal, Contractor					**$0**		**$42,900**		**$96,200**
PROFESSIONAL TECHNICAL SERVICES									
	Investigation	lump sum	$10,200	0.0	$0	1	$10,200	1	$10,200
	Permitting	%	5%	$0	$0	$42,900	$2,100	$96,200	$4,800
	Engineering design costs	%	20%	$0	$0	$42,900	$8,600	$96,200	$19,200
	Construction Management	%	15%	$0	$0	$42,900	$6,400	$96,200	$14,400
	Project Management	%	10%	$0	$0	$42,900	$4,300	$96,200	$9,600
Subtotal, Professional Services					**$0**		**$31,600**		**$58,200**
TOTAL INITIAL COST					**$0**		**$74,500**		**$154,400**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level D PPE
5. Soil 1 cubic yard = 1.6 tons
6. Concrete/Asphalt 1 cubic yard = 2 tons
7. Installation of 2 shallow monitoring wells and 1 intermediate monitoring well, all alternatives.
8. Existing perforated pipe used for enhanced bioremediation application, Alternative 2.
9. Existing perforated pipe used for soil vapor extraction, Alternative 3.

TABLE B10-2

IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
AOC-090
Boeing Renton Washington
Renton, Washington

	RECURRING COSTS	Unit	Unit Cost	ALTERNATIVE 1 MA Annual Quantity	ALTERNATIVE 1 MA Annual Cost	ALTERNATIVE 1 MA Lifetime Quantity	ALTERNATIVE 1 MA Lifetime Cost	ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation Annual Quantity	ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation Annual Cost	ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation Lifetime Quantity	ALTERNATIVE 2 Enhanced Bioremediation, Monitored Attenuation Lifetime Cost	ALTERNATIVE 3 SVE, Monitored Attenuation Annual Quantity	ALTERNATIVE 3 SVE, Monitored Attenuation Annual Cost	ALTERNATIVE 3 SVE, Monitored Attenuation Lifetime Quantity	ALTERNATIVE 3 SVE, Monitored Attenuation Lifetime Cost
1	**ENHANCED BIOREMEDIATION (Years 1,2,3)**														
	Additive	lbs	$6	0	$0	0	$0	2000	$12,000	4,000	$24,000	0	$0	0	$0
	Application (labor and equipment)	per well	$800	0	$0	0	$0	7	$5,600	14	$11,200	0	$0	0	$0
	Injection Well Abandonment (year 3)	linear ft	$30	0	$0	0	$0	140	$4,200	140	$4,200	0	$0	0	$0
	Base price per well abandonment (year 3)	each	$340	0	$0	0	$0	7	$2,380	7	$2,380	0	$0	0	$0
	Waste Disposal	drum	$170	0	$0	0	$0	14	$2,380	14	$2,380	0	$0	0	$0
Subtotal					**$0**		**$0**		**$26,600**		**$44,200**		**$0**		**$0**
2	**OPERATION AND MAINTENANCE**														
	Monitoring AS/SVE	annual	$17,100	0	$0	0	$0	0	$0	0	$0	1	$17,100	5	$85,500
	Air Sampling AS/SVE	per well	$500	0	$0	0	$0	0	$0	0	$0	1	$500	5	$2,500
	Electricity	monthly	$450	0	$0	0	$0	0	$0	0	$0	12	$5,400	60	$27,000
	Carbon Replacement	pound	$2.5	0	$0	0	$0	0	$0	0	$0	600	$1,500	3,000	$7,500
	Permanganate Replacement	pound	$2.5	0	$0	0	$0	0	$0	0	$0	700	$1,750	3,500	$8,750
	Maintenance AS/SVE	lump sum	$5,700	0	$0	0	$0	0	$0	0	$0	1	$5,700	5	$28,500
	Monitoring Well Maintenance	per well	$570	13	$7,410	180	$102,600	13	$7,410	180	$102,600	13	$7,410	180	$102,600
Subtotal					**$7,400**		**$102,600**		**$7,400**		**$102,600**		**$39,400**		**$262,400**
3	**QUARTERLY GW MONITORING (Years 1,2)**														
	Sampling	each well	$680	52	$35,360	104	$70,720	52	$35,360	104	$70,720	52	$35,360	104	$70,720
	Analysis	each well	$800	52	$41,600	104	$83,200	52	$41,600	104	$83,200	52	$41,600	104	$83,200
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$99,800**		**$199,500**		**$99,800**		**$199,500**		**$99,800**		**$199,500**
4	**SEMIANNUAL GW MONITORING (Years 3-15)**														
	Sampling	each well	$680	24	$16,320	312	$212,160	24	$16,320	312	$212,160	24	$16,320	312	$212,160
	Analysis	each well	$230	24	$5,520	312	$71,760	24	$5,520	312	$71,760	24	$5,520	312	$71,760
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$33,200**		**$432,100**		**$33,200**		**$432,100**		**$33,200**		**$432,100**
5	**FIVE YEAR GW MONITORING (Years 5,10,15)**														
	Sampling	each well	$680	13	$8,800	39	$26,500	13	$8,800	39	$26,500	13	$8,800	39	$26,500
	Analysis	each well	$800	13	$10,400	39	$31,200	13	$10,400	39	$31,200	13	$10,400	39	$31,200
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$24,900**		**$74,800**		**$24,900**		**$74,800**		**$24,900**		**$74,800**
6	**PROJECT MANAGEMENT**														
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.
5. Enhanced Biodegradation has three applications (first application is in implementation cost).
6. Five years of SVE.

TABLE B10-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
AOC-090
Boeing Renton Facility
Renton, Washington

	ALTERNATIVE 1					ALTERNATIVE 2						ALTERNATIVE 3				
	MNA					Enhanced Bioremediation, Monitored Attenuation						SVE, Monitored Attenuation				
Year	Initial Costs	O&M	PM	GW Mon.	Total	Initial Costs	O&M	Enh. Bio.	PM	GW Mon.	Total	Initial Costs	O&M	PM	GW Mon.	Total
0	$0				$0	$74,500					$74,500	$154,400				$154,400
1		$7,400	$13,700	$99,800	$120,900		$7,400	$17,600	$13,700	$99,800	$138,500		$39,400	$13,700	$33,200	$86,300
2		$7,400	$13,700	$99,800	$120,900		$7,400	$17,600	$13,700	$99,800	$138,500		$39,400	$13,700	$33,200	$86,300
3		$7,400	$13,700	$33,200	$54,300		$7,400	$9,000	$13,700	$33,200	$63,300		$39,400	$13,700	$33,200	$86,300
4		$7,400	$13,700	$33,200	$54,300		$7,400		$13,700	$33,200	$54,300		$39,400	$13,700	$33,200	$86,300
5		$7,400	$13,700	$41,500	$62,600		$7,400		$13,700	$41,500	$62,600		$39,400	$13,700	$41,500	$94,600
6		$7,400	$13,700	$33,200	$54,300		$7,400		$13,700	$33,200	$54,300		$7,400	$13,700	$33,200	$54,300
7		$7,400	$13,700	$33,200	$54,300		$7,400		$13,700	$33,200	$54,300		$7,400	$13,700	$33,200	$54,300
8		$7,400	$13,700	$33,200	$54,300		$7,400		$13,700	$33,200	$54,300		$7,400	$13,700	$33,200	$54,300
9		$7,400	$13,700	$33,200	$54,300		$7,400		$13,700	$33,200	$54,300		$7,400	$13,700	$33,200	$54,300
10		$7,400	$13,700	$41,500	$62,600		$7,400		$13,700	$41,500	$62,600		$7,400	$13,700	$41,500	$62,600
11		$7,400	$13,700	$33,200	$54,300		$7,400		$13,700	$33,200	$54,300		$7,400	$13,700	$33,200	$54,300
12		$7,400	$13,700	$33,200	$54,300		$7,400		$13,700	$33,200	$54,300		$7,400	$13,700	$33,200	$54,300
13		$7,400	$13,700	$33,200	$54,300		$7,400		$13,700	$33,200	$54,300		$7,400	$13,700	$33,200	$54,300
14		$7,400	$13,700	$33,200	$54,300		$7,400		$13,700	$33,200	$54,300		$7,400	$13,700	$33,200	$54,300
15		$7,400	$13,700	$41,500	$62,600		$7,400		$13,700	$41,500	$62,600		$7,400	$13,700	$41,500	$62,600
TOTAL	$0	$111,000	$205,500	$656,100	$972,600	$74,500	$111,000	$44,200	$205,500	$656,100	$1,091,300	$154,400	$271,000	$205,500	$522,900	$1,153,800
				Net Present Value	$870,000					**Net Present Value**	$986,000				**Net Present Value**	$1,045,000

1. Net annual discount rate of 1.4%.

TABLE B11-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
AOC-092
Renton Facility
Renton, Washington

	INITIAL COSTS			ALTERNATIVE 1 MNA		ALTERNATIVE 2 Excavation, Enhanced Bioremediation, Monitored Attenuation	
CONTRACTOR		**Unit**	**Unit Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
1	**Mobilization/Demobilization**						
	Mobilization/Demobilization	lump sum	$11,400	0.1	$1,140	0.25	$2,850
2	**Health and Safety**						
	Health and Safety Officer	hour	$85	8	$680	4	$340
	Equipment	month	$2,300	0	$0	1	$1,150
	PPE	day	$110	2	$220	4	$440
3	**Site Preparation**						
	Utility Locates	hour	$100	4	$400	4	$400
	Site Security	linear foot	$4.5	100	$450	100	$450
	Traffic Control	lump sum	$1,100	0	$0	1	$1,100
	Erosion Control	linear foot	$6	100	$600	100	$600
	Storm water Management	day	$570	0	$0	2	$1,140
4	**Surveying**						
	Surveying	day	$1,700	1	$1,700	1	$1,700
5	**Monitoring Wells**						
	Monitoring Well Installation (2" PVC)	linear foot	$85	45	$3,830	45	$3,830
	Base Price Per Well	each	$570	3	$1,710	3	$1,710
	Waste Disposal	drum	$170	11	$1,870	11	$1,870
6	**Source Area Excavation**						
	Saw Cut Asphalt (6")	linear foot	$3.5	0	$0	40	$140
	Excavation	cubic yard	$14	0	$0	30	$420
	Waste Transportation/Disposal	ton	$45	0	$0	50	$2,250
	Backfill	ton	$14	0	$0	50	$700
	Asphalt Paving (6")	square foot	$4.5	0	$0	36	$160
7	**Enhanced Bioremediation**						
	Chemical	pound	$20	0	$0	200	$4,000
	Application (labor and equipment)	day	$1,700	0	$0	1	$1,700
Subtotal					**$12,600**		**$27,000**
Sales Tax (9.5%)					**$1,200**		**$2,600**
Subtotal					**$13,800**		**$29,600**
Contingency (30%)					**$4,100**		**$8,900**
Subtotal, Contractor					**$17,900**		**$38,500**
PROFESSIONAL TECHNICAL SERVICES							
	Investigation	lump sum	$10,200	0.5	$5,100	1	$10,200
	Permitting	%	5%	$17,900	$900	$38,500	$1,900
	Engineering design costs	%	20%	$17,900	$3,600	$38,500	$7,700
	Construction Management	%	15%	$17,900	$2,700	$38,500	$5,800
	Project Management	%	10%	$17,900	$1,800	$38,500	$3,900
Subtotal, Professional Services					**$14,100**		**$29,500**
TOTAL INITIAL COST					**$32,000**		**$68,000**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level D PPE
5. Waste disposal is non-hazardous solid waste.
6. Soil 1 cubic yard = 1.6 tons
7. Concrete/Asphalt 1 cubic yard = 2 tons
8. Backfill costs assume delivered and placed.
9. Installation of 2 shallow monitoring wells, all alternatives.

TABLE B11-2

IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
AOC-092
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS	Unit	Unit Cost	ALTERNATIVE 1 MNA Annual Quantity	ALTERNATIVE 1 MNA Annual Cost	ALTERNATIVE 1 MNA Lifetime Quantity	ALTERNATIVE 1 MNA Lifetime Cost	ALTERNATIVE 2 Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation Annual Quantity	ALTERNATIVE 2 Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation Annual Cost	ALTERNATIVE 2 Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation Lifetime Quantity	ALTERNATIVE 2 Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation Lifetime Cost
1	**OPERATION AND MAINTENANCE**										
	Monitoring Well Maintenance	per well	$570	3	$1,710	30	$17,100	3	$1,710	30	$17,100
Subtotal					**$1,700**		**$17,100**		**$1,700**		**$17,100**
2	**QUARTERLY GW MONITORING (Years 1,2)**										
	Sampling	each well	$680	12	$8,160	24	$16,320	12	$8,160	24	$16,320
	Analysis	each well	$570	12	$6,840	24	$13,680	12	$6,840	24	$13,680
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$37,800**		**$75,600**		**$37,800**		**$75,600**
3	**SEMIANNUAL GW MONITORING (Years 3-15)**										
	Sampling	each well	$680	6	$4,080	78	$53,040	6	$4,080	78	$53,040
	Analysis	each well	$230	6	$1,380	78	$17,940	6	$1,380	78	$17,940
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$16,900**		**$219,200**		**$16,900**		**$219,200**
4	**FIVE YEAR GW MONITORING (Years 5,10,15)**										
	Sampling	each well	$680	3	$2,000	9	$6,100	3	$2,000	9	$6,100
	Analysis	each well	$570	3	$1,700	9	$5,100	3	$1,700	9	$5,100
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$9,400**		**$28,300**		**$9,400**		**$28,300**
5	**PROJECT MANAGEMENT**										
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.

TABLE B11-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
AOC-092
Boeing Renton Facility
Renton, Washington

	ALTERNATIVE 1					ALTERNATIVE 2				
	MNA					Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation				
Year	Initial Costs	O&M	PM	GW Mon.	Total	Initial Costs	O&M	PM	GW Mon.	Total
0	$32,000				$32,000	$68,000				$68,000
1		$1,700	$13,700	$37,800	$53,200		$1,700	$13,700	$37,800	$53,200
2		$1,700	$13,700	$37,800	$53,200		$1,700	$13,700	$37,800	$53,200
3		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
4		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
5		$1,700	$13,700	$17,900	$33,300		$1,700	$13,700	$17,900	$33,300
6		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
7		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
8		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
9		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
10		$1,700	$13,700	$17,900	$33,300		$1,700	$13,700	$17,900	$33,300
11		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
12		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
13		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
14		$1,700	$13,700	$16,900	$32,300		$1,700	$13,700	$16,900	$32,300
15		$1,700	$13,700	$17,900	$33,300		$1,700	$13,700	$17,900	$33,300
TOTAL	$32,000	$25,500	$205,500	$298,300	$561,300	$68,000	$25,500	$205,500	$298,300	$597,300
				Net Present Value	$503,000				**Net Present Value**	$538,000

Notes
1. Net annual discount rate of 1.4%.

TABLE B12-1

IMPLEMENTATION COST ESTIMATE
INITIAL COSTS
AOC-093
Boeing Renton Facility
Renton, Washington

		INITIAL COSTS			ALTERNATIVE 1 Source Area Excavation and MNA		ALTERNATIVE 2 Excavation, Enhanced Bioremediation, Monitored	
CONTRACTOR			**Unit**	**Unit Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
1	**Mobilization/Demobilization**							
		Mobilization/Demobilization	lump sum	$11,400	0.1	$1,140	0.25	$2,850
2	**Health and Safety**							
		Health and Safety Officer	hour	$85	4	$340	8	$680
		Equipment	month	$2,300	0	$0	1	$2,300
		PPE	day	$110	2	$220	8	$880
3	**Site Preparation**							
		Utility Locates	hour	$100	4	$400	8	$800
		Site Security	linear foot	$4.5	100	$450	200	$900
		Temporary Facilities	month	$3,400	0	$0	0.5	$1,700
		Traffic Control	lump sum	$1,100	0	$0	2	$2,200
		Erosion Control	linear foot	$6	100	$600	200	$1,200
		Storm water Management	day	$570	0	$0	2	$1,140
4	**Surveying**							
		Surveying	day	$1,700	0.5	$850	1	$1,700
5	**Monitoring Wells**							
		Concrete Coring	day	$1,700	0.5	$850	0.5	$850
		Monitoring Well Installation (2" PVC)	linear foot	$85	15	$1,280	15	$1,280
		Base Price Per Well	each	$570	1	$570	1	$570
		Waste Disposal	drum	$170	3	$510	3	$510
6	**Source Area Excavation**							
		Saw Cut Concrete (18")	linear foot	$14	60	$840	60	$840
		Excavation	cubic yard	$14	15	$210	15	$210
		Waste Transportation/Disposal	ton	$45	26	$1,170	26	$1,170
		Backfill	ton	$14	26	$360	26	$360
		Groundwater Management	gallon	$3.5	1,000	$3,500	1,000	$3,500
		Concrete Paving (18")	square foot	$14	200	$2,800	200	$2,800
7	**Enhanced Bioremediation**							
		Chemical (ORC)	pound	$17	0	$0	200	$3,400
		Application (labor and equipment)	day	$1,700	0	$0	1	$1,700
Subtotal						**$16,100**		**$33,500**
Sales Tax (9.5%)						**$1,500**		**$3,200**
Subtotal						**$17,600**		**$36,700**
Contingency (30%)						**$5,300**		**$11,000**
Subtotal, Contractor						**$22,900**		**$47,700**
PROFESSIONAL TECHNICAL SERVICES								
		Permitting	%	5%	$22,900	$1,100	$47,700	$2,400
		Engineering design costs	%	20%	$22,900	$4,600	$47,700	$9,500
		Construction Management	%	15%	$22,900	$3,400	$47,700	$7,200
		Project Management	%	10%	$22,900	$2,300	$47,700	$4,800
Subtotal, Professional Services						**$11,400**		**$23,900**
TOTAL INITIAL COST						**$34,300**		**$71,600**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Level D PPE.
5. Waste disposal is solid waste.
7. Soil 1 cubic yard = 1.6 tons
8. Concrete/Asphalt 1 cubic yard = 2 tons
9. Backfill costs assume delivered and placed.
10. Installation of 1 shallow monitoring well, all alternatives.

TABLE B12-2

IMPLEMENTATION COST ESTIMATE
RECURRING COSTS
AOC-093
Boeing Renton Facility
Renton, Washington

	RECURRING COSTS			ALTERNATIVE 1 MNA				ALTERNATIVE 2 Source Area Excavation, Enhanced Bioremediation, Monitored Attenuation			
		Unit	Unit Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost	Annual Quantity	Annual Cost	Lifetime Quantity	Lifetime Cost
1	**OPERATION AND MAINTENANCE**										
	Monitoring Well Maintenance	per well	$570	1	$570	15	$8,550	1	$570	15	$8,550
Subtotal					**$570**		**$8,600**		**$600**		**$8,600**
2	**QUARTERLY GW MONITORING (Years 1,2)**										
	Sampling	each well	$680	4	$2,720	8	$5,440	4	$2,720	8	$5,440
	Analysis	each well	$570	4	$2,280	8	$4,560	4	$2,280	8	$4,560
	Reporting	per round	$5,700	4	$22,800	8	$45,600	4	$22,800	8	$45,600
Subtotal					**$27,800**		**$55,600**		**$27,800**		**$55,600**
3	**SEMIANNUAL GW MONITORING (Years 3-15)**										
	Sampling	each well	$680	2	$1,360	26	$17,680	2	$1,360	26	$17,680
	Analysis	each well	$230	2	$460	26	$5,980	2	$460	26	$5,980
	Reporting	per round	$5,700	2	$11,400	26	$148,200	2	$11,400	26	$148,200
Subtotal					**$13,200**		**$171,900**		**$13,200**		**$171,900**
4	**FIVE YEAR GW MONITORING (Years 5,10,15)**										
	Sampling	each well	$680	1	$700	3	$2,000	1	$700	3	$2,000
	Analysis	each well	$570	1	$600	3	$1,700	1	$600	3	$1,700
	Reporting	per round	$5,700	1	$5,700	3	$17,100	1	$5,700	3	$17,100
Subtotal					**$7,000**		**$20,800**		**$7,000**		**$20,800**
5	**PROJECT MANAGEMENT**										
	Project Management	year	$13,700	1	$13,700	15	$205,500	1	$13,700	15	$205,500
Subtotal					**$13,700**		**$205,500**		**$13,700**		**$205,500**

Notes
1. 2012 Dollars.
2. Costs are +50% -30%.
3. 40 hour work week.
4. Sales tax of 9.5% included in unit price, when applicable.

TABLE B12-3

IMPLEMENTATION COST ESTIMATE
NET PRESENT VALUE
AOC-093
Boeing Renton Facility
Renton, Washington

	ALTERNATIVE 1					ALTERNATIVE 2				
	MNA					Source Area Excavation, Enhanced				
Year	Initial Costs	O&M	PM	GW Mon.	Total	Initial Costs	O&M	PM	GW Mon.	Total
0	$34,300				$34,300	$71,600				$71,600
1		$600	$13,700	$27,800	$42,100		$600	$13,700	$27,800	$42,100
2		$600	$13,700	$27,800	$42,100		$600	$13,700	$27,800	$42,100
3		$600	$13,700	$13,200	$27,500		$600	$13,700	$13,200	$27,500
4		$600	$13,700	$13,200	$27,500		$600	$13,700	$13,200	$27,500
5		$600	$13,700	$13,600	$27,900		$600	$13,700	$13,600	$27,900
6		$600	$13,700	$13,200	$27,500		$600	$13,700	$13,200	$27,500
7		$600	$13,700	$13,200	$27,500		$600	$13,700	$13,200	$27,500
8		$600	$13,700	$13,200	$27,500		$600	$13,700	$13,200	$27,500
9		$600	$13,700	$13,200	$27,500		$600	$13,700	$13,200	$27,500
10		$600	$13,700	$13,600	$27,900		$600	$13,700	$13,600	$27,900
11		$600	$13,700	$13,200	$27,500		$600	$13,700	$13,200	$27,500
12		$600	$13,700	$13,200	$27,500		$600	$13,700	$13,200	$27,500
13		$600	$13,700	$13,200	$27,500		$600	$13,700	$13,200	$27,500
14		$600	$13,700	$13,200	$27,500		$600	$13,700	$13,200	$27,500
15		$600	$13,700	$13,600	$27,900		$600	$13,700	$13,600	$27,900
TOTAL	$34,300	$9,000	$205,500	$228,400	$477,200	$71,600	$9,000	$205,500	$228,400	$514,500
				Net Present Value	$428,000				**Net Present Value**	$464,000

Notes
1. Net annual discount rate of 1.4%.

APPENDIX C

City of Renton Conditional Point of Compliance Approval and Access Agreement

CITY OF RENTON

Community Services - **Terry Higashiyama, Administrator**
Nationally Accredited Agency

Denis Law, Mayor

COPY

September 8, 2008

Mr. Byung Maeng, Project Manager
Washington State Department of Ecology
Northwest Regional Office
3190 ~ 160th Avenue SE
Bellevue, Washington 98008-5452

Subject: **Boeing Renton Facility Corrective Action Groundwater Monitoring (WAD 009 262 171)**

Dear Mr. Maeng:

The City has met with the Boeing Company to discuss their Cleanup Action Plan for portions of the Renton facility adjacent to Renton's Cedar River Trail Park.

We understand your approval of the plan is subject to the City's approval of a Conditional Point of Compliance for groundwater monitoring within the park. The Boeing Company advised the City that low levels of volatile organic compounds are currently present in groundwater beneath areas of the Park and monitoring of these compounds by the Boeing Company will continue during remediation of its facility. We understand that the Boeing Company has completed an analysis identifying no health risks to park users.

The City intends to work with the Boeing Company toward their goal of improving environmental conditions within and near the Boeing facility. On behalf of the City of Renton, I hereby approve the proposed Conditional Point of Compliance and continued groundwater monitoring by Boeing personnel at Boeing installed wells located within the park as indicated in Boeing's Feasibility Study and as envisioned for their Cleanup Action Plan.

Please feel free to contact me at 425.430.6605 or prenner@ci.renton.wa.us if you need any further information.

Sincerely,

Terry Higashiyama
Community Services Administrator

cc: Carl Bach, Boeing
Ray Power, Boeing
Peter Renner

June 8, 2011
9L-22-N410-CMB-072

Jennifer Henning
Department of Community & Economic Development
City of Renton
1055 South Grady Way
Renton WA 98057-3232

Subject: Response to City of Renton comments on the Draft Cleanup Action Plan

BOEING

Dear Ms. Henning:

Thank you for your comments on the Boeing Renton Draft Cleanup Action Plan (DCAP) as described in your April 8, 2011 letter to Byung Maeng of the Department of Ecology. The following discussion provides a clarification and response to each comment:

1) Zoning and Appropriate Use of Cleanup Levels

a. Condition #1 – Urban Center North (UC-N) Zones

This comment relates to zoning and appropriate use of cleanup levels. Specifically, the city is concerned that the cleanup levels are not protective of any future land use change from industrial to mixed use as allowed under UC-N1 and UC-N2 zoning.

Boeing is committed to a cleanup that allows current manufacturing operations to continue but that is also protective of future mixed use or uses of the site. The intent of the DCAP was not to specify cleanup plans for any type of land use that could conceivably occur in the future. The DCAP was prepared to allow for cleanup to levels that are sufficient to meet industrial standards that will allow Boeing to continue manufacturing operations at the site, while implementing cleanup actions that are fully protective of human health and the environment.

To address this concern, we propose adding the following statement to Section 3.1.2, *Facility Cleanup Objectives*, of the DCAP:

> " If there is a change of land use at some point in the future, site conditions will be reevaluated, including review of cleanup standards appropriate for future land uses, and additional clean up actions implemented and/or appropriate enforceable protective covenants will be placed as necessary to ensure protection of human health and the environment. Additional cleanup actions and covenants will depend on the land use and potential exposure pathways that could reasonably be expected to occur."

The last comment requests that the "DCAP should confirm that Boeing will record an environmental covenant restricting land uses with UC-N1 and –N2 to industrial uses only". Exhibit D of the public notice documents includes an environmental restrictive covenant for the Boeing Renton site.

b. Condition #2 – Cedar River Trails Park

The comment specifies that that the Cedar River Trails Park is used for general public uses and does [not] meet the industrial properties definition. Furthermore, the comment specifies that future monitoring of exposures must take into account actual land use at the Park.

The current monitoring program is consistent with the current land use at the park. Should the city change how the public uses the Cedar River Trails Park, ongoing environmental monitoring programs will be reevaluated to account for any change in actual land use.

To address this concern, we propose adding the following bullet to Section 3.1.2, *Facility Cleanup Objectives* of the DCAP:

- Protect current and future uses of the City's Cedar River Park from releases originating from the Boeing site. After notification to Boeing of any changes in planned use of the park property, ongoing environmental monitoring programs will be reevaluated by Boeing to account for the planned change in use.

2) Cleanup Levels and Media

The city's second comment, like comment 1a, asks that the Cleanup Action Plan show that the proposed remedies are fully protective of human health and the environment with respect to any future land use scenario. As stated above, Boeing is committed to a cleanup that will be fully protective of future land uses. The DCAP specifies how cleanup levels are fully protective of human health and the environment for each exposure pathway, considering the current industrial use of the property (Section 3.1.1: *Facility Migration and Exposure Pathways of Concern*). However, it was never intended to include other potential exposure pathways for any or every conceivable future land use. For example, it is unnecessary to consider a terrestrial ecological evaluation because the site is currently covered by buildings and pavement, and may always be covered by buildings or pavement. However, because groundwater beneath the site discharges to nearby surface water (either the Cedar River or Lake Washington), groundwater cleanup levels were specified to be fully protective of human health including surface water used directly as a source of drinking water.

As noted in the response to comment 1, Boeing has planned for potential future changes that may occur after DCAP implementation and will institute review of cleanup standards appropriate for future land uses, additional cleanup actions or application of appropriate restrictive covenants as necessary, prior to changes in land use.

3) Proposed Cleanup Actions

In the third comment the city states that access to city property and limiting institutional controls will be required for several of the cleanup actions. The city states that they will require access and property use agreements to be established for those areas that address Boeing's responsibilities. In addition, the city has asked for Boeing to develop figures that can be used to identify areas to be included in such agreements.

In August 2008 Boeing met with city representatives to discuss proposed cleanup at the site and the need for agreement between the city and Boeing relative to cleanup at several Boeing Solid Waste Management Units (SWMUs) and Areas of Concern (AOC) on or near city-owned property. In a letter dated September 8, 2008 the city agreed to allow monitoring on city-owned property and to work with Boeing toward the goal of improving environmental conditions within and near the plant. Additionally, as part of the lease renewal process Boeing provided the city with a copy of the draft cleanup plan in April 2010. Boeing understands the city's need for detailed "footprint" figures to be used with these agreements and has attached working draft figures (Attachment 1) of potentially affected areas for the city's consideration. It should be noted that areas depicting groundwater contamination are based on a combination of current and historical data, and groundwater contaminant concentrations will continue to decrease as the cleanup progresses.

In order to provide updated monitoring information to the city, Boeing will provide electronic copies of bimonthly monitoring reports and other reports relevant to city owned property to the city at the same time that Boeing provides copies to the Department of Ecology.

4) Former Fuel Farm at Renton Airport

The city's last comment is focused on the proposed cleanup plan for the area known as the Former Fuel Farm (FFF). The city states their concern about the relatively long restoration time frame for this cleanup and question whether the proposed monitoring plan is sufficient.

As stated above, Boeing is committed to cleanups at the site that go above and beyond the proposed cleanup actions if conditions change and warrant further remedial measures. In this case, lease boundary changes have occurred since the plan was developed and the city's airport manager recently notified Boeing of plans to expand the city-leased airplane hangars in this area. In response to these changes Boeing has proposed to accelerate the monitoring schedule for this area as well as collecting additional soil samples to determine whether any remaining soils exist that would impact expansion of the hangars as proposed by the city. A draft work plan for this additional sampling has been submitted to the city for comment and Boeing has modified the work plan in response to the city comments. During April 2011, the work plan was submitted to the Department of Ecology for comment and approval. Based on the results of this additional sampling and monitoring Boeing may need to remove additional affected soils from the area for disposal at an appropriate waste management facility.

No additional changes are necessary to the DCAP because the FFF work plan is only accelerating the well installation specifications described in the DCAP, and the additional soil sample locations are provided to evaluate soil conditions to support the redevelopment of this area and for the potential removal of this area from the Administrative Order. Based on prior sampling, it appears that the air sparging system has been effective in reducing contaminant concentrations in soil within the former source areas. Existing monitoring wells surrounding this area also have had insignificant detections of contaminants. Without the monitoring wells specified in the DCAP, the duration of monitored natural attenuation cannot be accurately specified. The duration of monitoring

necessary at this area will depend on groundwater conditions observed after well installation.

After installation of monitoring wells, and groundwater sampling and testing, further evaluations of groundwater data will be performed, and recommendations for ongoing groundwater monitoring will be specified in the Engineering Design Report. The Engineering Design Report will outline a groundwater monitoring schedule and approach that will be consistent with performance monitoring requirements (testing parameters and frequency) outlined by Washington State Department of Ecology and EPA guidance documents.

This letter also includes Figures (Attachment 1) that outline the approximate plume boundaries that extend onto, or are present on, City Property as a result of releases from Boeing operations. These Figures were provided by Boeing at the request of the City so that the City understands the general extent of contaminated soil or groundwater on City property. It is understood that these Figures represent plume extents at one snapshot in time and they can expand or retract through time. It is understood that the City will use these Figures for informational purposes and for worker and public safety should construction, maintenance or other activities occur in these zones. The Figures will be utilized in lieu of establishing formal environmental covenants on these locations at this time. "

We look forward to continuing progress on cleanup actions at the Boeing Renton Site, and we appreciate the city's assistance and cooperation with this work. Please call or email me if you have any further questions or comments on the cleanup action.

Sincerely,

Carl Bach
Project Manager
Boeing EHS Environmental Remediation
P.O. Box 3707, Mail Code 1W-12
Seattle WA; 98124-2207
206-898-0438
carl.m.bach@boeing.com;

cc (email only):

Byung Maeng	Department of Ecology
Suzanne Dale Estey	City of Renton
Peter Renner	City of Renton
Jesse Uman	Boeing
Ray Power	Boeing
Steven Tochko	Boeing
Dave Haddock	AMEC Geomatrix

ACCESS AGREEMENT

This Access Agreement ("Agreement") is made this first day of March, 2012 between the City of Renton (the "City"), a Washington municipal corporation, and The Boeing Company ("Boeing"), a Delaware corporation. The City and Boeing shall be referred to collectively in this Agreement as the "Parties".

1. The City owns property known as the Cedar River Trail Park (the "Park Property"), King County Parcel No. 0723059096, and is depicted in Figure 1 attached to this Agreement.

2. The City also owns property known as the Renton Municipal Airport (the "Airport Property"), King County Parcel No. 0723059007, and is depicted in Figure 2 to this Agreement. Boeing leases a portion of the Airport Property from the City under that certain Ground and Building Lease dated May 19, 2010.

3. Boeing's Renton Plant (the "Renton Plant") is located:

- on approximately 180 acres of land that Boeing owns immediately adjacent and to the east of the Park Property; and
- on approximately 18 acres of land on the Airport Property that Boeing leases from the City.

The Renton Plant is depicted in Figure 3 to this Agreement. The Renton Plant is bounded on the north by Lake Washington. The Cedar River Waterway and the Park Property separate the eastern portion of the Renton Plant from the Airport Property.

4. Boeing has been working with the Washington State Department of Ecology ("Ecology") to address historic releases of hazardous substances at the Renton Plant. Boeing has entered into Agreed Order No. DE 97HZ-N233 dated October 10, 1997, with Ecology to address these releases. Under the Agreed Order, Boeing is required to prepare and implement a Cleanup Action Plan (the "CAP") to clean up known contamination released from the Renton Plant, perform post-cleanup soil and groundwater monitoring, and institute other applicable institutional controls. The CAP presents the selected final cleanup actions, the cleanup standards expected to be achieved, and the approach and schedule for implementing the cleanup actions at 12 separate, defined solid waste management units and areas of concern ("AOCs") located at the Renton Plant. Boeing will enter into a new Agreed Order (No. 8191) with Ecology to implement the CAP.

5. The Parties agree that Boeing will need access to unleased portions of the Airport Property and to portions of the Park Property to implement the CAP. The City wishes to grant Boeing such access for the sole purpose of implementing actions required under the CAP, as approved by Ecology, including any approved amendments to the CAP. For purposes of this Agreement, the phrase "unleased portions of the Airport Property" shall mean those areas of the Airport Property not leased by Boeing.

AGREEMENT

In consideration of the mutual covenants contained in this Agreement, the receipt and sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. **Entire Agreement; Supersedes.** This Agreement represents the complete agreement of the Parties with respect to access to the Park and Airport Properties in connection with Boeing's Ecology-required environmental investigation and cleanup activities related to the Renton Plant. This Agreement supersedes any prior oral or written agreements or understandings regarding such access including without limitation (1) the access agreement between the Parties dated August 14, 2002, and (2) the letter from the City to Ecology dated September 8, 2008 to the extent it may have granted Boeing any access to City property. No change, waiver, or discharge is valid unless in writing and signed by the Party against whom it is sought to be enforced..

2. **License for Access.** The City hereby grants to Boeing and its agents and contractors a nonexclusive license for access to:

(a) that portion of the Park Property located within AOC 060 as defined in the CAP for the sole purpose of installing, monitoring, and/or maintaining groundwater monitoring wells GW-149S, GW-150S, and the three proposed groundwater monitoring wells (GW227S, GW228I, and GW229S) as required by the CAP and as depicted in Figure 28 of the CAP;

(b) that portion of the Park Property located within AOC 090 as defined in the CAP for the sole purpose of installing, monitoring, and/or maintaining groundwater monitoring wells GW-177I, GW-178S, GW-179I, GW-180S, and GW-208S as required by the CAP and as depicted in Figure 31 of the CAP; and

(c) that unleased portion of the Airport Property located within the Former Fuel Farm AOC as defined in the CAP for remedial action and monitoring activities as required by the CAP including without limitation the installation, monitoring, and/or maintenance of groundwater monitoring wells GW-102S, GW211S, GW-212S, GW219S, GW220S, GW222S, GW223S, AND GW224S as depicted in Figure 15 and 16 of the CAP.

(d) portions of the Park Property or unleased portions of the Airport Property for the sole purposes of installing, monitoring, or maintaining monitoring wells, collecting samples, or performing remedial actions as required and approved by Ecology. Any such additional access beyond that granted under Sections 2(a) through (c) above shall be conditioned on prior City approval.

3. **Cost Reimbursement.** Boeing shall bear any and all costs and expenses for the work performed by or on behalf of Boeing on the Park and Airport Properties associated with the implementation of the CAP. Further, Boeing shall reimburse any and all reasonable costs and expenses actually incurred by the City (including consultants' fees) associated with work performed on the Park Property and the unleased portions of the Airport property, up to ten thousand dollars ($10,000) per

calendar year, including without limitation costs associated with recording required environmental covenants and the implementation of soil and groundwater monitoring and other institutional controls required under the CAP. The limitation on cost reimbursement under this Section 3 shall apply only to the extent the scope of work required under the CAP does not materially change.

4. **Compliance with Law.** All activities undertaken on the Park and Airport Properties shall be conducted in accordance with the Washington State Model Toxics Control Act and chapter 173-340 WAC, and with all other applicable federal, state, and local laws and regulations including without limitation health and safety requirements. Boeing shall obtain, at its own sole expense, all necessary permits, licenses, and approvals from governmental authorities required to perform the activities contemplated by this Agreement and shall comply with all conditions, restrictions, and requirements imposed by such permits, licenses, and approvals.

5. **Term.** The access granted in this Agreement shall commence on the Effective Date and continue until such time as Ecology determines in writing that Boeing has satisfactorily completed those portions of the CAP relating to AOC 060, AOC 090, and the Former Fuel Farm AOC.

6. **Scheduling.** Boeing shall coordinate all activities with the City and Boeing shall obtain the City's approval on all work schedules. The City shall not unreasonably withhold its consent to proposed work schedules.

7. **Sampling Data.** Boeing is required to submit progress reports bimonthly (once every two months) to Ecology in accordance with the terms of Agreed Order No. 8191 The progress reports will include a list of cleanup activities, deviations to required tasks or to the CAP, schedule revisions, and all laboratory data received during the prior two-month period. Boeing will provide an electronic copy of the bimonthly report to the City at the same time that the report is submitted to Ecology.

8. **Reasonable Precautions.** Boeing agrees to take reasonable precautions to minimize any disruption to uses of the Park and Airport Properties by the City and minimize damage to the Park and Airport Properties resulting from the work activities, and shall restore the surface of the Park and Airport Properties as nearly as practicable to its condition before the commencement of such work. No materials including, but not limited to, soil and groundwater sampling material shall be left on the Park or Airport Properties for more than seven days after sampling has been conducted, unless the City consents to a longer period.

9. **Notices.** Any notice regarding subject matter covered under this Agreement shall be given to:

City of Renton
Attn: Peter Renner, Facilities Director
Telephone: 206.430.6605
Email: prenner@rentonwa.gov

The Boeing Company
Attn: Carl Bach, Remediation Project Manager
Telephone: 206.898.0438
Email: carl.m.bach@boeing.com

10. **Indemnification.** As between the City and Boeing, Boeing shall be responsible for ensuring that its employees, agents, consultants, and contractors comply with applicable federal, state, and local laws and regulations and shall be responsible for the health and safety of its employees, agents, consultants, and contractors while performing activities at the Park or Airport Properties. Boeing shall defend and indemnify and hold the City harmless from personal injury or property damage claims to the extent that such claims arise from Boeing's or its employees', agents', consultants', and contractors' negligence in performing the activities contemplated by this Agreement on the Park Property or unleased portions of the Airport Property. The City will provide prompt notice to Boeing in the event of a claim. To the extent authorized by applicable law, the City shall indemnify Boeing from personal injury or property damage claims to the extent such claims arise from the City's or the City's employees', agents', consultants', contractors', or invitees' negligence associated with activities on the Park or Airport Properties. Boeing will provide prompt notice to the City in the event of a claim. In the event of liability for personal injury or property damage claims caused by or resulting from concurrent acts or omissions by Boeing and the City, each Party's liability hereunder shall be only to the extent of such Party's or its employees', agents', consultants', and contractors' negligence. For purposes of this indemnity, Boeing specifically and expressly waives any immunity that it may be granted under the Washington State Industrial Insurance Act, Title 51 RCW, except that there is no waiver of immunity by Boeing for claims by its own employees against Boeing. The indemnity provisions contained in this Paragraph have been expressly and mutually negotiated by the Parties.

11. **Insurance.** Boeing shall require its contractors performing activities on the Park Property and unleased portions of the Airport Property to maintain the following insurance:

a. Comprehensive General Liability ("CGL") Insurance in an amount not less than $1,000,000 per occurrence combined single limit bodily injury and property damage.

b. Professional errors and omission insurance for liability arising out of any negligent act or omission related to its "professional services" with limits of $1,000,000 per claim and $1,000,000 annual aggregate.

c. Automobile liability insurance covering all owned, hired, or otherwise operated non-owned vehicles with a minimum combined single limit of $1,000,000 each occurrence for bodily injury or property damage.

d. Workers' Compensation in statutory amounts.

Boeing shall provide documentary evidence of insurance required under this Paragraph. The City shall be named as additional insured on the CGL and Automobile Liability policies.

12. **Reservation of Claims.** By entering into this Agreement, other than for costs paid under this Agreement by Boeing to the City under the section above entitled "Cost Reimbursement", the Parties do not waive, and expressly reserve, all claims they may have against each other and all other persons under federal and state law in connection with the implementation of the CAP and in connection with hazardous substances that may be located at, on, under, or in the vicinity of the Park and Airport Properties or Boeing's Renton Plant.

13. **No Liens.** Boeing shall discharge at once or bond or otherwise secure against all liens and attachments that are filed in connection with its activities under this Agreement.

14. **Relationship of the Parties.** Nothing in this Agreement shall be deemed to create a partnership or joint venture and/or principal and agent relationship between the Parties. No Party or authorized representative shall have authority to act as a general agent for the other Party or to bid for or undertake any contracts enforceable against the other Party.

15. **Binding on Successors and Assigns.** This Agreement shall be binding upon the successors and assigns of the Parties, and no Party may assign or delegate its obligations under this Agreement without the prior written consent of the other Party.

16. **Choice of Law; Venue.** This Agreement shall be interpreted and enforced pursuant to the laws of the state of Washington. Venue for any lawsuit arising out of this Agreement shall be in King County, Washington.

17. **Amendment.** This Agreement may be amended or modified only by the written agreement of both Parties. Boeing shall inform Ecology of any modification or amendment to this revised Agreement

18. **Severability.** If any part of this Agreement is for any reason found to be unenforceable, all other portions nevertheless remain enforceable.

19. **No Waiver.** The waiver of any breach of any term or condition of this Agreement does not waive any other breach of that term or condition or any other term or condition.

20. **Headings.** The headings used in this Agreement have been inserted for convenience only and shall not affect the construction of this Agreement.

21. **Authority to Execute.** Each person executing this Agreement represents and warrants that he or she is fully authorized to execute this Agreement on behalf of the Party he or she represents.

22. **Counterparts.** This Agreement may be executed in two counterparts, each of which shall be deemed to be an original and of equal force and effect.

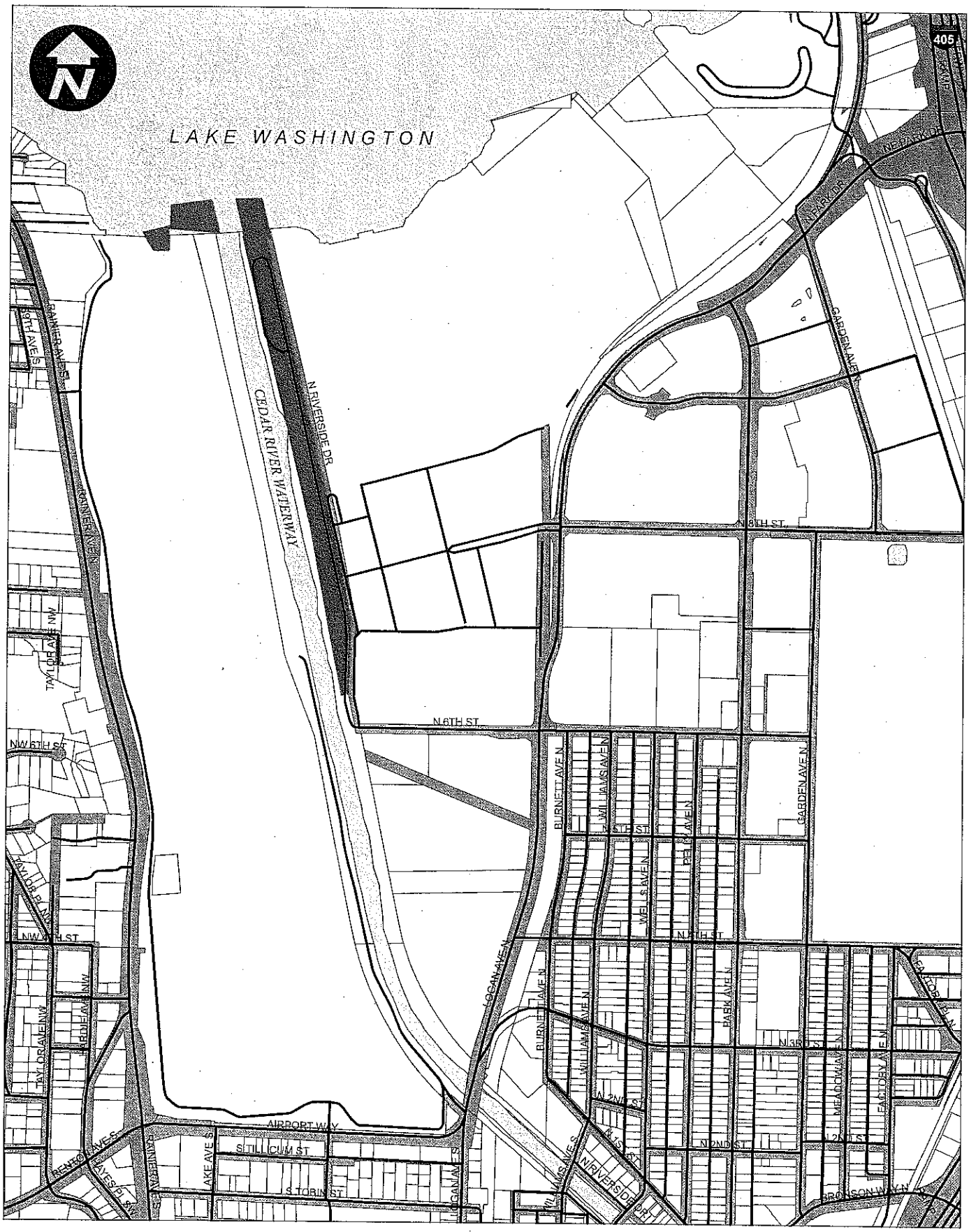
23. **Effective Date.** This Agreement shall become effective as of the date of the last signature below.

IN WITNESS WHEREOF, this Access Agreement has been executed as of the date specified above.

By:	By:
Denis Law, Mayor	
City of Renton	The Boeing Company
Date: 6/11/12	Date: April 17, 2012

Attest:

Bonnie I. Walton, City Clerk



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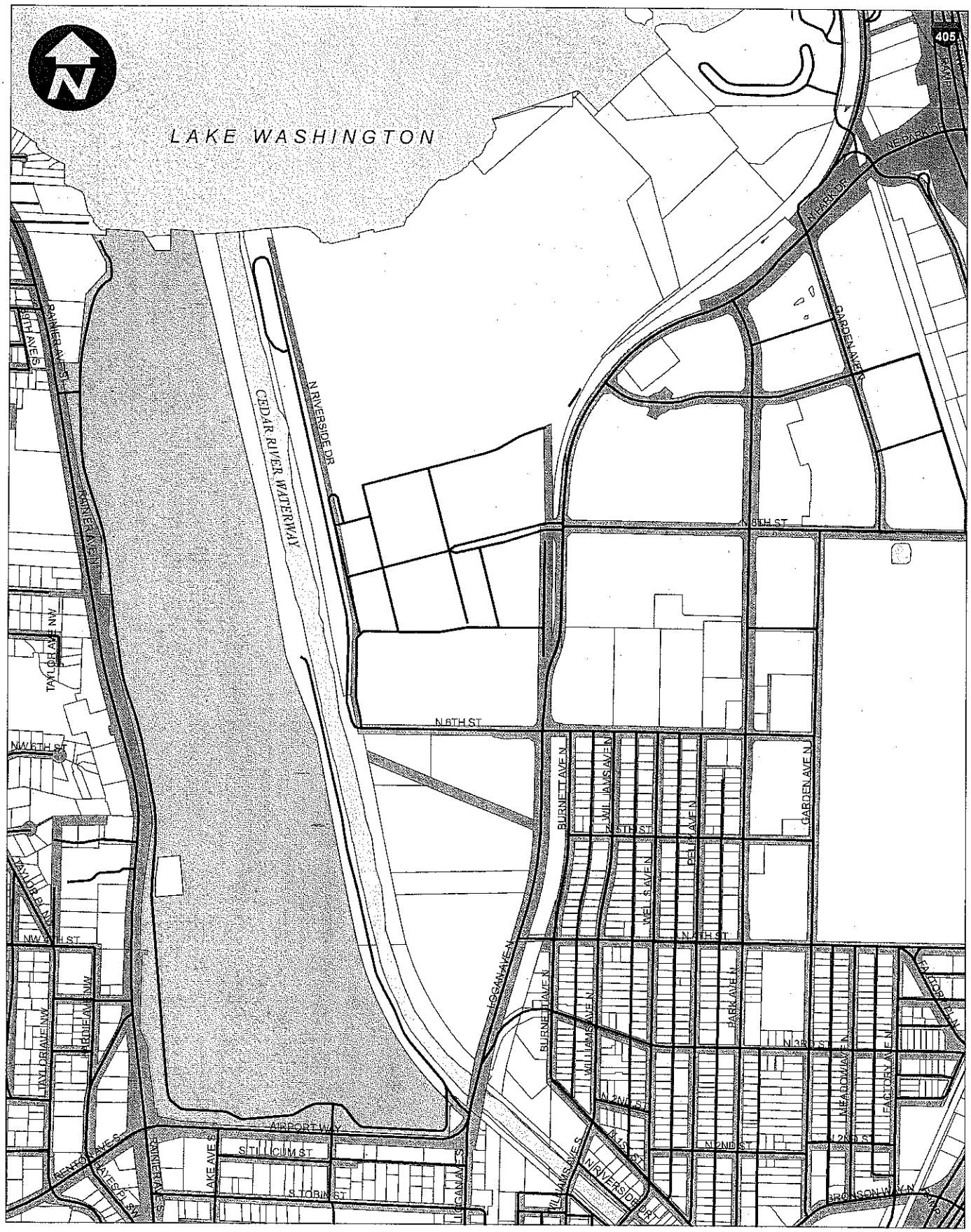
Feet

BOEING

Figure 1
Park Property
King County Parcel 0723059096



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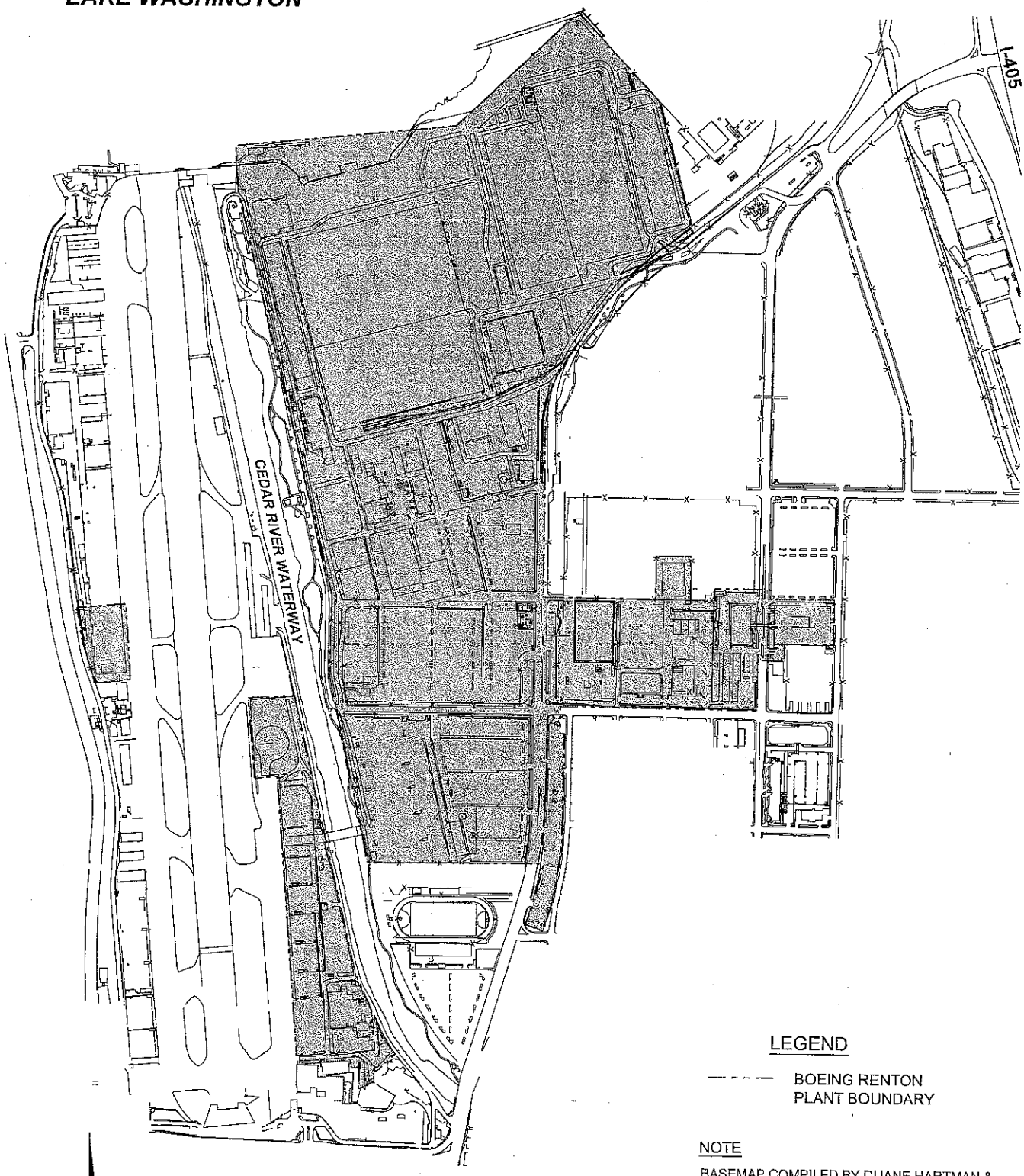
Feet

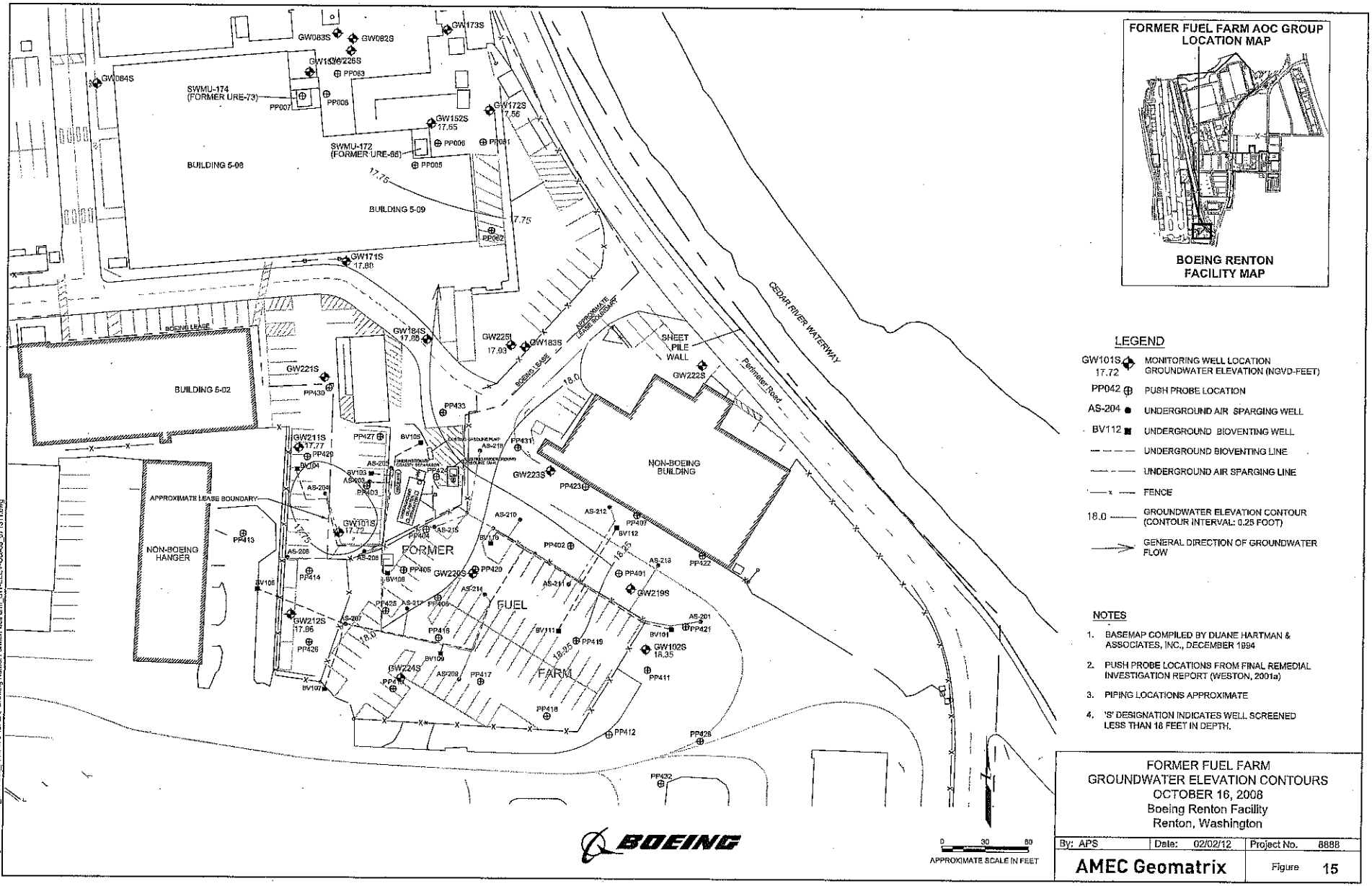
BOEING

Figure 2
Airport Property
King County Parcel 0723059007



BOEING

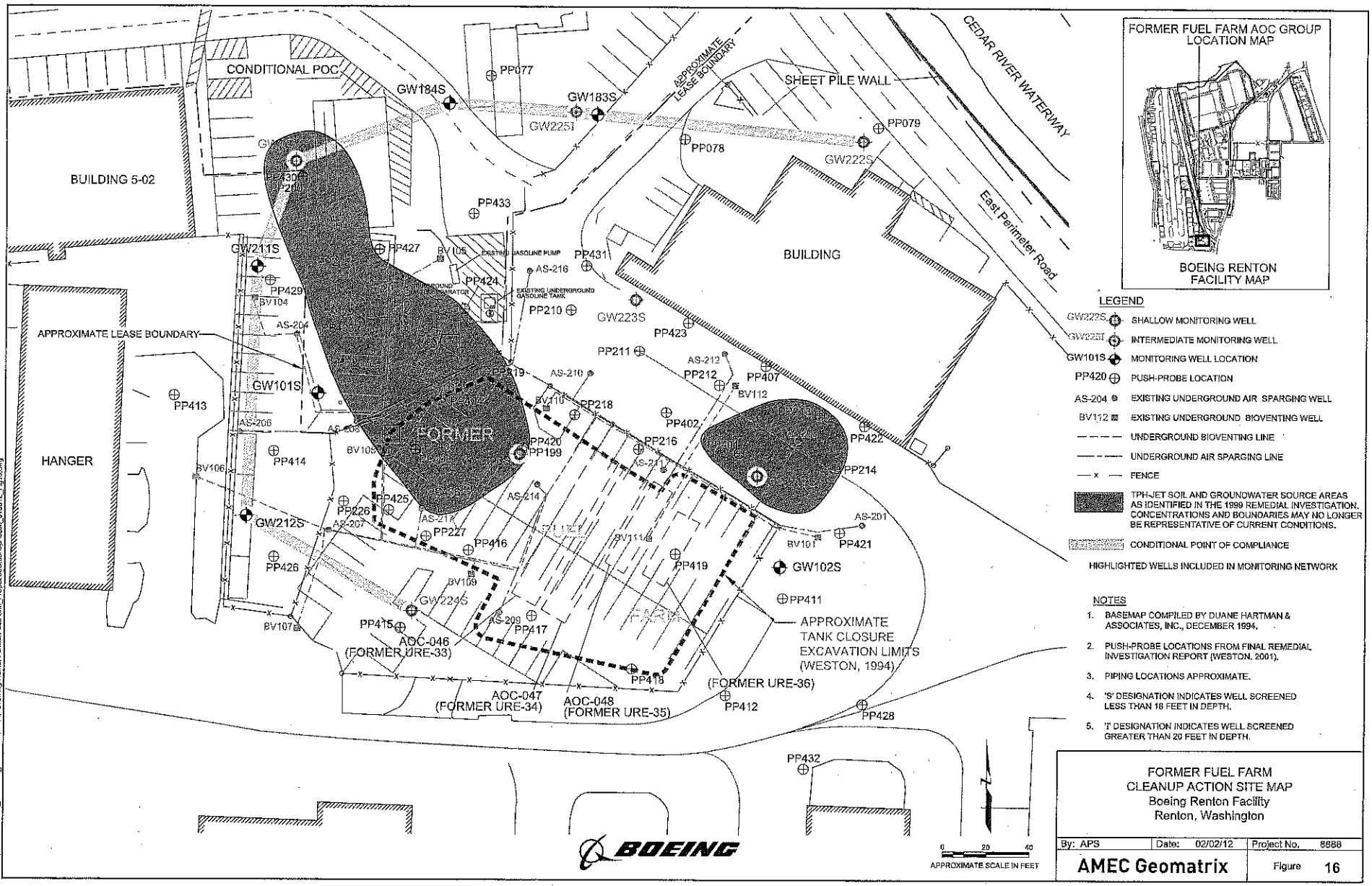
Figure 3
Renton Plant



FORMER FUEL FARM
GROUNDWATER ELEVATION CONTOURS
OCTOBER 16, 2008
Boeing Renton Facility
Renton, Washington

By: APS	Date: 02/02/12	Project No. 8888
AMEC Geomatrix	Figure 15	

Plot Date: 02/02/12 - 4:43pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2008\MXD_Final CAP\CAD_Drawing Name: FormerFuelFarm_GWELEV-Oct-08_071311.dwg



FORMER FUEL FARM
CLEANUP ACTION SITE MAP
Boeing Renton Facility
Renton, Washington

By: APS	Date: 02/02/12	Project No. 8888
AMEC Geomatrix		Figure 16

Plot Date: 02/02/12 - 6:42pm, Plotted by: adam.stenberg
Drawing Path: 8888_20000035_Final_CAP\CAD_Drawing Name: FormerFuelFarm_ProposedCleanupAction_013012_Pg16.dwg

APPENDIX D

Former Fuel Farm Cleanup Action Investigation Summaries

Appendix D-1: September 23, 2011 Memorandum

Memo

To:	Carl Bach, Boeing	Project:	0088880080
From:	Dave Haddock	cc:	Ray Power, Boeing Project File
Tel:	(206) 342-1760		
Fax:	(206) 342-1761		
Date:	September 23, 2011		

Subject: Former Fuel Farm Cleanup Action Investigation Summary
Boeing Renton Facility
Renton, Washington

1.0 INTRODUCTION

This memorandum summarizes the cleanup action investigation including both soil and groundwater characterization conducted by The Boeing Company (Boeing) and AMEC Geomatrix, Inc. (AMEC), at the Former Fuel Farm (the Site) on the Boeing Commercial Airplane Group - Renton Plant (Facility) located in the City of Renton, Washington (Figure 1). Boeing has been working with the Washington State Department of Ecology (Ecology) to address historic releases of hazardous substances at the Facility. This investigation was conducted to implement the cleanup alternative for the Site and to further evaluate the area in between the two source areas.

In May 2011, at Boeing's request, AMEC prepared the *Former Fuel Farm Cleanup Action Work Plan* (Work Plan) (AMEC, 2011a) which described the implementation of the chosen cleanup alternative at the Former Fuel Farm. The preferred cleanup alternative for the Former Fuel Farm is monitored natural attenuation (Alternative 3 in the *Draft Final Cleanup Action Plan* [AMEC, 2010]). In addition to expediting groundwater monitoring for the Site, soil conditions were to be evaluated in areas of proposed airport tenant expansions to determine whether any remaining soils exceed proposed cleanup levels and may need to be excavated and removed.

A detailed history of previous investigations and cleanup actions at the Site were presented in the Work Plan (AMEC, 2011a).

2.0 OBJECTIVES AND SCOPE

Two separate scopes of work were completed by AMEC staff. They are discussed in more detail below.

2.1 Source Area Soil sampling

A total of 17 push probes were completed as part of this investigation both within and in between the two source areas (Figure 1).

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

Soil samples were collected at the five push-probe locations (PP401, PP405, PP420, PP427, and PP430) within the source area to assess current conditions. Samples have not been collected at the PP401 or PP427 locations since 2003. Samples were collected from PP405, PP420, and PP430 locations to closely match three push-probe locations sampled during June 2009 (PP198, PP199, and PP200, respectively). These new data will be used to evaluate the reduction/attenuation of constituents of concern (COCs) in the source area.

In addition, twelve additional push probes were completed. Ten of these (PP210 through PP219) were advanced between the two source areas to evaluate potential data gaps in this area. The remaining two, PP226 and PP227, were completed southwest of the larger of the two source areas.

2.2 Additional Monitoring Well Installation

As outlined in the *Draft Final Cleanup Action Plan* (AMEC, 2010), three shallow monitoring wells were proposed to be installed in the source areas at the Site. They were to be located adjacent to soil boring PP401, PP420, and PP430. These monitoring wells (GW219S through GW221S) will be used for monitoring the groundwater concentration of COCs in the source area. At the request of Ecology, two additional shallow groundwater monitoring wells (GW223S and G224S) were to be installed east and south of the larger source area to better evaluate the groundwater flow direction at the Site and for investigation of potential migration of contaminants from the source area.

In addition, one shallow monitoring well (GW222S) and one intermediate monitoring well (GW225I) were to be installed along the point of compliance north of the source area. The shallow monitoring well was installed adjacent to soil boring PP079 and the intermediate monitoring well was installed adjacent to monitoring well GW183S. These two monitoring wells will be used to monitor the groundwater concentration of COCs at the point of compliance.

3.0 SAMPLING AND ANALYSIS

Field activities associated with the soil sampling and monitoring wells installation discussed in Section 2 are discussed below. AMEC staff and subcontractors conducted the soil sampling and monitoring well installation beginning May 26, 2011, and ending June 1, 2011.

3.1 Soil Sampling

Cascade Drilling, Inc., advanced a total of 17 direct-push probes during the investigation, each to a total depth of 12 feet (ft), which was either immediately below the deepest extent of petroleum hydrocarbons, as indicated by field indicators, or to just below the groundwater table. Five push probes (PP401, PP405, PP420, PP427, and PP430) were advanced at historic locations, ten push probes (PP210 through PP219) where advanced at new locations in between the two source areas, and two push probes (PP226 and PP227) were advanced south of the larger source area. Locations of the push borings are shown on Figure 1.

The borings were continuously logged for lithology and soil samples were screened with a photoionization detector (PID) in the field by AMEC staff to evaluate the presence of volatile compounds. Two soil samples were collected from each boring. One soil sample was collected

at a depth of 3 ft and one additional sample was collected from the depth interval with either 1) the highest concentration of petroleum hydrocarbons above the groundwater table, as indicated by field screening using a PID, odor, sheen, and other visual indicators, or 2) just above the groundwater table if field screening did not indicate the presence of petroleum hydrocarbons. Deep soil samples were collected at 8 ft below grade in PP218; at 9 ft below grade in PP226, PP227, PP405, and PP420; and at 10 ft below grade in all remaining push probe borings.

Soil samples were collected in accordance with the Ecology-approved *Remedial Investigation Work Plan* (RI Work Plan) (Weston, 1998) for the Site as subsequently amended, which specifies field methods for sample collection, sample designation, equipment decontamination, and documentation. Samples were collected directly from the liner of the direct-push probe using laboratory-provided disposable sampling equipment and stainless steel spoons. Soil samples were collected from the push-probe boring locations only.

The soil samples collected were analyzed for the constituents of concern specified in the *Draft Final Cleanup Action Plan* (AMEC, 2010) including:

- TPH-Jet fuel
- TPH-Diesel
- BTEX
- 2-methylnapthalene
- VPH
- EPH

Analyses were performed by Analytical Resources, Inc., of Tukwila, Washington. Analytical data and a summary data quality review memorandum are provided in Attachment A. Boring logs will be presented in the *Quarterly Monitoring Report: Second Quarter 2011* (AMEC, 2011b).

3.2 Monitoring Well Installation and Sampling

Seven monitoring wells were installed at the Site during the implementation of the cleanup action. All wells were installed by a Washington State-licensed well driller using a push-probe drill rig under the supervision of a Washington State-licensed geologist. The borings were continuously logged for lithology and were screened for contamination using a PID. Six of the wells were drilled to a depth of 15 or 16 ft and the wells were constructed using a 10-ft section of pre-packed 0.010-slot 2-inch diameter screen. One well was drilled to a depth of 30 ft and the well was constructed using a 10-ft section of pre-packed 0.010-slot 2-inch diameter screen. Well construction information will be presented in the *Quarterly Monitoring Report, Second Quarter 2011* (AMEC, 2011b).

On June 9, 2011, all newly installed monitoring wells were developed by AMEC staff in accordance with the RI Work Plan (Weston, 1998). Surveyed locations of the monitoring wells are shown on Figure 1.

One round of groundwater sampling (dry season) was conducted following the installation of the new groundwater monitoring wells on June 23, 2011 by Boeing staff. One additional round of groundwater sampling (wet season) will be conducted during the fall/winter of 2011-2012. All the new monitoring wells as well as the existing monitoring wells already part of the monitoring network were sampled during this event (Figure 1). Two rounds of groundwater sampling will be conducted to evaluate groundwater conditions when groundwater is at its relative low and high of the year. The groundwater sampling event discussed in this report is considered the dry season (June/July) event and one additional groundwater sampling event representing the wet season will be conducted in December 2011 or January 2012.

Groundwater samples were analyzed for the constituents specified in the *Draft Final Cleanup Action Plan,* including TPH-Jet fuel, TPH-D, and BTEX (AMEC, 2010). In addition, groundwater samples were analyzed for 2-methylnaphthalene at Boeing's request.

Groundwater samples were not analyzed for monitored natural attenuation (MNA) geochemical parameters (dissolved oxygen, nitrate, Fe[II], sulfate, methane, temperature, pH, specific conductance, alkalinitiy, oxidation/reduction potential, chloride, ethane, and TOC) during this sampling event but will be during the next sampling event.

Groundwater data will be reviewed after the completion of the two groundwater monitoring events to evaluate the current groundwater conditions at the Site and the effectiveness of the groundwater monitoring system. Any potential adjustments to the groundwater monitoring system will be based on this data review.

4.0 RESULTS

Soil and groundwater analytical results are discussed separately in the sections below. Laboratory analytical data and the data validation memorandum are provided in Attachment 1.

4.1 Soil Results

Soil analytical data are shown on Figure 2 and presented in Table 1. Results in Table 1 are compared to the cleanup levels presented in the *Draft Final Cleanup Action Plan* (AMEC, 2010). Only benzene, at 3 ft below ground surface (bgs) in boring PP212 just north of the smaller source area and at 10 ft bgs in boring PP217 within the larger source area, was detected at concentrations greater than the FS cleanup level (Figure 2). The FS cleanup level for benzene is 12 micrograms per kilogram (µg/kg) and the concentrations detected in boring PP212 and PP217 were 13 and 18 µg/kg, respectively.

No other analytes were detected at concentrations greater than the FS cleanup levels in any sample collected.

Soil samples were collected from PP401, PP405, PP420, PP427, and PP430 in June 2003 as part of quarterly sampling and the results are presented in Table 2 and on Figure 2. At all locations, except PP401, concentrations of TPH diesel range, TPH Jet-A, and benzene have significantly attenuated (up to two-orders of magnitude) from 2003 to 2011. This can be interpreted as evidence for robust attenuation of COCs in subsurface soils at the Site.

4.2 Groundwater Results

Groundwater analytical data are on Figure 3 and presented in Table 3. Results in Table 3 are compared to the cleanup levels for the Former Fuel Farm presented in the FS.

TPH in the diesel range and Jet-A range were found at concentrations slightly exceeding their respective cleanup level (0.5 mg/L) in samples collected from four locations (GW219, GW220, GW221, and GW224) with TPH-diesel concentrations ranging from 0.68 to 1.2 mg/L and TPH-Jet-A concentrations ranging from 0.62 to 1.6 mg/L. All four of the locations are within or in close proximity to the known groundwater source areas. Monitoring wells GW220 and GW221 are located within the large of the two source areas and GW219 is located within the smaller of the two source area (Figure 3). GW224 is located approximately 40 ft south of the larger source area.

TPH in the motor oil range was detected at GW 219 (0.46 mg/L) and GW220 (0.2 mg/L); ethylbenzene at GW219 (0.42 mg/L), toluene in GW224 (1.3 mg/L), and 2-methylnaphthalene in GW219 (4.1 mg/L) and GW224 (42 mg/L). These analytes are not contaminants of concern in groundwater for the Former Fuel Farm area and no cleanup levels have been established for them.

No COCs were detected in GW222 and GW 225 which are both located along the conditional point of compliance north of the Site.

4.3 Groundwater Elevation Contours

Groundwater levels were collected on June 29, 2011, at all monitoring wells within the Site, including monitoring wells that are not sampled for groundwater. The resulting groundwater elevation contour map is presented in Figure 4.

In general, the groundwater flow is towards the southwest, away from the Cedar River waterway, which is located northeast of the Site. The gradient in the shallow water bearing zone between the northeastern end of the Site (GW222S) and the southwestern part of the Site (GW224S) is approximately 0.005 ft/ft.

Historically the observed groundwater gradient direction has been variable due to the proximity of the Cedar River waterway. The current observed groundwater gradient direction potentially indicates that the increase in water being released from the Howard Hanson Dam in the upper reaches of the Cedar River watershed is influencing the groundwater gradient direction at the Site.

5.0 CONCLUSIONS

As described in Section 4.0, few COCs were detected above their respective site specific cleanup levels.

Benzene was detected above cleanup levels in soil, and TPH diesel-range and TPH Jet-A were detected above cleanup levels in groundwater. It should be noted that the benzene soil cleanup level is meant to be protective of groundwater at the Site. Since benzene was not detected in

any wells, including source area wells, the soil cleanup level of 12 µg/kg is likely a conservative level. Soil benzene concentrations appreciably higher than those detected in PP212 and PP217 may be required before groundwater quality is affected. No COCs were detected in groundwater along the conditional point of compliance north of the Site. No other analyte was detected above their respective cleanup level.

A comparison of soil analytical data collected in 2003 and data collected in 2011 suggests robust attenuation of COCs, with up to two order-of-magnitude decrease in concentration, within the source areas.

6.0 REFERENCES

AMEC, 2010, Draft Final Cleanup Action Plan, Boeing Renton Facility, Renton, Washington: Submitted to the Boeing Company, October.

AMEC, 2011a, Former Fuel Farm Cleanup Action Work Plan, Boeing Renton Facility, Renton, Washington: Submitted to the Boeing Company, May.

AMEC, 2011b, Quarterly Monitoring Report RCRA Corrective Action Program, Second Quarter 2011: Prepared for The Boeing Company, Seattle, Washington, (In progress).

Weston, 1998, Remedial Investigation Work Plan, Boeing Renton Plant, Renton, Washington.

Enclosures:

Tables

Table 1	June 2011 Soil Analytical Results
Table 2	June 2003 Soil Analytical Results
Table 3	June 2011 Groundwater Analytical Results

Figures

Figure 1	Former Fuel Farm Cleanup Action Investigation Site Map
Figure 2	Summary of Soil Analytical Results June 2003 and 2011
Figure 3	Summary of Groundwater Analytical Results June 2011
Figure 4	Former Fuel Farm AOC Groundwater Elevations, June 29, 2011

Attachments

Attachment 1	Laboratory Report and Data Validation Memo

TABLES

TABLE 1

JUNE 2011 SOIL ANALYTICAL RESULTS[1,2]
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Location				PP401		PP405		PP420		PP427	
Sample ID				RI-SB22-PP401-0030	RI-SB22-PP401-0100	RI-SB22-PP405-0030	RI-SB22-PP405-0090	RI-SB22-PP420-0030	RI-SB22-PP420-0090	RI-SB22-PP427-0030	RI-SB22-PP427-0100
Sample Date	MTCA Method A Industrial	MTCA Method A Unrestricted	FS Cleanup Level [3]	5/26/2011	5/26/2011	5/27/2011	5/27/2011	5/27/2011	5/27/2011	5/26/2011	5/26/2011
Depth (ft bgs)				3	10	3	9	3	9	3	10
Analyte											
TPH (mg/kg)											
Diesel Range Hydrocarbons	2000	2000	2000	240	580	5.3 U	5.5 U	5.4 U	1100	12	240
Jet-A	2000	2000	2000	120 U	210	5.3 U	5.5 U	5.4 U	1300	11 U	80
BTEX (µg/kg)											
Benzene	30	30	12	5.4	1.9	1.1 U	0.9 U	1.2 U	58 U	0.9 U	1.9
Ethylbenzene	6000	6000	--	1.8	1 U	1.1 U	0.9 U	1.2 U	94	0.9 U	1.4 U
m,p-Xylene	--	--	9000 [4]	9.5	2.2	1.1 U	0.9 U	1.2 U	190	0.9 U	3.7
o-Xylene	--	--	--	1.8	1 U	1.1 U	0.9 U	1.2 U	58 U	0.9 U	1.4 U
Toluene	7,000	7000	--	1.2 U	1 U	1.1 U	0.9 U	1.2 U	58 U	0.9 U	3.2
EPH (µg/kg)											
C10-C12 Aliphatics	--	--	--	2300 U	3900	2200 U	2200 U	2200 U	340000	2300 U	5000
C12-C16 Aliphatics	--	--	--	8000	61000	2200 U	2200 U	2200 U	440000	2300 U	8200
C16-C21 Aliphatics	--	--	--	37000	100000	2200 U	2200 U	2200 U	42000	2300 U	13000
C21-C34 Aliphatics	--	--	--	160000	160000	2200 U	2200 U	2200 U	21000	2300 U	150000
C8-C10 Aliphatics	--	--	--	2300 U	2500 U	2200 U	2200 U	2200 U	44000	2300 U	3200 U
C10-C12 Aromatics	--	--	--	2300 U	2500 U	2200 U	2200 U	2200 U	19000	2300 U	3200 U
C10-C12 Aromatics	--	--	--	12000 U	26000	8800 U	8300 U	12000 U	240000	9700 U	19000 U
C12-C16 Aromatics	--	--	--	2300 U	3900	2200 U	2200 U	2200 U	81000	2300 U	4000
C16-C21 Aromatics	--	--	--	14000	35000	2200 U	2200 U	2200 U	31000	2300 U	17000
C21-C34 Aromatics	--	--	--	86000	100000	2200 U	2200 U	2200 U	3700	2300 U	96000
C8-C10 Aromatics	--	--	--	2300 U	2500 U	2200 U	2200 U	2200 U	2300 U	2300 U	3200 U
VPH (µg/kg)											
Benzene	--	--	--	1200 U	1200 U	880 U	830 U	1200 U	1100 U	970 U	1900 U
C10-C12 Aliphatics	--	--	--	12000 U	12000 U	8800 U	8300 U	12000 U	11000 U	9700 U	19000 U
C12-C13 Aromatics	--	--	--	12000 U	36000	8800 U	8300 U	12000 U	150000	9700 U	19000 U
C5-C6 Aliphatics	--	--	--	12000 U	12000 U	8800 U	8300 U	12000 U	11000 U	9700 U	19000 U
C6-C8 Aliphatics	--	--	--	12000 U	12000 U	8800 U	8300 U	12000 U	11000 U	9700 U	19000 U
C8-C10 Aliphatics	--	--	--	12000 U	12000 U	8800 U	8300 U	12000 U	11000 U	9700 U	19000 U
C8-C10 Aromatics	--	--	--	12000 U	12000 U	8800 U	8300 U	12000 U	36000	9700 U	19000 U
Ethylbenzene	--	--	--	1200 U	1200 U	880 U	830 U	1200 U	1100 U	970 U	1900 U
m,p-Xylene	--	--	--	2400 U	2500 U	1800 U	1700 U	2400 U	2200 U	1900 U	3800 U
Methyl tert-Butyl Ether	--	--	--	1200 U	1200 U	880 U	830 U	1200 U	1100 U	970 U	1900 U
n-Decane	--	--	--	1200 U	1200 U	880 U	830 U	1200 U	1200	970 U	1900 U
n-Dodecane	--	--	--	1200 U	2300	880 U	830 U	1200 U	16000	970 U	1900 U
n-Hexane	--	--	--	1200 U	1200 U	880 U	830 U	1200 U	1100 U	970 U	1900 U
n-Octane	--	--	--	1200 U	1200 U	880 U	830 U	1200 U	1100 U	970 U	1900 U
n-Pentane	--	--	--	1200 U	1200 U	880 U	830 U	1200 U	1100 U	970 U	1900 U
o-Xylene	--	--	--	1200 U	1200 U	880 U	830 U	1200 U	1100 U	970 U	1900 U
Toluene	--	--	--	1200 U	1200 U	880 U	830 U	1200 U	1100 U	970 U	1900 U
SVOCs (µg/kg)											
2-Methylnaphthalene	--	--	45800	64 UJ	300 J	59 UJ	56 UJ	59 UJ	3100 J	63 UJ	62 UJ

TABLE 1

JUNE 2011 SOIL ANALYTICAL RESULTS[1,2]
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Location				PP430		PP210		PP211		PP212	
Sample ID				RI-SB22-PP430-0030	RI-SB22-PP430-0100	RI-SB-PP210-0030	RI-SB-PP210-0100	RI-SB-PP211-0030	RI-SB-PP211-0100	RI-SB-PP212-0030	RI-SB-PP212-0100
Sample Date	MTCA Method A Industrial	MTCA Method A Unrestricted	FS Cleanup Level [3]	5/26/2011	5/26/2011	5/27/2011	5/27/2011	5/26/2011	5/26/2011	5/26/2011	5/26/2011
Depth (ft bgs)				3	10	3	10	3	10	3	10
Analyte											
TPH (mg/kg)											
Diesel Range Hydrocarbons	2000	2000	2000	29	60	21	23	32	530	14	35
Jet-A	2000	2000	2000	11 U	110 U	6.2	5.5 U	12 U	250 U	11 U	12 U
BTEX (µg/kg)											
Benzene	30	30	12	1.2 U	1 U	1.2 U	1.1 U	1.4 U	4.2	13	1.5
Ethylbenzene	6000	6000	--	1.2 U	1 U	1.2 U	1.1 U	1.4 U	1.1 U	1 U	1.3 U
m,p-Xylene	--	--	9000 [4]	1.2 U	1 U	1.2 U	1.1 U	1.4 U	2.9	1 U	1.3 U
o-Xylene	--	--	--	1.2 U	1 U	1.2 U	1.1 U	1.4 U	1.1 U	1 U	1.3 U
Toluene	7,000	7000	--	1.2 U	1 U	1.2 U	1.1 U	1.4 U	1.2	3.3	1.3 U
EPH (µg/kg)											
C10-C12 Aliphatics	--	--	--	2200 U	2200 U	2400 U	2300 U	2300 U	6200	2300 U	2500 U
C12-C16 Aliphatics	--	--	--	2200 U	2400	2400 U	2300 U	2300 U	60000	2300 U	2500 U
C16-C21 Aliphatics	--	--	--	2200 U	5400	2400 U	2300 U	2900	140000	2300 U	6200
C21-C34 Aliphatics	--	--	--	2200 U	64000	2400 U	5600	5700	490000	2300 U	36000
C8-C10 Aliphatics	--	--	--	2200 U	2200 U	2400 U	2300 U	2300 U	4200	2300 U	2500 U
C10-C12 Aromatics	--	--	--	2200 U	2200 U	2400 U	2300 U	2300 U	2500 U	2300 U	2500 U
C10-C12 Aromatics	--	--	--	14000 U	10000 U	11000 U	9100 U	11000 U	13000 U	10000 U	12000 U
C12-C16 Aromatics	--	--	--	2200 U	2200 U	2400 U	2300 U	2300 U	2800	2300 U	2500 U
C16-C21 Aromatics	--	--	--	2200 U	6100	2400 U	2300 U	2300 U	17000	2300 U	2500 U
C21-C34 Aromatics	--	--	--	2200 U	51000	2400 U	2300 U	2800	72000	2300 U	2500 U
C8-C10 Aromatics	--	--	--	2200 U	2200 U	2400 U	2300 U	2300 U	2500 U	2300 U	2500 U
VPH (µg/kg)											
Benzene	--	--	--	1400 U	1000 U	1100 U	910 U	1100 U	1300 U	1000 U	1200 U
C10-C12 Aliphatics	--	--	--	14000 U	10000 U	11000 U	9100 U	11000 U	13000 U	10000 U	12000 U
C12-C13 Aromatics	--	--	--	14000 U	10000 U	11000 U	9100 U	11000 U	13000 U	10000 U	12000 U
C5-C6 Aliphatics	--	--	--	14000 U	10000 U	11000 U	9100 U	11000 U	13000 U	10000 U	12000 U
C6-C8 Aliphatics	--	--	--	14000 U	10000 U	11000 U	9100 U	11000 U	13000 U	10000 U	12000 U
C8-C10 Aliphatics	--	--	--	14000 U	10000 U	11000 U	9100 U	11000 U	13000 U	10000 U	12000 U
C8-C10 Aromatics	--	--	--	14000 U	10000 U	11000 U	9100 U	11000 U	13000 U	10000 U	12000 U
Ethylbenzene	--	--	--	1400 U	1000 U	1100 U	910 U	1100 U	1300 U	1000 U	1200 U
m,p-Xylene	--	--	--	2700 U	2000 U	2300 U	1800 U	2200 U	2700 U	2100 U	2400 U
Methyl tert-Butyl Ether	--	--	--	1400 U	1000 U	1100 U	910 U	1100 U	1300 U	1000 U	1200 U
n-Decane	--	--	--	1400 U	1000 U	1100 U	910 U	1100 U	1300 U	1000 U	1200 U
n-Dodecane	--	--	--	1400 U	1000 U	1100 U	910 U	1100 U	1300 U	1000 U	1200 U
n-Hexane	--	--	--	1400 U	1000 U	1100 U	910 U	1100 U	1300 U	1000 U	1200 U
n-Octane	--	--	--	1400 U	1000 U	1100 U	910 U	1100 U	1300 U	1000 U	1200 U
n-Pentane	--	--	--	1400 U	1000 U	1100 U	910 U	1100 U	1300 U	1000 U	1200 U
o-Xylene	--	--	--	1400 U	1000 U	1100 U	910 U	1100 U	1300 U	1000 U	1200 U
Toluene	--	--	--	1400 U	1000 U	1100 U	910 U	1100 U	1300 U	1000 U	1200 U
SVOCs (µg/kg)											
2-Methylnaphthalene	--	--	45800	61 UJ	61 UJ	64 UJ	61 UJ	64 UJ	210 J	63 UJ	61 UJ

TABLE 1

JUNE 2011 SOIL ANALYTICAL RESULTS[1,2]

Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Location				PP213		PP214		PP215		PP216	
Sample ID				RI-SB-PP213-0030	RI-SB-PP213-0100	RI-SB-PP214-0030	RI-SB-PP214-0100	RI-SB-PP215-0030	RI-SB-PP215-0100	RI-SB-PP216-0030	RI-SB-PP216-0100
Sample Date	MTCA	MTCA	FS	5/26/2011	5/26/2011	5/26/2011	5/26/2011	5/26/2011	5/26/2011	5/27/2011	5/27/2011
Depth (ft bgs)	Method A	Method A	Cleanup	3	10	3	10	3	10	3	10
Analyte	**Industrial**	**Unrestricted**	**Level [3]**								
TPH (mg/kg)											
Diesel Range Hydrocarbons	2000	2000	2000	46	20	37	57	5.6 U	18	90	28
Jet-A	2000	2000	2000	16	12 U	12 U	16	11 U	11 U	16	22
BTEX (µg/kg)											
Benzene	30	30	12	1.1 U	1.2 U	2	1.1 U	1.2 U	1 U	2.1	1.2 U
Ethylbenzene	6000	6000	--	1.1 U	1.2 U	1.2 U	1.1 U	1.2 U	1 U	1.1 U	1.2 U
m,p-Xylene	--	--	9000 [4]	1.9	1.2 U	1.2 U	1.1 U	1.2 U	1 U	1.1 U	1.9
o-Xylene	--	--	--	1.1 U	1.2 U	1.2 U	1.1 U	1.2 U	1 U	1.1 U	1.2 U
Toluene	7,000	7000	--	1.1 U	1.2 U	1.2 U	1.1 U	1.2 U	1 U	1.1 U	1.2 U
EPH (µg/kg)											
C10-C12 Aliphatics	--	--	--	2300 U	2400 U	2500 U	2300 U	2200 U	2300 U	2300 U	2300 U
C12-C16 Aliphatics	--	--	--	2300 U	2400 U	2500 U	2500	2200 U	2300 U	4000	2900
C16-C21 Aliphatics	--	--	--	2300 U	2400 U	3300	6000	2200 U	2300 U	25000	2300 U
C21-C34 Aliphatics	--	--	--	3400	2400 U	8900	2300	2200 U	2300 U	110000	2300 U
C8-C10 Aliphatics	--	--	--	5100	2400 U	2500 U	3000	2200 U	2300 U	2300 U	2300 U
C10-C12 Aromatics	--	--	--	2300 U	2400 U	2500 U	2300 U	2200 U	2300 U	2300 U	2300 U
C10-C12 Aromatics	--	--	--	11000 U	12000 U	12000 U	12000 U	11000 U	11000 U	11000 U	12000 U
C12-C16 Aromatics	--	--	--	2300 U	2400 U	2500 U	2300 U	2200 U	2300 U	2300 U	2300 U
C16-C21 Aromatics	--	--	--	2700	2400 U	2500 U	2300 U	2200 U	2300 U	12000	2300 U
C21-C34 Aromatics	--	--	--	2500	2400 U	2500 U	2300 U	2200 U	2300 U	70000	2300 U
C8-C10 Aromatics	--	--	--	2300 U	2400 U	2500 U	2300 U	2200 U	2300 U	2300 U	2300 U
VPH (µg/kg)											
Benzene	--	--	--	1100 U	1200 U	1200 U	1200 U	1100 U	1100 U	1100 U	1200 U
C10-C12 Aliphatics	--	--	--	11000 U	12000 U	12000 U	12000 U	11000 U	11000 U	11000 U	12000 U
C12-C13 Aromatics	--	--	--	11000 U	12000 U	12000 U	12000 U	11000 U	11000 U	11000 U	12000 U
C5-C6 Aliphatics	--	--	--	11000 U	12000 U	12000 U	12000 U	11000 U	11000 U	11000 U	12000 U
C6-C8 Aliphatics	--	--	--	19000	12000 U	12000 U	12000 U	11000 U	11000 U	11000 U	12000 U
C8-C10 Aliphatics	--	--	--	11000 U	12000 U	12000 U	12000 U	11000 U	11000 U	11000 U	12000 U
C8-C10 Aromatics	--	--	--	11000 U	12000 U	12000 U	12000 U	11000 U	11000 U	11000 U	12000 U
Ethylbenzene	--	--	--	1100 U	1200 U	1200 U	1200 U	1100 U	1100 U	1100 U	1200 U
m,p-Xylene	--	--	--	2300 U	2300 U	2400 U	2400 U	2300 U	2100 U	2100 U	2300 U
Methyl tert-Butyl Ether	--	--	--	1100 U	1200 U	1200 U	1200 U	1100 U	1100 U	1100 U	1200 U
n-Decane	--	--	--	1100 U	1200 U	1200 U	1200 U	1100 U	1100 U	1100 U	1200 U
n-Dodecane	--	--	--	1100 U	1200 U	1200 U	1200 U	1100 U	1100 U	1100 U	1200 U
n-Hexane	--	--	--	1100 U	1200 U	1200 U	1200 U	1100 U	1100 U	1100 U	1200 U
n-Octane	--	--	--	1100 U	1200 U	1200 U	1200 U	1100 U	1100 U	1100 U	1200 U
n-Pentane	--	--	--	1100 U	1200 U	1200 U	1200 U	1100 U	1100 U	1100 U	1200 U
o-Xylene	--	--	--	1100 U	1200 U	1200 U	1200 U	1100 U	1100 U	1100 U	1200 U
Toluene	--	--	--	1100 U	1200 U	1200 U	1200 U	1100 U	1100 U	1100 U	1200 U
SVOCs (µg/kg)											
2-Methylnaphthalene	--	--	45800	63 UJ	65 UJ	61 UJ	60 UJ	62 UJ	63 UJ	63 UJ	67 J

TABLE 1

JUNE 2011 SOIL ANALYTICAL RESULTS[1,2]
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Location				PP217		PP218		PP219		PP226		PP227	
Sample ID				RI-SB-PP217-0030	RI-SB-PP217-0100	RI-SB-PP218-0030	RI-SB-PP218-0080	RI-SB-PP219-0030	RI-SB-PP219-0100	RI-SB-PP226-0030	RI-SB-PP226-0090	RI-SB-PP227-0030	RI-SB-PP227-0090
Sample Date	MTCA Method A Industrial	MTCA Method A Unrestricted	FS Cleanup Level [3]	5/26/2011	5/26/2011	5/27/2011	5/27/2011	5/27/2011	5/27/2011	5/27/2011	5/27/2011	5/27/2011	5/27/2011
Depth (ft bgs)				3	10	3	8	3	10	3	9	3	
Analyte													
TPH (mg/kg)													
Diesel Range Hydrocarbons	2000	2000	2000	5.8 U	37	59	20	14	24	5.6 U	110	5.2 U	5.4 U
Jet-A	2000	2000	2000	12 U	14	14	6.2 U	5.4 U	5.6	5.6 U	56	5.2 U	5.4 U
BTEX (µg/kg)													
Benzene	30	30	12	1.2 U	19	9.9	1.7	1.2 U	0.9	0.9 U	2.1 U	1.1 U	0.9 U
Ethylbenzene	6000	6000	--	1.2 U	1.7	1.4 U	1.1 U	1.2 U	0.9 U	0.9 U	2.1 U	1.1 U	0.9 U
m,p-Xylene	--	--	9000 [4]	1.2 U	3.5	1.4 U	1.1 U	1.2 U	1.8	0.9 U	2.1 U	1.1 U	0.9 U
o-Xylene	--	--	--	1.2 U	1.7 U	1.4 U	1.1 U	1.2 U	0.9 U	0.9 U	2.1 U	1.1 U	0.9 U
Toluene	7,000	7000	--	1.2 U	2.6	3.5	1.1 U	1.2 U	0.9 U	0.9 U	2.1 U	1.1 U	0.9 U
EPH (µg/kg)													
C10-C12 Aliphatics	--	--	--	2400 U	2600 U	2500 U	2500 U	2200 U	2200 U	2200 U	3400 U	2100 U	2200 U
C12-C16 Aliphatics	--	--	--	2400 U	2600 U	2500 U	2500 U	2200 U	2200 U	2200 U	3400 U	2100 U	2200 U
C16-C21 Aliphatics	--	--	--	2400 U	2600 U	2500 U	2500 U	2200 U	2400	2200 U	3400 U	2100 U	2200 U
C21-C34 Aliphatics	--	--	--	2400 U	7300	4700	2500 U	3900	5200	7400	4200	2100 U	2200 U
C8-C10 Aliphatics	--	--	--	2400 U	2600 U	2500 U	2500 U	2200 U	2200 U	2200 U	3400 U	2100 U	2200 U
C10-C12 Aromatics	--	--	--	2400 U	2600 U	2500 U	2500 U	2200 U	2200 U	2200 U	3400 U	2100 U	2200 U
C10-C12 Aromatics	--	--	--	11000 U	12000 U	17000 U	12000 U	11000 U	9000 U	9400 U	20000 U	9000 U	11000 U
C12-C16 Aromatics	--	--	--	2400 U	2600 U	2500 U	2500 U	2200 U	2200 U	2200 U	3400 U	2100 U	2200 U
C16-C21 Aromatics	--	--	--	2400 U	2600 U	2500 U	2500 U	2200 U	2200 U	2200 U	3400 U	2100 U	2200 U
C21-C34 Aromatics	--	--	--	2400 U	2700	2500 U	2500 U	2200 U	2500	2200 U	3400 U	2100 U	2200 U
C8-C10 Aromatics	--	--	--	2400 U	2600 U	2500 U	2500 U	2200 U	2200 U	2200 U	3400 U	2100 U	2200 U
VPH (µg/kg)													
Benzene	--	--	--	1100 U	1200 U	1700 U	1200 U	1100 U	900 U	940 U	2000 U	900 U	1100 U
C10-C12 Aliphatics	--	--	--	11000 U	12000 U	17000 U	12000 U	11000 U	9000 U	9400 U	20000 U	9000 U	11000 U
C12-C13 Aromatics	--	--	--	11000 U	12000 U	17000 U	12000 U	11000 U	9000 U	9400 U	20000 U	9000 U	11000 U
C5-C6 Aliphatics	--	--	--	11000 U	12000 U	17000 U	12000 U	11000 U	9000 U	9400 U	20000 U	9000 U	11000 U
C6-C8 Aliphatics	--	--	--	11000 U	12000 U	17000 U	12000 U	11000 U	9000 U	9400 U	20000 U	9000 U	11000 U
C8-C10 Aliphatics	--	--	--	11000 U	12000 U	17000 U	12000 U	11000 U	9000 U	9400 U	20000 U	9000 U	11000 U
C8-C10 Aromatics	--	--	--	11000 U	12000 U	17000 U	12000 U	11000 U	9000 U	9400 U	20000 U	9000 U	11000 U
Ethylbenzene	--	--	--	1100 U	1200 U	1700 U	1200 U	1100 U	900 U	940 U	2000 U	900 U	1100 U
m,p-Xylene	--	--	--	2300 U	2400 U	3400 U	2400 U	2200 U	1800 U	1900 U	4100 U	1800 U	2200 U
Methyl tert-Butyl Ether	--	--	--	1100 U	1200 U	1700 U	1200 U	1100 U	900 U	940 U	2000 U	900 U	1100 U
n-Decane	--	--	--	1100 U	1200 U	1700 U	1200 U	1100 U	900 U	940 U	2000 U	900 U	1100 U
n-Dodecane	--	--	--	1100 U	1200 U	1700 U	1200 U	1100 U	900 U	940 U	2000 U	900 U	1100 U
n-Hexane	--	--	--	1100 U	1200 U	1700 U	1200 U	1100 U	900 U	940 U	2000 U	900 U	1100 U
n-Octane	--	--	--	1100 U	1200 U	1700 U	1200 U	1100 U	900 U	940 U	2000 U	900 U	1100 U
n-Pentane	--	--	--	1100 U	1200 U	1700 U	1200 U	1100 U	900 U	940 U	2000 U	900 U	1100 U
o-Xylene	--	--	--	1100 U	1200 U	1700 U	1200 U	1100 U	900 U	940 U	2000 U	900 U	1100 U
Toluene	--	--	--	1100 U	1200 U	1700 U	1200 U	1100 U	900 U	940 U	2000 U	900 U	1100 U
SVOCs (µg/kg)													
2-Methylnaphthalene	--	--	45800	58 UJ	63 UJ	63 UJ	62 UJ	60 UJ	61 UJ	61 UJ	99 J	63 UJ	60 UJ

Notes

1. Laboratory data flags are as follows:
   U = Analyte not detected at reporting limit given.
   -- = not established.
2. [ ] = value exceeds cleanup value from the FS.
3. FS cleanup level is the cleanup level agreed upon with Ecology and presented in the Draft Final FS.
4. Value presented is for total xylenes

Abbreviations

µg/kg = micrograms per kilogram
BTEX = benzene, toluene, ethylbenzene, xylenes
EPH = extractable petroleum hydrocarbons
FS = feasibility study
ft bgs= feet below ground surface
mg/kg = milligrams per kilogram
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons
VPH = volatile petroluem hydrocarbons

TABLE 2

JUNE 2003 SOIL ANALYTICAL RESULTS[1, 2]

Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Constituent / Station ID / Sample ID / Sample Date / Sample Depth [3]	MTCA Method A Industrial	MTCA Method A Residential	FS Cleanup Level [4]	PP401 I-SB21-PP401-0100 6/17/2003 10	PP405 I-SB21-PP405-0100 6/17/2003 10	PP420 I-SB21-PP420-0100 6/17/2003 10	PP420 (field dup) I-SB21-PP420-1100 6/17/2003 10	PP427 I-SB21-PP427-0100 6/17/2003 10	PP430 I-SB21-PP430-0100 6/17/2003 10
PAHs (µg/kg)									
2-Methylnaphthalene	--	--	45,800	86	8300	140	400	69	30 U
Acenaphthene	--	--	--	8.5 U	210 U	180	180	30 U	30 U
Acenaphthylene	--	--	--	8.5 U	210 U	120 U	100	30 U	30 U
Anthracene	--	--	--	8.5 U	210 U	120	260	30 U	30 U
Benzo(a)anthracene	--	--	--	8.5 U	210 U	120 U	100 U	30 U	30 U
Benzo(a)pyrene	--	--	--	8.5 U	210 U	120 U	100 U	30 U	30 U
Benzo(b)fluoranthene	--	--	--	8.5 U	210 U	120 U	100 U	30 U	30 U
Benzo(g,h,i)perylene	--	--	--	8.5 U	210 U	120 U	100 U	30 U	30 U
Benzo(k)fluoranthene	--	--	--	8.5 U	210 U	120 U	100 U	30 U	30 U
Chrysene	--	--	--	8.5 U	210 U	120 U	100 U	30 U	30 U
Dibenz(a,h)anthracene	--	--	--	8.5 U	210 U	120 U	100 U	30 U	30 U
Dibenzofuran	--	--	--	8.5 U	210 U	140	220	30 U	30 U
Fluoranthene	--	--	--	8.5 U	210 U	120 U	100 U	30 U	30 U
Fluorene	--	--	--	8.5 U	320	180	190	500	440
Indeno(1,2,3-cd)pyrene	--	--	--	8.5 U	210 U	120 U	100 U	30 U	30 U
Naphthalene	--	--	--	39	210 U	380	320	30 U	30 U
Phenanthrene	--	--	--	10	210 U	140	260	360	880
Pyrene	--	--	--	8.5 U	210 U	120 U	100 U	45	42
EPH (µg/kg)									
C8-C10 Aliphatics	--	--	--	7,200	560,000	230,000	450,000	37,000	39,000
C8-C10 Aromatics	--	--	--	4,300 U	23,000	12,000 U	11,000 U	4,100 U	4,000 U
C10-C12 Aliphatics	--	--	--	10,000	1,600,000	600,000	1,400,000	150,000	150,000
C10-C12 Aromatics	--	--	--	4,300 U	360,000	91,000	220,000	4,100 U	4,400
C12-C16 Aliphatics	--	--	--	23,000	1,500,000	620,000	1,100,000	920,000	710,000
C12-C16 Aromatics	--	--	--	4,300 U	740,000	240,000	460,000	26,000	87,000
C16-C21 Aliphatics	--	--	--	10,000	140,000	64,000	99,000	960,000	400,000
C16-C21 Aromatics	--	--	--	4,300 U	60,000	36,000	81,000	170,000	390,000
C21-C34 Aliphatics	--	--	--	13,000	110,000	57,000	87,000	170,000	44,000
C21-C34 Aromatics	--	--	--	4,300 U	21,000 U	12,000 U	55,000	41,000	4,000 U
VPH (µg/kg)									
C5-C6 Aliphatics	--	--	--	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U
C6-C8 Aliphatics	--	--	--	15,000	5,000 U	220,000	110,000	12,000	30,000
C8-C10 Aliphatics	--	--	--	13,000	5,000 U	190,000	71,000	5,000 U	16,000
C8-C10 Aromatics	--	--	--	140,000	5,000 U	830,000	390,000	40,000	94,000
C10-C12 Aliphatics	--	--	--	330,000	7,600	1,500,000	760,000	100,000	200,000
C10-C12 Aromatics	--	--	--	330,000	7,200	1,500,000	770,000	130,000	220,000
C12-C13 Aromatics	--	--	--	280,000	14,000	960,000	480,000	160,000	290,000
Benzene	30	30	12	150	11 U	490	84	23 U	130
Ethylbenzene	6000	6000	--	500 U	5,000 U	1,200	520	500 U	500 U
m,p-Xylene	--	--	9,000 [5]	2,600	5,000 U	7,800	3,600	500 U	890
Methyl tert-Butyl Ether	--	--	--	120 U	56 U	120 U	120 U	110 U	130 U
o-Xylene	--	--	--	700	5,000 U	7,100	3,400	500 U	940
Toluene	7000	7000	--	500 U	5,000 U	730	500 U	500 U	500 U

TABLE 2

JUNE 2003 SOIL ANALYTICAL RESULTS[1, 2]
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Constituent / Station ID / Sample ID / Sample Date / Sample Depth [3]	MTCA Method A Industrial	MTCA Method A Residential	FS Cleanup Level [4]	PP401 I-SB21-PP401-0100 6/17/2003 10	PP405 I-SB21-PP405-0100 6/17/2003 10	PP420 I-SB21-PP420-0100 6/17/2003 10	PP420 (field dup) I-SB21-PP420-1100 6/17/2003 10	PP427 I-SB21-PP427-0100 6/17/2003 10	PP430 I-SB21-PP430-0100 6/17/2003 10
Volatile Organic Compounds (µg/kg)									
Benzene	30	30	12	29 U	35 U	29 U	29 U	29 U	18 U
Ethylbenzene	6,000	6,000	--	51	1,100	1,200	1,200	29 U	79
m,p-Xylene	--	--	9,000 [5]	57 U	110	100	100	58 U	35 U
o-Xylene	--	--	--	100	1,100	1,300	1,200	76	75
Toluene	7,000	7,000	--	29 U	77	150	160	29 U	18 U
Total Petroleum Hydrocarbons (mg/kg)									
Diesel range	2,000	2,000	2,000	120	3,800	1,500	2,400	1,900	2,900
Motor oil	2,000	2,000	2,000	56	140	76	140	85 J	30 J
Jet A	2,000	2,000	2,000	94	6,400	2,400	4,100	1,400	2,400

Notes
1. Data qualifiers are as follows:
   U = the analyte was not detected at value to the left, which is the reporting limit.
   J = Analyte was detected; value is estimated.
2. [ ] = value exceeds cleanup value from the FS.
3. Sample depths expressed as feet below ground surface.
4. FS cleanup level is the cleanup level agreed upon with Ecology and presented in the Draft Final FS.
5. Value presented is for total xylenes

Abbreviations
µg/kg = micrograms per kilogram
BTEX = benzene, toluene, ethylbenzene, xylenes
EPH = extractable petroleum hydrocarbons
FS = feasibility study
mg/kg = milligrams per kilogram
PAHs = Polycyclic Aromatic Hydrocarbons
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons
VPH = volatile petroluem hydrocarbons

TABLE 3

JUNE 2011 GROUNDWATER ANALYTICAL RESULTS[1, 2]

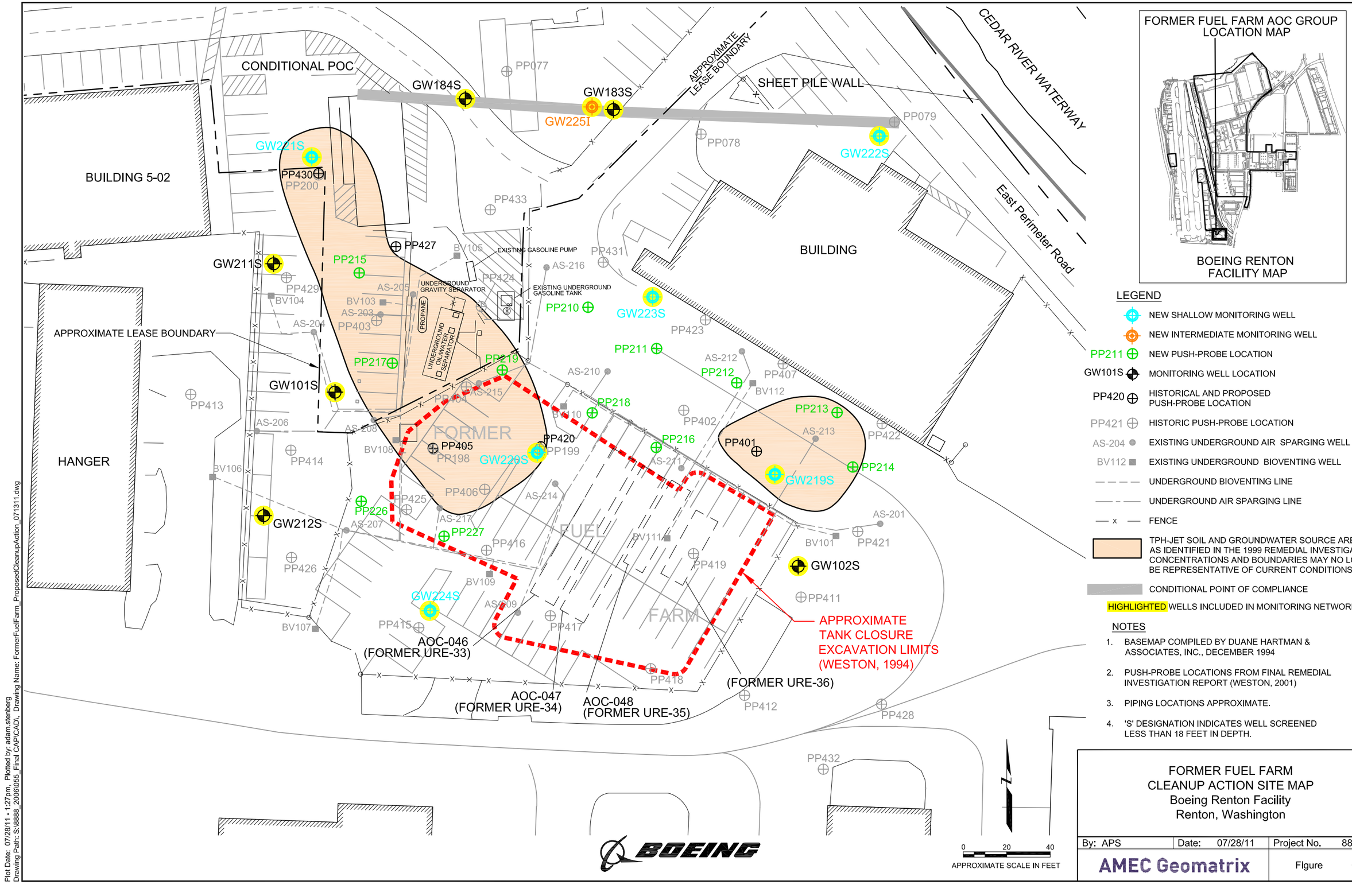
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Constituent	Station ID / Sample ID / Sample Date	MTCA Method A Groundwater	FS Cleanup Level [3]	GW219 / GW219-110630 / 6/30/2011	GW220 / GW220-110630 / 6/30/2011	GW221 / GW22110630 / 6/30/2011	GW222 / GW222-110630 / 6/30/2011	GW223 / GW223-110630 / 6/30/2011	GW224 / GW224110630 / 6/30/2011	GW225 / GW225-110630 / 6/30/2011
PAHs (µg/L)										
2-Methylnaphthalene		--	--	4.1	1.0 U	1.0 U	1.0 U	1.0 U	42	1.0 U
Volatile Organic Compounds (µg/L)										
Benzene		5	--	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Ethylbenzene		700	--	0.42	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
m,p-Xylene		1,000	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
o-Xylene		--	--	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Toluene		1,000	--	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	1.3	0.25 U
Total Petroleum Hydrocarbons (mg/L)										
Diesel range		0.5	0.5	1.2	0.94	0.68	0.10 U	0.10 U	0.77	0.10 U
Motor oil		0.5	--	0.46	0.2	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Jet A		0.5	0.5	1.6	1.6	0.62	0.10 U	0.10 U	1.6	0.10 U

Notes
1, Data qualifiers are as follows:
U = the analyte was not detected at value to the left, which is the reporting limit.
2. [ ] = value exceeds the FS cleanup level.
3. FS cleanup level is the cleanup level agreed upon with Ecology and presented in the Draft Final FS.

Abbreviations
µg/L = micrograms per liter
FS = feasibility study
mg/L = milligrams per liter
PAHs = Polycyclic Aromatic Hydrocarbons

FIGURES



FORMER FUEL FARM AOC GROUP LOCATION MAP

BOEING RENTON FACILITY MAP

LEGEND

- NEW SHALLOW MONITORING WELL
- NEW INTERMEDIATE MONITORING WELL
- PP211 NEW PUSH-PROBE LOCATION
- GW101S MONITORING WELL LOCATION
- PP420 HISTORICAL AND PROPOSED PUSH-PROBE LOCATION
- PP421 HISTORIC PUSH-PROBE LOCATION
- AS-204 EXISTING UNDERGROUND AIR SPARGING WELL
- BV112 EXISTING UNDERGROUND BIOVENTING WELL
- UNDERGROUND BIOVENTING LINE
- UNDERGROUND AIR SPARGING LINE
- 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.
- CONDITIONAL POINT OF COMPLIANCE
- HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

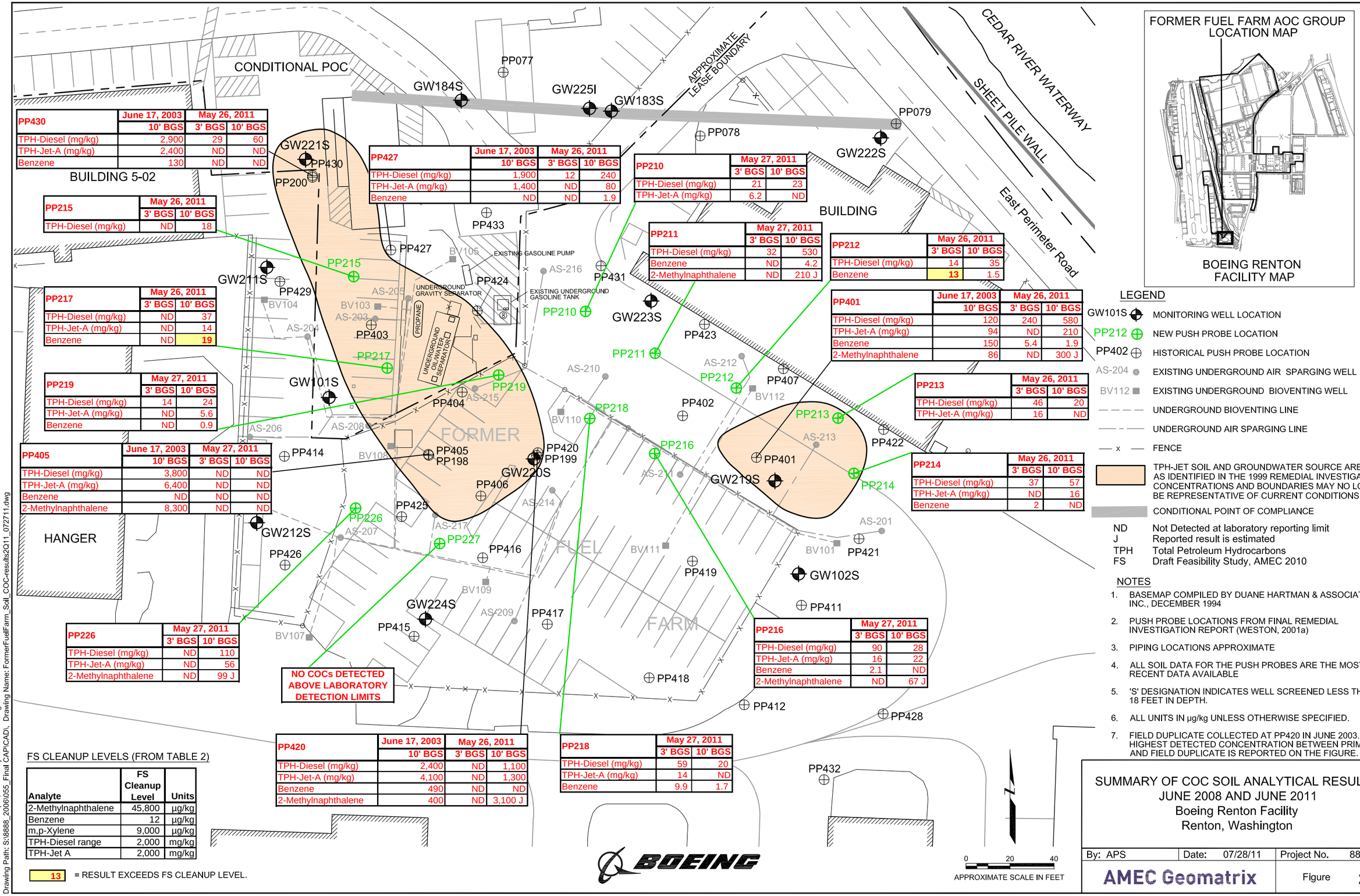
NOTES

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.

FORMER FUEL FARM CLEANUP ACTION SITE MAP
Boeing Renton Facility
Renton, Washington

By: APS	Date: 07/28/11	Project No. 8888
AMEC Geomatrix		Figure 1

Plot Date: 07/28/11 - 1:27pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\, Drawing Name: FormerFuelFarm_ProposedCleanupAction_071311.dwg



PP430	June 17, 2003	May 26, 2011	
	10' BGS	3' BGS	10' BGS
TPH-Diesel (mg/kg)	2,900	29	60
TPH-Jet-A (mg/kg)	2,400	ND	ND
Benzene	130	ND	ND

PP427	June 17, 2003	May 26, 2011	
	10' BGS	3' BGS	10' BGS
TPH-Diesel (mg/kg)	1,900	12	240
TPH-Jet-A (mg/kg)	1,400	ND	80
Benzene	ND	ND	1.9

PP210	May 27, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	21	23
TPH-Jet-A (mg/kg)	6.2	ND

PP215	May 26, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	ND	18

PP211	May 27, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	32	530
Benzene	ND	4.2
2-Methylnaphthalene	ND	210 J

PP212	May 26, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	14	35
Benzene	**13**	1.5

PP217	May 26, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	ND	37
TPH-Jet-A (mg/kg)	ND	14
Benzene	ND	**19**

PP401	June 17, 2003	May 26, 2011	
	10' BGS	3' BGS	10' BGS
TPH-Diesel (mg/kg)	120	240	580
TPH-Jet-A (mg/kg)	94	ND	210
Benzene	150	5.4	1.9
2-Methylnaphthalene	86	ND	300 J

PP219	May 27, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	14	24
TPH-Jet-A (mg/kg)	ND	5.6
Benzene	ND	0.9

PP213	May 26, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	46	20
TPH-Jet-A (mg/kg)	16	ND

PP405	June 17, 2003	May 27, 2011	
	10' BGS	3' BGS	10' BGS
TPH-Diesel (mg/kg)	3,800	ND	ND
TPH-Jet-A (mg/kg)	6,400	ND	ND
Benzene	ND	ND	ND
2-Methylnaphthalene	8,300	ND	ND

PP214	May 26, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	37	57
TPH-Jet-A (mg/kg)	ND	16
Benzene	2	ND

PP226	May 27, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	ND	110
TPH-Jet-A (mg/kg)	ND	56
2-Methylnaphthalene	ND	99 J

NO COCs DETECTED ABOVE LABORATORY DETECTION LIMITS

PP216	May 27, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	90	28
TPH-Jet-A (mg/kg)	16	22
Benzene	2.1	ND
2-Methylnaphthalene	ND	67 J

PP420	June 17, 2003	May 26, 2011	
	10' BGS	3' BGS	10' BGS
TPH-Diesel (mg/kg)	2,400	ND	1,100
TPH-Jet-A (mg/kg)	4,100	ND	1,300
Benzene	490	ND	ND
2-Methylnaphthalene	400	ND	3,100 J

PP218	May 27, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	59	20
TPH-Jet-A (mg/kg)	14	ND
Benzene	9.9	1.7

FS CLEANUP LEVELS (FROM TABLE 2)

Analyte	FS Cleanup Level	Units
2-Methylnaphthalene	45,800	µg/kg
Benzene	12	µg/kg
m,p-Xylene	9,000	µg/kg
TPH-Diesel range	2,000	mg/kg
TPH-Jet A	2,000	mg/kg

13 = RESULT EXCEEDS FS CLEANUP LEVEL.

FORMER FUEL FARM AOC GROUP LOCATION MAP

BOEING RENTON FACILITY MAP

LEGEND

- GW101S — MONITORING WELL LOCATION
- PP212 — NEW PUSH PROBE LOCATION
- PP402 — HISTORICAL PUSH PROBE LOCATION
- AS-204 — EXISTING UNDERGROUND AIR SPARGING WELL
- BV112 — EXISTING UNDERGROUND BIOVENTING WELL
- UNDERGROUND BIOVENTING LINE
- UNDERGROUND AIR SPARGING LINE
- 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.
- CONDITIONAL POINT OF COMPLIANCE

ND Not Detected at laboratory reporting limit
J Reported result is estimated
TPH Total Petroleum Hydrocarbons
FS Draft Feasibility Study, AMEC 2010

NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
2. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001a)
3. PIPING LOCATIONS APPROXIMATE
4. ALL SOIL DATA FOR THE PUSH PROBES ARE THE MOST RECENT DATA AVAILABLE
5. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 18 FEET IN DEPTH.
6. ALL UNITS IN µg/kg UNLESS OTHERWISE SPECIFIED.
7. FIELD DUPLICATE COLLECTED AT PP420 IN JUNE 2003. HIGHEST DETECTED CONCENTRATION BETWEEN PRIMARY AND FIELD DUPLICATE IS REPORTED ON THE FIGURE.

APPROXIMATE SCALE IN FEET: 0 20 40

SUMMARY OF COC SOIL ANALYTICAL RESULTS JUNE 2008 AND JUNE 2011

Boeing Renton Facility
Renton, Washington

By: APS	Date: 07/28/11	Project No. 8888
AMEC Geomatrix		Figure 2

Plot Date: 07/28/11 - 1:33pm Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\ Drawing Name: FormerFuelFarm_Soil_COC-results2Q11_072711.dwg

CONDITIONAL POC

APPROXIMATE LEASE BOUNDARY

SHEET PILE WALL

CEDAR RIVER WATERWAY

East Perimeter Road

BUILDING 5-02

BUILDING

HANGER

FORMER FUEL FARM

GW184S GW225I GW183S GW221S GW222S GW211S GW101S GW220S GW219S GW212S GW224S GW223S GW102S

PP077 PP078 PP079 PP430 PP433 PP427 PP431 PP429 PP424 PP423 PP403 PP210 PP211 PP217 PP219 PP404 PP413 PP407 PP402 PP212 PP218 PP213 PP422 PP414 PP405 PP420 PP216 PP401 PP214 PP406 PP425 PP226 PP227 PP416 PP419 PP426 PP417 PP411 PP415 PP418 PP412 PP428 PP432 PP421

BV105 BV104 BV103 BV106 BV108 BV110 BV112 BV111 BV101 BV109 BV107

AS-205 AS-203 AS-204 AS-215 AS-206 AS-208 AS-210 AS-212 AS-213 AS-211 AS-217 AS-214 AS-207 AS-209 AS-201 AS-216

EXISTING GASOLINE PUMP

EXISTING UNDERGROUND GASOLINE TANK

UNDERGROUND GRAVITY SEPARATOR

PROPANE

UNDERGROUND OIL/WATER SEPARATOR

NO COCs DETECTED ABOVE LABORATORY DETECTION LIMITS

NO COCs DETECTED ABOVE LABORATORY DETECTION LIMITS

NO COCs DETECTED ABOVE LABORATORY DETECTION LIMITS

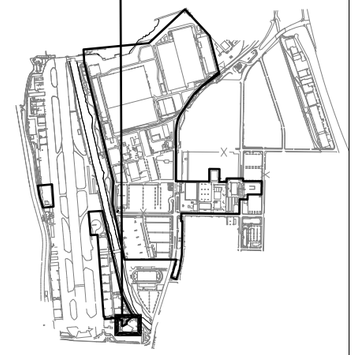
GW221S	June 30, 2011
TPH-Diesel (mg/L)	0.68
TPH-Jet-A (mg/L)	0.62

GW 220S	June 30, 2011
TPH-Diesel (mg/L)	0.94
TPH-Jet-A (mg/L)	1.6

GW219S	June 30, 2011
TPH-Diesel (mg/L)	1.2
TPH-Jet-A (mg/L)	1.6

GW224S	June 30, 2011
TPH-Diesel (mg/L)	0.77
TPH-Jet-A (mg/L)	1.6

FORMER FUEL FARM AOC GROUP LOCATION MAP



BOEING RENTON FACILITY MAP

LEGEND

- GW101S — MONITORING WELL LOCATION GROUNDWATER ELEVATION (MAY 8, 2008)
- PP211 — NEW PUSH PROBE LOCATION
- PP402 — HISTORICAL PUSH PROBE LOCATION
- AS-204 — EXISTING UNDERGROUND AIR SPARGING WELL
- BV112 — EXISTING UNDERGROUND BIOVENTING WELL
- UNDERGROUND BIOVENTING LINE
- UNDERGROUND AIR SPARGING LINE
- 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.
- CONDITIONAL POINT OF COMPLIANCE

TPH Total Petroleum Hydrocarbons
FS Draft Feasibility Study, AMEC 2010

NOTES

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

FS CLEANUP LEVELS (FROM TABLE 2)

Analyte	FS Cleanup Level	Units
TPH-Diesel range	0.5	mg/L
TPH-Jet A	0.5	mg/L

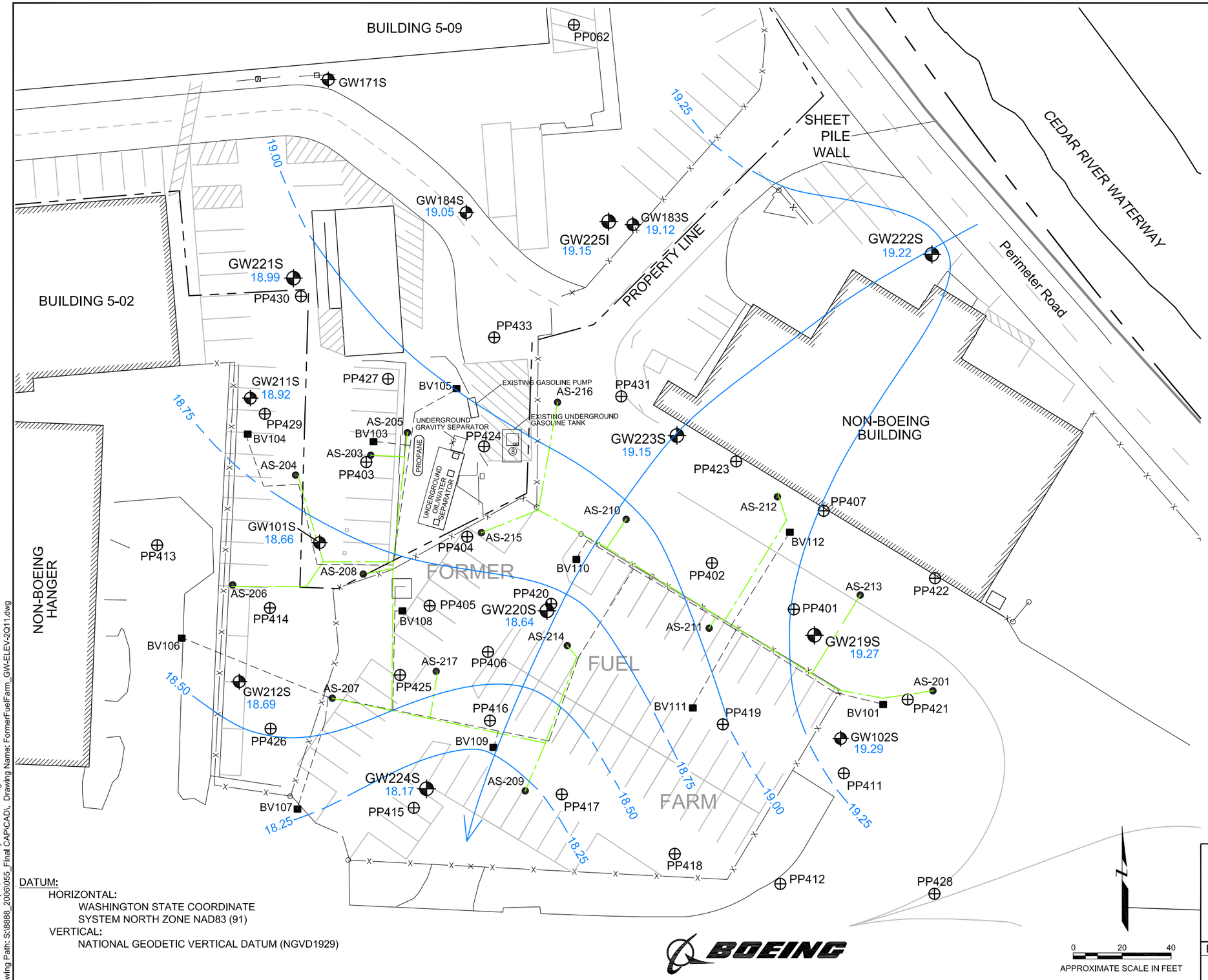
1.6 = RESULT EXCEEDS FS CLEANUP LEVEL.

0 20 40
APPROXIMATE SCALE IN FEET

SUMMARY OF COC GROUNDWATER ANALYTICAL RESULTS JUNE 2011 Boeing Renton Facility Renton, Washington

By: APS	Date: 07/28/11	Project No. 8888
AMEC Geomatrix		Figure 3

Plot Date: 07/28/11 - 1:35pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\, Drawing Name: Former Fuel Farm_GW_COC-results2Q11_072711.dwg



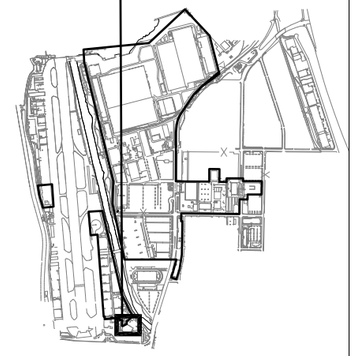
LEGEND

- GW101S / 18.66 — MONITORING WELL LOCATION WITH GROUNDWATER ELEVATION (NGVD-FEET)
- PP042 — PUSH PROBE LOCATION
- AS-204 — UNDERGROUND AIR SPARGING WELL
- BV112 — UNDERGROUND BIOVENTING WELL
- UNDERGROUND BIOVENTING LINE
- UNDERGROUND AIR SPARGING LINE
- FENCE
- 18.75 — GROUNDWATER ELEVATION CONTOUR (CONTOUR INTERVAL: 0.25 FOOT) (DASHED WHERE INFERRED)
- GENERAL DIRECTION OF GROUNDWATER FLOW

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. THE 'S' LETTER DESIGNATION INDICATES A SHALLOWER WELL. SEE SECTION 3.3 FOR ADDITIONAL INFORMATION ABOUT THE SCREENED INTERVAL DEPTHS.
5. AIR SPARGE/BIOVENTING SYSTEM WAS IN OPERATION DURING SAMPLING EVENT.

FORMER FUEL FARM AOC GROUP LOCATION MAP



BOEING RENTON FACILITY MAP

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

N

0 20 40
APPROXIMATE SCALE IN FEET

FORMER FUEL FARM AOC GROUNDWATER ELEVATIONS, JUNE 29, 2011
Boeing Renton Facility
Renton, Washington

By: APS	Date: 07/27/11	Project No. 8888
AMEC Geomatrix		Figure 4

Plot Date: 07/27/11 - 2:44pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\, Drawing Name: FormerFuelFarm_GW-ELEV-2Q11.dwg

ATTACHMENT 1

Laboratory Report and Data Validation Memo

Memo

To:	Dave Haddock	Project:	0088880080.0040
From:	Toni Olson	cc:	Project File
Tel:	(206) 342-1760		
Fax:	(206) 342-1761		
Date:	July 27, 2011		

Subject: Boeing Renton Former Fuel Farm Investigation – May 2011
Summary Data Quality Review – SDGs SY76 and SY90

This memorandum presents a summary data quality review for analyses of 36 soil samples collected on May 26 and 27, 2011. 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 analytes:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX) by U.S. Environmental Protection Agency (EPA) Method 8260C;
- Total petroleum hydrocarbons (TPH) as diesel (TPH-Dx) plus Jet-A (TPH-Jet A) ranges by Washington State Department of Ecology (Ecology) method NWTPH-Dx;
- Volatile petroleum hydrocarbons (VPH) by Ecology Method NWTPH-VPH;
- Extractable petroleum hydrocarbons (EPH) by Ecology Method NWTPH-EPH; and
- 2-Methylnaphthalene by EPA Method 8270D.

The samples and the analyses conducted on the samples are listed below.

Sample ID	Date Collected	Laboratory Sample ID	Requested Analyses
RI-SB22-PP430-0030	5/26/2011	SY76A	All
RI-SB22-PP430-0100	5/26/2011	SY76B	All
RI-SB22-PP427-0030	5/26/2011	SY76C	All
RI-SB22-PP427-0100	5/26/2011	SY76D	All
RI-SB-PP215-0030	5/26/2011	SY76E	All
RI-SB-PP215-0100	5/26/2011	SY76F	All
RI-SB-PP217-0030	5/26/2011	SY76G	All
RI-SB-PP217-0100	5/26/2011	SY76H	All
RI-SB-PP214-0300	5/26/2011	SY76I	All
RI-SB-PP214-0100	5/26/2011	SY76J	All

AMEC Geomatrix, Inc.
600 University Street, Suite 1020
Seattle, Washington
USA 98101-4107
Tel (206) 342-1760
Fax (206) 342-1761
www.amecgeomatrixinc.com

Sample ID	Date Collected	Laboratory Sample ID	Requested Analyses
RI-SB-PP213-0030	5/26/2011	SY76K	All
RI-SB-PP213-0100	5/26/2011	SY76L	All
RI-SB22-PP401-0030	5/26/2011	SY76M	All
RI-SB22-PP401-0100	5/26/2011	SY76N	All
RI-SB-PP212-0300	5/26/2011	SY76O	All
RI-SB-PP212-0100	5/26/2011	SY76P	All
RI-SB-PP211-0030	5/26/2011	SY76Q	All
RI-SB-PP211-0100	5/26/2011	SY76R	All
Trip Blanks	5/26/2011	SY76S	All
RI-SB-PP216-0030	5/27/2011	SY90A	All
RI-SB-PP216-0100	5/27/2011	SY90B	All
RI-SB-PP218-0030	5/27/2011	SY90C	All
RI-SB-PP218-0080	5/27/2011	SY90D	All
RI-SB-PP210-0030	5/27/2011	SY90E	All
RI-SB-PP210-0100	5/27/2011	SY90F	All
RI-SB-PP219-0030	5/27/2011	SY90G	All
RI-SB-PP219-0100	5/27/2011	SY90H	All
RI-SB-PP226-0030	5/27/2011	SY90I	All
RI-SB-PP226-0090	5/27/2011	SY90J	All
RI-SB-PP226-1090	5/27/2011	SY90K	All
RI-SB-PP227-0030	5/27/2011	SY90L	All
RI-SB-PP227-0090	5/27/2011	SY90M	All
RI-SB22-PP405-0030	5/27/2011	SY90N	All
RI-SB22-PP405-0090	5/27/2011	SY90O	All
RI-SB22-PP405-1090	5/27/2011	SY90P	All
RI-SB22-PP420-0030	5/27/2011	SY90Q	All
RI-SB22-PP420-0090	5/27/2011	SY90R	All
Trip Blank	5/27/2011	SY90S	All

Data were reviewed in accordance with the appropriate method procedures and criteria documented in the Quality Assurance Project Plan (QAPP) (Geomatrix, 2007). 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.

Hold times, method/trip blanks, surrogate recoveries, laboratory control samples (LCS), laboratory duplicates (LCSD), blank spike samples, 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 guidance documents (EPA, 2008, 2010).

Samples were submitted to the laboratory each day upon completion of sampling. Upon receipt by ARI, the sample jar information was compared to the chain-of-custody (COC) form. The temperatures of the coolers were recorded as part of the check-in procedure, and all were below the maximum acceptable temperature of 6 degrees Celsius (°C).

The following observations were noted by laboratory personnel upon sample receipt.

- SDG SY76: One BTEX vial for sample RI-SB-PP211-0030 was labeled with a sample time of 1400 rather than 1410. The laboratory verified the sample time with the chain of custody and proceeded with analysis. Sample results are not affected and are not qualified.
- SDG SY90: 2-methylnaphthalene analysis was requested on the COC for samples RI-SB-PP226-1090 and RI-SB-PP405-1090 (both field duplicates); however, insufficient sample volume was submitted to perform the analyses. The samples were only analyzed for BTEX and VPH.

Although not noted by laboratory personnel upon sample receipt, trip blanks included with samples submitted on May 26, 2011 were requested to be analyzed for BTEX, VPH, and 2-methylnaphthalene. Trip blanks are not intended to be analyzed for SVOCs, and this was likely an error on the COC. The trip blanks were only analyzed for BTEX and VPH by the laboratory, with results reported in SDG SY76. Additionally, it should be noted that one trip blank was included with samples submitted on May 27, 2011, but not listed on the COC form. This trip blank was also analyzed for BTEX and VPH, with results reported in SDG SY90.

ORGANIC ANALYSES

Samples were analyzed for the analytes listed in the introduction of this report. Laboratory data were evaluated for the following parameters.

1. Preservation and Holding Times – Acceptable

2. Blanks – Acceptable except as noted:

   EPH by Method NWTPH-EPH:

   SDG SY90: C-21-C34 aliphatics was detected in the method blank associated with batch FID8/MS 6/13/2011 at a concentration of 2,300 µg/kg. The laboratory flagged affected results with a “B”. Associated sample results were greater than the reporting limit and greater than the blank contamination; therefore, results are not qualified and are reported without the “B” flag.

3. Surrogates – Acceptable except as noted:

TPH-Dx and TPH-Jet A by Method NWTPH-Dx:

SDG SY76: The surrogate o-terphenyl was out of control low for sample RI-SB-PP213-0100. The sample was re-extracted and re-analyzed with all surrogate recoveries in control. Results are reported from the re-extraction only and are not qualified.

4. Laboratory Control Sample/Laboratory Control Sample Duplicates (LCS/LCSD) – Acceptable except as noted:

   VPH by Method NWTPH-VPH:

   SDG SY76: The recoveries for n-pentane in the LCS/LCSD associated with batch PID1/MH 5/31/2011 were 134% and 133%, greater than the laboratory control limits of 70-130%. n-Pentane was not detected in any of the samples; therefore, results do not appear to be biased and are not qualified. The LCSD recovery for n-dodecane associated with the same batch was 131%, also greater than the control limits. The associated LCS result was within the control limits; therefore sample results were not qualified.

   2-Methylnaphthalene by EPA Method 8270D:

   SDG SY76: The recoveries for 2-methylnaphthalene in the LCS/LCSD associated with batch NT6/JZ 6/14/2011 were 50.6% and 50.4%, less than the laboratory control limits of 54-106%. The laboratory stated that the recoveries were within allowable marginal exceedance limits and therefore, no further corrective action was taken. However, the low recoveries equate to a low bias and therefore, sample results are reported as estimated. Detections are flagged with a "J" and non-detects are flagged with "UJ."

   SDG SY90: The recoveries for 2-methylnaphthalene in the LCS/LCSD associated with batch NT6/JZ 6/15/2011 were 52.3% and 50.8%, less than the laboratory control limits of 54-106%. The laboratory stated that the recoveries were within allowable marginal exceedance limits and therefore, no further corrective action was taken. However, the low recoveries equate to a low bias and therefore, sample results are reported as estimated. Detections are flagged with a "J" and non-detects are flagged with "UJ."

5. Matrix Spike/Matrix Spike Duplicates (MS/MSD) – Acceptable except as noted:

   EPH by Method NWTPH-EPH:
   SDG SY90: The MS/MSD was performed using sample RI-SB22-PP405-0030 in SDG SY90. The RPD for C8-C10 aliphatics was 59.0%, greater than the +/-40% control limit. C8-C10 aliphatics were not detected in sample RI-SB-PP405-0030 and it is therefore not qualified.

6. Field Duplicates – Acceptable

Two field duplicates were submitted during this sampling event, meeting the project frequency requirement of 5% or 1 for every 20 samples, for BTEX and VPH. Sample RI-SB-PP226-1090 was collected as a field duplicate of sample RI-SB-PP226-0090 and sample RI-SB22-PP405-1090 was collected as a field duplicate of sample RI-SB22-PP405-0090. The field duplicate relative percent differences (RPDs) could not be calculated because all results for the primary samples and duplicates were below laboratory detection limits.

7. Reporting Limits – Acceptable

OVERALL ASSESSMENT OF DATA

The completeness of SDGs SY76 and SY90 is 100%. The usefulness of this data is based on EPA guidance documents listed in the introduction to this report. Few problems were identified and analytical performance was generally within specified limits. The data, as qualified, meet the project's data quality objectives.

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
RI-SB22-PP430-0030	8270D	2-methylnaphthalene	61 UJ	LCS/LCSD Recoveries
RI-SB22-PP430-0100	8270D	2-methylnaphthalene	61 UJ	LCS/LCSD Recoveries
RI-SB22-PP427-0030	8270D	2-methylnaphthalene	63 UJ	LCS/LCSD Recoveries
RI-SB22-PP427-0100	8270D	2-methylnaphthalene	62 UJ	LCS/LCSD Recoveries
RI-SB-PP215-0030	8270D	2-methylnaphthalene	62 UJ	LCS/LCSD Recoveries
RI-SB-PP215-0100	8270D	2-methylnaphthalene	63 UJ	LCS/LCSD Recoveries
RI-SB-PP217-0030	8270D	2-methylnaphthalene	58 UJ	LCS/LCSD Recoveries
RI-SB-PP217-0100	8270D	2-methylnaphthalene	63 UJ	LCS/LCSD Recoveries
RI-SB-PP214-0300	8270D	2-methylnaphthalene	61 UJ	LCS/LCSD Recoveries
RI-SB-PP214-0100	8270D	2-methylnaphthalene	60 UJ	LCS/LCSD Recoveries
RI-SB-PP213-0030	8270D	2-methylnaphthalene	63 UJ	LCS/LCSD Recoveries
RI-SB-PP213-0100	8270D	2-methylnaphthalene	65 UJ	LCS/LCSD Recoveries
RI-SB22-PP401-0030	8270D	2-methylnaphthalene	64 UJ	LCS/LCSD Recoveries
RI-SB22-PP401-0100	8270D	2-methylnaphthalene	300 J	LCS/LCSD Recoveries
RI-SB-PP212-0300	8270D	2-methylnaphthalene	63 UJ	LCS/LCSD Recoveries
RI-SB-PP212-0100	8270D	2-methylnaphthalene	61 UJ	LCS/LCSD Recoveries
RI-SB-PP211-0030	8270D	2-methylnaphthalene	64 UJ	LCS/LCSD Recoveries
RI-SB-PP211-0100	8270D	2-methylnaphthalene	210 J	LCS/LCSD Recoveries
RI-SB-PP216-0030	8270D	2-methylnaphthalene	63 UJ	LCS/LCSD Recoveries
RI-SB-PP216-0100	8270D	2-methylnaphthalene	67 J	LCS/LCSD Recoveries
RI-SB-PP218-0030	8270D	2-methylnaphthalene	63 UJ	LCS/LCSD Recoveries
RI-SB-PP218-0080	8270D	2-methylnaphthalene	62 UJ	LCS/LCSD Recoveries
RI-SB-PP210-0030	8270D	2-methylnaphthalene	64 UJ	LCS/LCSD Recoveries
RI-SB-PP210-0100	8270D	2-methylnaphthalene	61 UJ	LCS/LCSD Recoveries
RI-SB-PP219-0030	8270D	2-methylnaphthalene	60 UJ	LCS/LCSD Recoveries
RI-SB-PP219-0100	8270D	2-methylnaphthalene	61 UJ	LCS/LCSD Recoveries
RI-SB-PP226-0030	8270D	2-methylnaphthalene	61 UJ	LCS/LCSD Recoveries

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
RI-SB-PP226-0090	8270D	2-methylnaphthalene	99 J	LCS/LCSD Recoveries
RI-SB-PP226-1090		none		LCS/LCSD Recoveries
RI-SB-PP227-0030	8270D	2-methylnaphthalene	63 UJ	LCS/LCSD Recoveries
RI-SB-PP227-0090	8270D	2-methylnaphthalene	60 UJ	LCS/LCSD Recoveries
RI-SB22-PP405-0030	8270D	2-methylnaphthalene	59 UJ	LCS/LCSD Recoveries
RI-SB22-PP405-0090	8270D	2-methylnaphthalene	56 UJ	LCS/LCSD Recoveries
RI-SB22-PP405-1090		none		LCS/LCSD Recoveries
RI-SB22-PP420-0030	8270D	2-methylnaphthalene	59 UJ	LCS/LCSD Recoveries
RI-SB22-PP420-0090	8270D	2-methylnaphthalene	3,100 J	LCS/LCSD Recoveries

Notes
J = Compound is positively identified, result is an estimate.
UJ = Compound was not detected, associated reporting limit is an estimate.

REFERENCES

Geomatrix (Geomatrix Consultants, Inc.), 2007, Quality Assurance Project Plan Addendum, Remedial Investigation Work Plan Addendum, Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, January.

EPA (US Environmental Protection Agency), 2010, US EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review: EPA 540-R-10-011, January.

EPA, 2008, US EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review: EPA 540-R-08-01, June.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

June 20, 2011

David R. Haddock
Geomatrix Consultants, Inc.
One Union Square
600 University Street, Suite 1020
Seattle, WA 98101

RE: Client Project: Boeing Renton Former Fuel Farm Investigation
ARI Job No: SY76

Dear Mr. Haddock:

Please find enclosed original Chain of Custody (COC) and the analytical results for the project referenced above. Analytical Resources, Inc. accepted eighteen soil samples and a trip blank in good condition on May 26, 2011. Samples were frozen to protect holding times.

The samples were analyzed for VOCs, EPH, VPH, SVOCs and NWTPH-Dx plus Jet-A, as requested on the COC.

The SVOCs LCS and LCSD are out of control low for 2-Methylnaphthalene. The recoveries were within allowable marginal exceedance limits and no further action was taken.

The VPH LCS and/or LCSD are out of control high for n-Pentane and/or n-Dodecane. No further action was taken.

The surrogate o-terphenyl was out of control low for sample RI-SB-PP213-0100. The sample was re-extracted and re-analyzed with all surrogate recoveries in control and both sets of data have been included for your review.

There were no other anomalies associated with the samples.

Copies of these reports and all associated raw data will be kept on file. 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

cc: Carl Bach, The Boeing Company, P.O. Box 3707, M/S 1W-12, Seattle, WA 98124-2207
Raymond Power, The Boeing Company, PO Box 3707, M/S 63-41, Seattle, WA 98124

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 5176	Turn-around Requested: Standard	Page: 1 of 2	
ARI Client Company: Boeing	Phone: 206-342-1760	Date: 5/26/11	Ice Present? Y
Client Contact: Nik Bacher AGMX (for Boeing)		No. of Coolers: 2	Cooler Temps: 3.5, 0.3
Client Project Name: Former Fuel Farm Investigation			
Client Project #: 8888	Samplers: N. Bacher		

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: TPH-Dx incl. Jet Fuel	BTEX	2-methyl naphthalene	VPH	EPH				Notes/Comments
RI-SB22-PP4130-0030	5/26/11	0915	Soil	6	X	X	X	X	X				
RI-SB22-PP4130-0100		0930		6	X	X	X	X	X				
RI-SB22-PP4127-0030		0950		6	X	X	X	X	X				
RI-SB22-PP4127-0100		1000		6	X	X	X	X	X				
RI-SB-PP215-0030		1025		6	X	X	X	X	X				
RI-SB-PP215-0100		1040		6	X	X	X	X	X				
RI-SB-PP217-0030		1055		6	X	X	X	X	X				
RI-SB-PP217-0100		1115		6	X	X	X	X	X				
RI-SB-PP214-0030		1205		6	X	X	X	X	X				
RI-SB-PP214-0100		1225		6	X	X	X	X	X				

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
Please homogenize 16 oz. jars before analyzing. Include Jet Fuel in TPH-Dx analysis	Printed Name: Nik Bacher	Printed Name: A. Volgarden	Printed Name:	Printed Name:
	Company: AGMX	Company: ARI	Company:	Company:
	Date & Time: 5/26/11 1640	Date & Time: 5/26/11 1640	Date & Time:	Date & Time:

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

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number:	Turn-around Requested: Standard	Page: 2 of 2	
ARI Client Company: Boeing	Phone: 206-342-1760	Date: 5/26/11	Ice Present? Y
Client Contact: Nik Bacher AGMX (for Boeing)		No. of Coolers: 2	Cooler Temps: 3.5, 0.3
Client Project Name: Former Fuel Farm Investigation			
Client Project #: 58858	Samplers: N. Bacher		

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: PH-Dx (incl. Jet Fuel)	BTEX	2-methyl naphthalene	VPH	EPH				Notes/Comments
R1-SB-PP213-0030	5/26/11	1235	Soil	6	X	X	X	X	X				
R1-SB-PP213-0100		1255		6	X	X	X	X	X				
R1-SB22-PP401-0030		1305		6	X	X	X	X	X				
R1-SB22-PP401-0100		1325		6	X	X	X	X	X				
R1-SB-PP212-0030		1335		6	X	X	X	X	X				
R1-SB-PP212-0100		1400		6	X	X	X	X	X				
R1-SB-PP211-0030		1410		6	X	X	X	X	X				
R1-SB-PP211-0100	"	1425	"	6	X	X	X	X	X				
Trip Blank	5/23/11		H_2O	2		X	X	X					

Comments/Special Instructions: Please homogenize 16 oz. jars before analyzing. Include Jet-Fuel in PPH-Dx analysis	Relinquished by: (Signature) Nik Bacher	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
	Printed Name: Nik Bacher	Printed Name: A. Volgardsen	Printed Name:	Printed Name:
	Company: AGMX	Company: ARI	Company:	Company:
	Date & Time: 5/26/11 1640	Date & Time: 5/26/11 1640	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.

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: SY76
Client: The Boeing Company
Project Event: 8888
Project Name: Former Fuel Farm Investigation

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	RI-SB22-PP430-0030	SY76A	11-11951	Soil	05/26/11 09:15	05/26/11 16:40
2.	RI-SB22-PP430-0100	SY76B	11-11952	Soil	05/26/11 09:30	05/26/11 16:40
3.	RI-SB22-PP427-0030	SY76C	11-11953	Soil	05/26/11 09:50	05/26/11 16:40
4.	RI-SB22-PP427-0100	SY76D	11-11954	Soil	05/26/11 10:00	05/26/11 16:40
5.	RI-SB-PP215-0030	SY76E	11-11955	Soil	05/26/11 10:25	05/26/11 16:40
6.	RI-SB-PP215-0100	SY76F	11-11956	Soil	05/26/11 10:40	05/26/11 16:40
7.	RI-SB-PP217-0030	SY76G	11-11957	Soil	05/26/11 10:55	05/26/11 16:40
8.	RI-SB-PP217-0100	SY76H	11-11958	Soil	05/26/11 11:15	05/26/11 16:40
9.	RI-SB-PP214-0030	SY76I	11-11959	Soil	05/26/11 12:05	05/26/11 16:40
10.	RI-SB-PP214-0100	SY76J	11-11960	Soil	05/26/11 12:25	05/26/11 16:40
11.	RI-SB-PP213-0030	SY76K	11-11961	Soil	05/26/11 12:35	05/26/11 16:40
12.	RI-SB-PP213-0100	SY76L	11-11962	Soil	05/26/11 12:55	05/26/11 16:40
13.	RI-SB22-PP401-0030	SY76M	11-11963	Soil	05/26/11 13:05	05/26/11 16:40
14.	RI-SB22-PP401-0100	SY76N	11-11964	Soil	05/26/11 13:25	05/26/11 16:40
15.	RI-SB-PP212-0030	SY76O	11-11965	Soil	05/26/11 13:35	05/26/11 16:40
16.	RI-SB-PP212-0100	SY76P	11-11966	Soil	05/26/11 14:00	05/26/11 16:40
17.	RI-SB-PP211-0030	SY76Q	11-11967	Soil	05/26/11 14:10	05/26/11 16:40
18.	RI-SB-PP211-0100	SY76R	11-11968	Soil	05/26/11 14:25	05/26/11 16:40
19.	Trip Blanks	SY76S	11-11969	Water	05/26/11	05/26/11 16:40

Printed 05/27/11

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Boeing
Project Name: Former Fuel Farm
COC No(s): _____ (NA)
Delivered by: Fed-Ex UPS Courier (Hand Delivered) Other: _____
Assigned ARI Job No: _____
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)..... 3.5 0.3 ___ ___ ___ ___

If cooler temperature is out of compliance fill out form 00070F — Temp Gun ID#: 90941619

Cooler Accepted by: AV Date: 5/26/11 Time: 1640

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	5/23/11	

Was Sample Split by ARI : (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

Samples Logged by: AV Date: 5/27/11 Time: 805

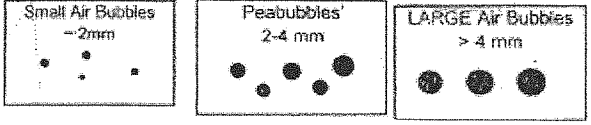
*** Notify Project Manager of discrepancies or concerns ****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

1 Sodium vial for RI-SB-PP211-0030 has a time of 1400 not 1410, has correct ID on vial

By: AV Date: 5/27/11



Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Data Reporting Qualifiers

Effective 2/14/2011

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S	Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte
NA	The flagged analyte was not analyzed for
NR	Spiked compound recovery is not reported due to chromatographic interference
NS	The flagged analyte was not spiked into the sample
M	Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses
M2	The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"
Y	The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.
EMPC	Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**
C	The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column
P	The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference
X	Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**
Z	Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A	The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP430-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76A
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 12:57

Sample Amount: 4.10 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 12.7%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.2	< 1.2	U
108-88-3	Toluene	1.2	< 1.2	U
100-41-4	Ethylbenzene	1.2	< 1.2	U
179601-23-1	m,p-Xylene	1.2	< 1.2	U
95-47-6	o-Xylene	1.2	< 1.2	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	121%
d8-Toluene	104%
Bromofluorobenzene	98.9%
d4-1,2-Dichlorobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP430-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76B
LIMS ID: 11-11952
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 13:19

Sample Amount: 4.86 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 10.3%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.0	< 1.0	U
108-88-3	Toluene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
179601-23-1	m,p-Xylene	1.0	< 1.0	U
95-47-6	o-Xylene	1.0	< 1.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	121%
d8-Toluene	96.5%
Bromofluorobenzene	89.7%
d4-1,2-Dichlorobenzene	97.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP427-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76C
LIMS ID: 11-11953
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 13:46

Sample Amount: 5.37 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 12.6%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	0.9	< 0.9	U
108-88-3	Toluene	0.9	< 0.9	U
100-41-4	Ethylbenzene	0.9	< 0.9	U
179601-23-1	m,p-Xylene	0.9	< 0.9	U
95-47-6	o-Xylene	0.9	< 0.9	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	117%
d8-Toluene	102%
Bromofluorobenzene	98.7%
d4-1,2-Dichlorobenzene	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP427-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76D
LIMS ID: 11-11954
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 14:13

Sample Amount: 3.51 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 38.9%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.4**	**1.9**	
108-88-3	**Toluene**	**1.4**	**3.2**	
100-41-4	Ethylbenzene	1.4	< 1.4	U
179601-23-1	**m,p-Xylene**	**1.4**	**3.7**	
95-47-6	o-Xylene	1.4	< 1.4	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	117%
d8-Toluene	100%
Bromofluorobenzene	95.4%
d4-1,2-Dichlorobenzene	98.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP215-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76E
LIMS ID: 11-11955
Matrix: Soil
Data Release Authorized: MW
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 14:41

Sample Amount: 4.24 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 11.2%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.2	< 1.2	U
108-88-3	Toluene	1.2	< 1.2	U
100-41-4	Ethylbenzene	1.2	< 1.2	U
179601-23-1	m,p-Xylene	1.2	< 1.2	U
95-47-6	o-Xylene	1.2	< 1.2	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	115%
d8-Toluene	101%
Bromofluorobenzene	98.5%
d4-1,2-Dichlorobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP215-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76F
LIMS ID: 11-11956
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 15:08

Sample Amount: 4.91 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 11.9%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.0	< 1.0	U
108-88-3	Toluene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
179601-23-1	m,p-Xylene	1.0	< 1.0	U
95-47-6	o-Xylene	1.0	< 1.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	119%
d8-Toluene	99.8%
Bromofluorobenzene	93.3%
d4-1,2-Dichlorobenzene	100%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP217-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76G
LIMS ID: 11-11957
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 15:35

Sample Amount: 4.25 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 16.8%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.2	< 1.2	U
108-88-3	Toluene	1.2	< 1.2	U
100-41-4	Ethylbenzene	1.2	< 1.2	U
179601-23-1	m,p-Xylene	1.2	< 1.2	U
95-47-6	o-Xylene	1.2	< 1.2	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	120%
d8-Toluene	102%
Bromofluorobenzene	96.8%
d4-1,2-Dichlorobenzene	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP217-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76H
LIMS ID: 11-11958
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 16:02

Sample Amount: 3.03 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 22.0%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.7**	**19**	
108-88-3	**Toluene**	**1.7**	**2.6**	
100-41-4	**Ethylbenzene**	**1.7**	**1.7**	
179601-23-1	**m,p-Xylene**	**1.7**	**3.5**	
95-47-6	o-Xylene	1.7	< 1.7	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	115%
d8-Toluene	98.8%
Bromofluorobenzene	78.2%
d4-1,2-Dichlorobenzene	110%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP214-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76I
LIMS ID: 11-11959
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 16:30

Sample Amount: 4.12 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 19.3%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.2**	**2.0**	
108-88-3	Toluene	1.2	< 1.2	U
100-41-4	Ethylbenzene	1.2	< 1.2	U
179601-23-1	m,p-Xylene	1.2	< 1.2	U
95-47-6	o-Xylene	1.2	< 1.2	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	119%
d8-Toluene	100%
Bromofluorobenzene	82.9%
d4-1,2-Dichlorobenzene	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP214-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76J
LIMS ID: 11-11960
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 16:57

Sample Amount: 4.60 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 17.1%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.1	< 1.1	U
108-88-3	Toluene	1.1	< 1.1	U
100-41-4	Ethylbenzene	1.1	< 1.1	U
179601-23-1	m,p-Xylene	1.1	< 1.1	U
95-47-6	o-Xylene	1.1	< 1.1	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	120%
d8-Toluene	101%
Bromofluorobenzene	97.2%
d4-1,2-Dichlorobenzene	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP213-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76K
LIMS ID: 11-11961
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 17:24

Sample Amount: 4.48 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 13.6%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.1	< 1.1	U
108-88-3	Toluene	1.1	< 1.1	U
100-41-4	Ethylbenzene	1.1	< 1.1	U
179601-23-1	**m,p-Xylene**	**1.1**	**1.9**	
95-47-6	o-Xylene	1.1	< 1.1	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	119%
d8-Toluene	99.6%
Bromofluorobenzene	86.6%
d4-1,2-Dichlorobenzene	99.5%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP213-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76L
LIMS ID: 11-11962
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 17:51

Sample Amount: 4.15 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 16.6%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.2	< 1.2	U
108-88-3	Toluene	1.2	< 1.2	U
100-41-4	Ethylbenzene	1.2	< 1.2	U
179601-23-1	m,p-Xylene	1.2	< 1.2	U
95-47-6	o-Xylene	1.2	< 1.2	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	118%
d8-Toluene	101%
Bromofluorobenzene	98.3%
d4-1,2-Dichlorobenzene	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP401-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76M
LIMS ID: 11-11963
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 18:18

Sample Amount: 4.26 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 15.7%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.2**	**5.4**	
108-88-3	Toluene	1.2	< 1.2	U
100-41-4	**Ethylbenzene**	**1.2**	**1.8**	
179601-23-1	**m,p-Xylene**	**1.2**	**9.5**	
95-47-6	**o-Xylene**	**1.2**	**1.8**	

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	118%
d8-Toluene	99.5%
Bromofluorobenzene	86.6%
d4-1,2-Dichlorobenzene	97.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP401-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76N
LIMS ID: 11-11964
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 18:46

Sample Amount: 5.16 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 21.7%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.0**	**1.9**	
108-88-3	Toluene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
179601-23-1	**m,p-Xylene**	**1.0**	**2.2**	
95-47-6	o-Xylene	1.0	< 1.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	119%
d8-Toluene	102%
Bromofluorobenzene	100%
d4-1,2-Dichlorobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP212-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76O
LIMS ID: 11-11965
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 19:13

Sample Amount: 5.20 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 12.9%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.0**	**13**	
108-88-3	**Toluene**	**1.0**	**3.3**	
100-41-4	Ethylbenzene	1.0	< 1.0	U
179601-23-1	m,p-Xylene	1.0	< 1.0	U
95-47-6	o-Xylene	1.0	< 1.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	118%
d8-Toluene	102%
Bromofluorobenzene	91.2%
d4-1,2-Dichlorobenzene	99.1%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP212-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76P
LIMS ID: 11-11966
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 19:40

Sample Amount: 3.94 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 20.5%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.3**	**1.5**	
108-88-3	Toluene	1.3	< 1.3	U
100-41-4	Ethylbenzene	1.3	< 1.3	U
179601-23-1	m,p-Xylene	1.3	< 1.3	U
95-47-6	o-Xylene	1.3	< 1.3	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	117%
d8-Toluene	104%
Bromofluorobenzene	93.3%
d4-1,2-Dichlorobenzene	99.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP211-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76Q
LIMS ID: 11-11967
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 20:07

Sample Amount: 3.59 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 14.2%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.4	< 1.4	U
108-88-3	Toluene	1.4	< 1.4	U
100-41-4	Ethylbenzene	1.4	< 1.4	U
179601-23-1	m,p-Xylene	1.4	< 1.4	U
95-47-6	o-Xylene	1.4	< 1.4	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	121%
d8-Toluene	101%
Bromofluorobenzene	90.3%
d4-1,2-Dichlorobenzene	100%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP211-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76R
LIMS ID: 11-11968
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 20:34

Sample Amount: 4.39 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 21.4%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.1**	**4.2**	
108-88-3	**Toluene**	**1.1**	**1.2**	
100-41-4	Ethylbenzene	1.1	< 1.1	U
179601-23-1	**m,p-Xylene**	**1.1**	**2.9**	
95-47-6	o-Xylene	1.1	< 1.1	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	124%
d8-Toluene	100%
Bromofluorobenzene	88.9%
d4-1,2-Dichlorobenzene	97.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: Trip Blanks**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY76S
LIMS ID: 11-11969
Matrix: Water
Data Release Authorized: MW
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 21:01

Sample Amount: 5.00 mL
Purge Volume: 5.0 mL

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.0	< 1.0	U
108-88-3	Toluene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
179601-23-1	m,p-Xylene	2.0	< 2.0	U
95-47-6	o-Xylene	1.0	< 1.0	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	111%
d8-Toluene	104%
Bromofluorobenzene	98.8%
d4-1,2-Dichlorobenzene	100%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: MB-060111**
 METHOD BLANK

Lab Sample ID: MB-060111
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: NA
Date Received: NA

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/01/11 12:02

Sample Amount: 5.00 g-dry-wt
Purge Volume: 5.0 mL
Moisture: NA

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.0	< 1.0	U
108-88-3	Toluene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
179601-23-1	m,p-Xylene	1.0	< 1.0	U
95-47-6	o-Xylene	1.0	< 1.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	111%
d8-Toluene	102%
Bromofluorobenzene	100%
d4-1,2-Dichlorobenzene	101%

ANALYTICAL RESOURCES INCORPORATED

VOA SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888

ARI ID	Client ID	Level	DCE	TOL	BFB	DCB	TOT OUT
MB-060111	Method Blank	Low	111%	102%	100%	101%	0
LCS-060111	Lab Control	Low	103%	103%	99.8%	100%	0
LCSD-060111	Lab Control Dup	Low	108%	104%	105%	101%	0
SY76A	RI-SB22-PP430-0030	Low	121%	104%	98.9%	102%	0
SY76B	RI-SB22-PP430-0100	Low	121%	96.5%	89.7%	97.8%	0
SY76C	RI-SB22-PP427-0030	Low	117%	102%	98.7%	101%	0
SY76D	RI-SB22-PP427-0100	Low	117%	100%	95.4%	98.6%	0
SY76E	RI-SB-PP215-0030	Low	115%	101%	98.5%	102%	0
SY76F	RI-SB-PP215-0100	Low	119%	99.8%	93.3%	100%	0
SY76G	RI-SB-PP217-0030	Low	120%	102%	96.8%	101%	0
SY76H	RI-SB-PP217-0100	Low	115%	98.8%	78.2%	110%	0
SY76I	RI-SB-PP214-0030	Low	119%	100%	82.9%	101%	0
SY76J	RI-SB-PP214-0100	Low	120%	101%	97.2%	101%	0
SY76K	RI-SB-PP213-0030	Low	119%	99.6%	86.6%	99.5%	0
SY76L	RI-SB-PP213-0100	Low	118%	101%	98.3%	101%	0
SY76M	RI-SB22-PP401-0030	Low	118%	99.5%	86.6%	97.2%	0
SY76N	RI-SB22-PP401-0100	Low	119%	102%	100%	102%	0
SY76O	RI-SB-PP212-0030	Low	118%	102%	91.2%	99.1%	0
SY76P	RI-SB-PP212-0100	Low	117%	104%	93.3%	99.6%	0
SY76Q	RI-SB-PP211-0030	Low	121%	101%	90.3%	100%	0
SY76R	RI-SB-PP211-0100	Low	124%	100%	88.9%	97.8%	0

SW8260C	LCS/MB LIMITS Low	LCS/MB LIMITS Med	QC LIMITS Low	QC LIMITS Med
(DCE) = d4-1,2-Dichloroethane	79-121	76-120	75-152	69-120
(TOL) = d8-Toluene	80-120	80-120	82-115	80-120
(BFB) = Bromofluorobenzene	80-120	80-120	64-120	76-128
(DCB) = d4-1,2-Dichlorobenzene	80-120	80-120	80-120	80-120

Log Number Range: 11-11951 to 11-11968

ANALYTICAL RESOURCES INCORPORATED

VOA SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888

ARI ID	Client ID	PV	DCE	TOL	BFB	DCB	TOT OUT
SY76S	Trip Blanks	5	111%	104%	98.8%	100%	0

	LCS/MB LIMITS	QC LIMITS
SW8260C		
(DCE) = d4-1,2-Dichloroethane	80-122	80-125
(TOL) = d8-Toluene	80-120	80-120
(BFB) = Bromofluorobenzene	80-120	80-120
(DCB) = d4-1,2-Dichlorobenzene	80-120	80-120

Prep Method: SW5030B
Log Number Range: 11-11969 to 11-11969

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: LCS-060111**
Page 1 of 1 **LAB CONTROL SAMPLE**

Lab Sample ID: LCS-060111
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/07/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: FINN5/PAB
LCSD: FINN5/PAB
Date Analyzed LCS: 06/01/11 11:00
LCSD: 06/01/11 11:34

Sample Amount LCS: 5.00 g-dry-wt
LCSD: 5.00 g-dry-wt
Purge Volume LCS: 5.0 mL
LCSD: 5.0 mL
Moisture: NA

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzene	50.8	50.0	102%	50.1	50.0	100%	1.4%
Toluene	51.6	50.0	103%	49.3	50.0	98.6%	4.6%
Ethylbenzene	52.5	50.0	105%	52.9	50.0	106%	0.8%
m,p-Xylene	100	100	100%	103	100	103%	3.0%
o-Xylene	49.8	50.0	99.6%	50.8	50.0	102%	2.0%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

Volatile Surrogate Recovery

	LCS	LCSD
d4-1,2-Dichloroethane	103%	108%
d8-Toluene	103%	104%
Bromofluorobenzene	99.8%	105%
d4-1,2-Dichlorobenzene	100%	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB22-PP430-0030
SAMPLE

Lab Sample ID: SY76A
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 09:45
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 36.4 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1400	< 1,400 U
108-88-3	Toluene	1400	< 1,400 U
100-41-4	Ethylbenzene	1400	< 1,400 U
179601-23-1	m,p-Xylene	2700	< 2,700 U
95-47-6	o-Xylene	1400	< 1,400 U
1634-04-4	Methyl tert-Butyl Ether	1400	< 1,400 U
109-66-0	n-Pentane	1400	< 1,400 U
110-54-3	n-Hexane	1400	< 1,400 U
111-65-9	n-Octane	1400	< 1,400 U
124-18-5	n-Decane	1400	< 1,400 U
112-40-3	n-Dodecane	1400	< 1,400 U

Range	RL	Result
C8-C10 Aromatics	14,000	< 14,000 U
C10-C12 Aromatics	14,000	< 14,000 U
C12-C13 Aromatics	14,000	< 14,000 U
C5-C6 Aliphatics	14,000	< 14,000 U
C6-C8 Aliphatics	14,000	< 14,000 U
C8-C10 Aliphatics	14,000	< 14,000 U
C10-C12 Aliphatics	14,000	< 14,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	104%
FID: 2,5-Dibromotoluene	98.6%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH
Page 1 of 1

Sample ID: RI-SB22-PP430-0100
SAMPLE

Lab Sample ID: SY76B
LIMS ID: 11-11952
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 10:14
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 49.8 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1000	< 1,000 U
108-88-3	Toluene	1000	< 1,000 U
100-41-4	Ethylbenzene	1000	< 1,000 U
179601-23-1	m,p-Xylene	2000	< 2,000 U
95-47-6	o-Xylene	1000	< 1,000 U
1634-04-4	Methyl tert-Butyl Ether	1000	< 1,000 U
109-66-0	n-Pentane	1000	< 1,000 U
110-54-3	n-Hexane	1000	< 1,000 U
111-65-9	n-Octane	1000	< 1,000 U
124-18-5	n-Decane	1000	< 1,000 U
112-40-3	n-Dodecane	1000	< 1,000 U

Range	RL	Result
C8-C10 Aromatics	10,000	< 10,000 U
C10-C12 Aromatics	10,000	< 10,000 U
C12-C13 Aromatics	10,000	< 10,000 U
C5-C6 Aliphatics	10,000	< 10,000 U
C6-C8 Aliphatics	10,000	< 10,000 U
C8-C10 Aliphatics	10,000	< 10,000 U
C10-C12 Aliphatics	10,000	< 10,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	103%
FID: 2,5-Dibromotoluene	98.6%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB22-PP427-0030
SAMPLE

Lab Sample ID: SY76C
LIMS ID: 11-11953
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 10:44
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 51.8 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	970	< 970 U
108-88-3	Toluene	970	< 970 U
100-41-4	Ethylbenzene	970	< 970 U
179601-23-1	m,p-Xylene	1900	< 1,900 U
95-47-6	o-Xylene	970	< 970 U
1634-04-4	Methyl tert-Butyl Ether	970	< 970 U
109-66-0	n-Pentane	970	< 970 U
110-54-3	n-Hexane	970	< 970 U
111-65-9	n-Octane	970	< 970 U
124-18-5	n-Decane	970	< 970 U
112-40-3	n-Dodecane	970	< 970 U

Range	RL	Result
C8-C10 Aromatics	9,700	< 9,700 U
C10-C12 Aromatics	9,700	< 9,700 U
C12-C13 Aromatics	9,700	< 9,700 U
C5-C6 Aliphatics	9,700	< 9,700 U
C6-C8 Aliphatics	9,700	< 9,700 U
C8-C10 Aliphatics	9,700	< 9,700 U
C10-C12 Aliphatics	9,700	< 9,700 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	102%
FID: 2,5-Dibromotoluene	99.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB22-PP427-0100
SAMPLE

Lab Sample ID: SY76D
LIMS ID: 11-11954
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 11:13
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 26.1 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1900	< 1,900 U
108-88-3	Toluene	1900	< 1,900 U
100-41-4	Ethylbenzene	1900	< 1,900 U
179601-23-1	m,p-Xylene	3800	< 3,800 U
95-47-6	o-Xylene	1900	< 1,900 U
1634-04-4	Methyl tert-Butyl Ether	1900	< 1,900 U
109-66-0	n-Pentane	1900	< 1,900 U
110-54-3	n-Hexane	1900	< 1,900 U
111-65-9	n-Octane	1900	< 1,900 U
124-18-5	n-Decane	1900	< 1,900 U
112-40-3	n-Dodecane	1900	< 1,900 U

Range	RL	Result
C8-C10 Aromatics	19,000	< 19,000 U
C10-C12 Aromatics	19,000	< 19,000 U
C12-C13 Aromatics	19,000	< 19,000 U
C5-C6 Aliphatics	19,000	< 19,000 U
C6-C8 Aliphatics	19,000	< 19,000 U
C8-C10 Aliphatics	19,000	< 19,000 U
C10-C12 Aliphatics	19,000	< 19,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	108%
FID: 2,5-Dibromotoluene	103%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP215-0030
SAMPLE

Lab Sample ID: SY76E
LIMS ID: 11-11955
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 11:42
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 43.5 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2300	< 2,300 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	n-Decane	1100	< 1,100 U
112-40-3	n-Dodecane	1100	< 1,100 U

Range	RL	Result
C8-C10 Aromatics	11,000	< 11,000 U
C10-C12 Aromatics	11,000	< 11,000 U
C12-C13 Aromatics	11,000	< 11,000 U
C5-C6 Aliphatics	11,000	< 11,000 U
C6-C8 Aliphatics	11,000	< 11,000 U
C8-C10 Aliphatics	11,000	< 11,000 U
C10-C12 Aliphatics	11,000	< 11,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	104%
FID: 2,5-Dibromotoluene	97.4%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

SY76 - DRINTRA

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP215-0100
SAMPLE

Lab Sample ID: SY76F
LIMS ID: 11-11956
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 13:11
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 46.9 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2100	< 2,100 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	n-Decane	1100	< 1,100 U
112-40-3	n-Dodecane	1100	< 1,100 U

Range	RL	Result
C8-C10 Aromatics	11,000	< 11,000 U
C10-C12 Aromatics	11,000	< 11,000 U
C12-C13 Aromatics	11,000	< 11,000 U
C5-C6 Aliphatics	11,000	< 11,000 U
C6-C8 Aliphatics	11,000	< 11,000 U
C8-C10 Aliphatics	11,000	< 11,000 U
C10-C12 Aliphatics	11,000	< 11,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	94.0%
FID: 2,5-Dibromotoluene	96.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP217-0030
SAMPLE

Lab Sample ID: SY76G
LIMS ID: 11-11957
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 13:40
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 44.0 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2300	< 2,300 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	n-Decane	1100	< 1,100 U
112-40-3	n-Dodecane	1100	< 1,100 U

Range	RL	Result
C8-C10 Aromatics	11,000	< 11,000 U
C10-C12 Aromatics	11,000	< 11,000 U
C12-C13 Aromatics	11,000	< 11,000 U
C5-C6 Aliphatics	11,000	< 11,000 U
C6-C8 Aliphatics	11,000	< 11,000 U
C8-C10 Aliphatics	11,000	< 11,000 U
C10-C12 Aliphatics	11,000	< 11,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	96.4%
FID: 2,5-Dibromotoluene	96.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP217-0100
SAMPLE

Lab Sample ID: SY76H
LIMS ID: 11-11958
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 14:10
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 41.0 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1200	< 1,200 U
108-88-3	Toluene	1200	< 1,200 U
100-41-4	Ethylbenzene	1200	< 1,200 U
179601-23-1	m,p-Xylene	2400	< 2,400 U
95-47-6	o-Xylene	1200	< 1,200 U
1634-04-4	Methyl tert-Butyl Ether	1200	< 1,200 U
109-66-0	n-Pentane	1200	< 1,200 U
110-54-3	n-Hexane	1200	< 1,200 U
111-65-9	n-Octane	1200	< 1,200 U
124-18-5	n-Decane	1200	< 1,200 U
112-40-3	n-Dodecane	1200	< 1,200 U

Range	RL	Result
C8-C10 Aromatics	12,000	< 12,000 U
C10-C12 Aromatics	12,000	< 12,000 U
C12-C13 Aromatics	12,000	< 12,000 U
C5-C6 Aliphatics	12,000	< 12,000 U
C6-C8 Aliphatics	12,000	< 12,000 U
C8-C10 Aliphatics	12,000	< 12,000 U
C10-C12 Aliphatics	12,000	< 12,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	106%
FID: 2,5-Dibromotoluene	101%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP214-0030
SAMPLE

Lab Sample ID: SY76I
LIMS ID: 11-11959
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 14:39
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 41.4 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1200	< 1,200 U
108-88-3	Toluene	1200	< 1,200 U
100-41-4	Ethylbenzene	1200	< 1,200 U
179601-23-1	m,p-Xylene	2400	< 2,400 U
95-47-6	o-Xylene	1200	< 1,200 U
1634-04-4	Methyl tert-Butyl Ether	1200	< 1,200 U
109-66-0	n-Pentane	1200	< 1,200 U
110-54-3	n-Hexane	1200	< 1,200 U
111-65-9	n-Octane	1200	< 1,200 U
124-18-5	n-Decane	1200	< 1,200 U
112-40-3	n-Dodecane	1200	< 1,200 U

Range	RL	Result
C8-C10 Aromatics	12,000	< 12,000 U
C10-C12 Aromatics	12,000	< 12,000 U
C12-C13 Aromatics	12,000	< 12,000 U
C5-C6 Aliphatics	12,000	< 12,000 U
C6-C8 Aliphatics	12,000	< 12,000 U
C8-C10 Aliphatics	12,000	< 12,000 U
C10-C12 Aliphatics	12,000	< 12,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	101%
FID: 2,5-Dibromotoluene	96.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP214-0100
SAMPLE

Lab Sample ID: SY76J
LIMS ID: 11-11960
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 15:09
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 41.5 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1200	< 1,200 U
108-88-3	Toluene	1200	< 1,200 U
100-41-4	Ethylbenzene	1200	< 1,200 U
179601-23-1	m,p-Xylene	2400	< 2,400 U
95-47-6	o-Xylene	1200	< 1,200 U
1634-04-4	Methyl tert-Butyl Ether	1200	< 1,200 U
109-66-0	n-Pentane	1200	< 1,200 U
110-54-3	n-Hexane	1200	< 1,200 U
111-65-9	n-Octane	1200	< 1,200 U
124-18-5	n-Decane	1200	< 1,200 U
112-40-3	n-Dodecane	1200	< 1,200 U

Range	RL	Result
C8-C10 Aromatics	12,000	< 12,000 U
C10-C12 Aromatics	12,000	< 12,000 U
C12-C13 Aromatics	12,000	< 12,000 U
C5-C6 Aliphatics	12,000	< 12,000 U
C6-C8 Aliphatics	12,000	< 12,000 U
C8-C10 Aliphatics	12,000	< 12,000 U
C10-C12 Aliphatics	12,000	< 12,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	103%
FID: 2,5-Dibromotoluene	98.4%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP213-0030
SAMPLE

Lab Sample ID: SY76K
LIMS ID: 11-11961
Matrix: Soil
Data Release Authorized:
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 15:38
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 43.5 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2300	< 2,300 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	n-Decane	1100	< 1,100 U
112-40-3	n-Dodecane	1100	< 1,100 U

Range	RL	Result
C8-C10 Aromatics	11,000	< 11,000 U
C10-C12 Aromatics	11,000	< 11,000 U
C12-C13 Aromatics	11,000	< 11,000 U
C5-C6 Aliphatics	11,000	< 11,000 U
C6-C8 Aliphatics	**11,000**	**19,000**
C8-C10 Aliphatics	11,000	< 11,000 U
C10-C12 Aliphatics	11,000	< 11,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	95.2%
FID: 2,5-Dibromotoluene	92.6%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP213-0100
SAMPLE

Lab Sample ID: SY76L
LIMS ID: 11-11962
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 16:08
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 42.6 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1200	< 1,200 U
108-88-3	Toluene	1200	< 1,200 U
100-41-4	Ethylbenzene	1200	< 1,200 U
179601-23-1	m,p-Xylene	2300	< 2,300 U
95-47-6	o-Xylene	1200	< 1,200 U
1634-04-4	Methyl tert-Butyl Ether	1200	< 1,200 U
109-66-0	n-Pentane	1200	< 1,200 U
110-54-3	n-Hexane	1200	< 1,200 U
111-65-9	n-Octane	1200	< 1,200 U
124-18-5	n-Decane	1200	< 1,200 U
112-40-3	n-Dodecane	1200	< 1,200 U

Range	RL	Result
C8-C10 Aromatics	12,000	< 12,000 U
C10-C12 Aromatics	12,000	< 12,000 U
C12-C13 Aromatics	12,000	< 12,000 U
C5-C6 Aliphatics	12,000	< 12,000 U
C6-C8 Aliphatics	12,000	< 12,000 U
C8-C10 Aliphatics	12,000	< 12,000 U
C10-C12 Aliphatics	12,000	< 12,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	99.6%
FID: 2,5-Dibromotoluene	97.6%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH
Page 1 of 1

Sample ID: RI-SB22-PP401-0030
SAMPLE

Lab Sample ID: SY76M
LIMS ID: 11-11963
Matrix: Soil
Data Release Authorized: hmw
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 16:37
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 42.4 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1200	< 1,200 U
108-88-3	Toluene	1200	< 1,200 U
100-41-4	Ethylbenzene	1200	< 1,200 U
179601-23-1	m,p-Xylene	2400	< 2,400 U
95-47-6	o-Xylene	1200	< 1,200 U
1634-04-4	Methyl tert-Butyl Ether	1200	< 1,200 U
109-66-0	n-Pentane	1200	< 1,200 U
110-54-3	n-Hexane	1200	< 1,200 U
111-65-9	n-Octane	1200	< 1,200 U
124-18-5	n-Decane	1200	< 1,200 U
112-40-3	n-Dodecane	1200	< 1,200 U

Range	RL	Result
C8-C10 Aromatics	12,000	< 12,000 U
C10-C12 Aromatics	12,000	< 12,000 U
C12-C13 Aromatics	12,000	< 12,000 U
C5-C6 Aliphatics	12,000	< 12,000 U
C6-C8 Aliphatics	12,000	< 12,000 U
C8-C10 Aliphatics	12,000	< 12,000 U
C10-C12 Aliphatics	12,000	< 12,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	102%
FID: 2,5-Dibromotoluene	97.0%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH
Page 1 of 1

Sample ID: RI-SB22-PP401-0100
SAMPLE

Lab Sample ID: SY76N
LIMS ID: 11-11964
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 17:36
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 40.2 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1200	< 1,200 U
108-88-3	Toluene	1200	< 1,200 U
100-41-4	Ethylbenzene	1200	< 1,200 U
179601-23-1	m,p-Xylene	2500	< 2,500 U
95-47-6	o-Xylene	1200	< 1,200 U
1634-04-4	Methyl tert-Butyl Ether	1200	< 1,200 U
109-66-0	n-Pentane	1200	< 1,200 U
110-54-3	n-Hexane	1200	< 1,200 U
111-65-9	n-Octane	1200	< 1,200 U
124-18-5	n-Decane	1200	< 1,200 U
112-40-3	**n-Dodecane**	**1200**	**2,300**

Range	RL	Result
C8-C10 Aromatics	12,000	< 12,000 U
C10-C12 Aromatics	**12,000**	**26,000**
C12-C13 Aromatics	**12,000**	**36,000**
C5-C6 Aliphatics	12,000	< 12,000 U
C6-C8 Aliphatics	12,000	< 12,000 U
C8-C10 Aliphatics	12,000	< 12,000 U
C10-C12 Aliphatics	12,000	< 12,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	98.0%
FID: 2,5-Dibromotoluene	101%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH
Page 1 of 1

Sample ID: RI-SB-PP212-0030
SAMPLE

Lab Sample ID: SY76O
LIMS ID: 11-11965
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 18:06
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 48.4 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1000	< 1,000 U
108-88-3	Toluene	1000	< 1,000 U
100-41-4	Ethylbenzene	1000	< 1,000 U
179601-23-1	m,p-Xylene	2100	< 2,100 U
95-47-6	o-Xylene	1000	< 1,000 U
1634-04-4	Methyl tert-Butyl Ether	1000	< 1,000 U
109-66-0	n-Pentane	1000	< 1,000 U
110-54-3	n-Hexane	1000	< 1,000 U
111-65-9	n-Octane	1000	< 1,000 U
124-18-5	n-Decane	1000	< 1,000 U
112-40-3	n-Dodecane	1000	< 1,000 U

Range	RL	Result
C8-C10 Aromatics	10,000	< 10,000 U
C10-C12 Aromatics	10,000	< 10,000 U
C12-C13 Aromatics	10,000	< 10,000 U
C5-C6 Aliphatics	10,000	< 10,000 U
C6-C8 Aliphatics	10,000	< 10,000 U
C8-C10 Aliphatics	10,000	< 10,000 U
C10-C12 Aliphatics	10,000	< 10,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	90.2%
FID: 2,5-Dibromotoluene	93.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP212-0100
SAMPLE

Lab Sample ID: SY76P
LIMS ID: 11-11966
Matrix: Soil
Data Release Authorized:
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 18:35
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 41.5 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1200	< 1,200 U
108-88-3	Toluene	1200	< 1,200 U
100-41-4	Ethylbenzene	1200	< 1,200 U
179601-23-1	m,p-Xylene	2400	< 2,400 U
95-47-6	o-Xylene	1200	< 1,200 U
1634-04-4	Methyl tert-Butyl Ether	1200	< 1,200 U
109-66-0	n-Pentane	1200	< 1,200 U
110-54-3	n-Hexane	1200	< 1,200 U
111-65-9	n-Octane	1200	< 1,200 U
124-18-5	n-Decane	1200	< 1,200 U
112-40-3	n-Dodecane	1200	< 1,200 U

Range	RL	Result
C8-C10 Aromatics	12,000	< 12,000 U
C10-C12 Aromatics	12,000	< 12,000 U
C12-C13 Aromatics	12,000	< 12,000 U
C5-C6 Aliphatics	12,000	< 12,000 U
C6-C8 Aliphatics	12,000	< 12,000 U
C8-C10 Aliphatics	12,000	< 12,000 U
C10-C12 Aliphatics	12,000	< 12,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	103%
FID: 2,5-Dibromotoluene	96.6%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

SY76 : 000047

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH
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Sample ID: RI-SB-PP211-0030
SAMPLE

Lab Sample ID: SY76Q
LIMS ID: 11-11967
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 19:05
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 46.3 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2200	< 2,200 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	n-Decane	1100	< 1,100 U
112-40-3	n-Dodecane	1100	< 1,100 U

Range	RL	Result
C8-C10 Aromatics	11,000	< 11,000 U
C10-C12 Aromatics	11,000	< 11,000 U
C12-C13 Aromatics	11,000	< 11,000 U
C5-C6 Aliphatics	11,000	< 11,000 U
C6-C8 Aliphatics	11,000	< 11,000 U
C8-C10 Aliphatics	11,000	< 11,000 U
C10-C12 Aliphatics	11,000	< 11,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	95.4%
FID: 2,5-Dibromotoluene	96.0%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP211-0100
SAMPLE

Lab Sample ID: SY76R
LIMS ID: 11-11968
Matrix: Soil
Data Release Authorized: MW
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 19:34
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 37.6 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1300	< 1,300 U
108-88-3	Toluene	1300	< 1,300 U
100-41-4	Ethylbenzene	1300	< 1,300 U
179601-23-1	m,p-Xylene	2700	< 2,700 U
95-47-6	o-Xylene	1300	< 1,300 U
1634-04-4	Methyl tert-Butyl Ether	1300	< 1,300 U
109-66-0	n-Pentane	1300	< 1,300 U
110-54-3	n-Hexane	1300	< 1,300 U
111-65-9	n-Octane	1300	< 1,300 U
124-18-5	n-Decane	1300	< 1,300 U
112-40-3	n-Dodecane	1300	< 1,300 U

Range	RL	Result
C8-C10 Aromatics	13,000	< 13,000 U
C10-C12 Aromatics	13,000	< 13,000 U
C12-C13 Aromatics	13,000	< 13,000 U
C5-C6 Aliphatics	13,000	< 13,000 U
C6-C8 Aliphatics	13,000	< 13,000 U
C8-C10 Aliphatics	13,000	< 13,000 U
C10-C12 Aliphatics	13,000	< 13,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	98.0%
FID: 2,5-Dibromotoluene	96.6%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

SY76 : 000024

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH
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Sample ID: Trip Blanks
SAMPLE

Lab Sample ID: SY76S
LIMS ID: 11-11969
Matrix: Water
Data Release Authorized:
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Analyzed: 05/31/11 09:15
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	5.0	< 5.0 U
108-88-3	Toluene	5.0	< 5.0 U
100-41-4	Ethylbenzene	5.0	< 5.0 U
179601-23-1	m,p-Xylene	10	< 10 U
95-47-6	o-Xylene	5.0	< 5.0 U
1634-04-4	Methyl tert-Butyl Ether	5.0	< 5.0 U
109-66-0	n-Pentane	5.0	< 5.0 U
110-54-3	n-Hexane	5.0	< 5.0 U
111-65-9	n-Octane	5.0	< 5.0 U
124-18-5	n-Decane	5.0	< 5.0 U
112-40-3	n-Dodecane	5.0	< 5.0 U

Range	RL	Result
C8-C10 Aromatics	50	< 50 U
C10-C12 Aromatics	50	< 50 U
C12-C13 Aromatics	50	< 50 U
C5-C6 Aliphatics	50	< 50 U
C6-C8 Aliphatics	50	< 50 U
C8-C10 Aliphatics	50	< 50 U
C10-C12 Aliphatics	50	< 50 U

Values reported in µg/L (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	110%
FID: 2,5-Dibromotoluene	99.4%

ANALYTICAL RESOURCES INCORPORATED

VPH SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888

Client ID	PDBT	FDBT	TOT OUT
MB-053111	93.4%	95.8%	0
LCS-053111	98.8%	103%	0
LCSD-053111	103%	104%	0
RI-SB22-PP430-0030	104%	98.6%	0
RI-SB22-PP430-0100	103%	98.6%	0
RI-SB22-PP427-0030	102%	99.8%	0
RI-SB22-PP427-0100	108%	103%	0
RI-SB-PP215-0030	104%	97.4%	0
RI-SB-PP215-0100	94.0%	96.8%	0
RI-SB-PP217-0030	96.4%	96.8%	0
RI-SB-PP217-0100	106%	101%	0
RI-SB-PP214-0030	101%	96.8%	0
RI-SB-PP214-0100	103%	98.4%	0
RI-SB-PP213-0030	95.2%	92.6%	0
RI-SB-PP213-0100	99.6%	97.6%	0
RI-SB22-PP401-0030	102%	97.0%	0
RI-SB22-PP401-0100	98.0%	101%	0
RI-SB-PP212-0030	90.2%	93.8%	0
RI-SB-PP212-0100	103%	96.6%	0
RI-SB-PP211-0030	95.4%	96.0%	0
RI-SB-PP211-0100	98.0%	96.6%	0

	LCS/MB LIMITS	QC LIMITS
(PDBT) = 2,5-Dibromotoluene	(60-140)	(60-140)
(FDBT) = 2,5-Dibromotoluene	(60-140)	(60-140)

Prep Method: METHOD
Log Number Range: 11-11951 to 11-11968

FORM-II VPH

ANALYTICAL RESOURCES INCORPORATED

VPH SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888

ARI ID	Client ID	PDBT	FDBT	TOT OUT
SY76S	Trip Blanks	110%	99.4%	0

	LCS/MB LIMITS	QC LIMITS
(PDBT) = 2,5-Dibromotoluene	(60-140)	(60-140)
(FDBT) = 2,5-Dibromotoluene	(60-140)	(60-140)

Prep Method: METHOD
Log Number Range: 11-11969 to 11-11969

FORM-II VPH

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: MB-053111
METHOD BLANK

Lab Sample ID: MB-053111
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Date Analyzed: 05/31/11 08:33
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 111 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	450	< 450 U
108-88-3	Toluene	450	< 450 U
100-41-4	Ethylbenzene	450	< 450 U
179601-23-1	m,p-Xylene	900	< 900 U
95-47-6	o-Xylene	450	< 450 U
1634-04-4	Methyl tert-Butyl Ether	450	< 450 U
109-66-0	n-Pentane	450	< 450 U
110-54-3	n-Hexane	450	< 450 U
111-65-9	n-Octane	450	< 450 U
124-18-5	n-Decane	450	< 450 U
112-40-3	n-Dodecane	450	< 450 U

Range	RL	Result
C8-C10 Aromatics	4,500	< 4,500 U
C10-C12 Aromatics	4,500	< 4,500 U
C12-C13 Aromatics	4,500	< 4,500 U
C5-C6 Aliphatics	4,500	< 4,500 U
C6-C8 Aliphatics	4,500	< 4,500 U
C8-C10 Aliphatics	4,500	< 4,500 U
C10-C12 Aliphatics	4,500	< 4,500 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	93.4%
FID: 2,5-Dibromotoluene	95.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: LCS-053111
LCS/LCSD

Lab Sample ID: LCS-053111
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/01/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 05/31/11 07:04
Date Analyzed LCSD: 05/31/11 07:34
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 111 mg-dry-wt

Analyte/Range	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzene	4510	4500	100%	4490	4500	99.8%	0.4%
Toluene	4540	4500	101%	4520	4500	100%	0.4%
Ethylbenzene	4670	4500	104%	4680	4500	104%	0.2%
m,p-Xylene	9270	9010	103%	9270	9010	103%	0.0%
o-Xylene	4580	4500	102%	4540	4500	101%	0.9%
Methyl tert-Butyl Ether	4300	4500	95.6%	4270	4500	94.9%	0.7%
Naphthalene	4960	4500	110%	5080	4500	113%	2.4%
1,2,3-Trimethylbenzene	4850	4500	108%	4820	4500	107%	0.6%
1-Methylnaphthalene	4790	4500	106%	5520	4500	123%	14.2%
n-Pentane	6010	4500	134%	5990	4500	133%	0.3%
n-Hexane	5400	4500	120%	5380	4500	120%	0.4%
n-Octane	5120	4500	114%	5150	4500	114%	0.6%
n-Decane	5260	4500	117%	5580	4500	124%	5.9%
n-Dodecane	5540	4500	123%	5900	4500	131%	6.3%

Values reported in µg/kg (ppb)
RPD calculated using sample concentrations per SW846.

VPH Surrogate Recovery

	LCS	LCSD
PID: 2,5-Dibromotoluene	98.8%	103%
FID: 2,5-Dibromotoluene	103%	104%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB22-PP430-0030
SAMPLE

Lab Sample ID: SY76A
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 07:01
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 8.17 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 12.7%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	61	< 61 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	69.6%

TD 7/27/11

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: RI-SB22-PP430-0100
SAMPLE

Lab Sample ID: SY76B
LIMS ID: 11-11952
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 07:34
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 8.20 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 10.3%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	61	< 61 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	73.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB22-PP427-0030
SAMPLE

Lab Sample ID: SY76C
LIMS ID: 11-11953
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 08:07
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.94 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 12.6%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	63	< 63 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	72.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB22-PP427-0100
SAMPLE

Lab Sample ID: SY76D
LIMS ID: 11-11954
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 08:40
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 8.05 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 38.9%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	62	< 62 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	64.4%

SY76-D1RR2

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB-PP215-0030
SAMPLE

Lab Sample ID: SY76E
LIMS ID: 11-11955
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 09:13
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 8.13 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 11.2%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	62	< 62 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	70.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB-PP215-0100
SAMPLE

Lab Sample ID: SY76F
LIMS ID: 11-11956
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 09:45
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.99 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 11.9%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	63	< 63 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	73.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: RI-SB-PP217-0030
SAMPLE

Lab Sample ID: SY76G
LIMS ID: 11-11957
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 10:18
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 8.55 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 16.8%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	58	< 58 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	70.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB-PP217-0100
SAMPLE

Lab Sample ID: SY76H
LIMS ID: 11-11958
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 10:51
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.98 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 22.0%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	63	< 63 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	66.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB-PP214-0030
SAMPLE

Lab Sample ID: SY76I
LIMS ID: 11-11959
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 11:24
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 8.24 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 19.3%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	61	< 61 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	63.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB-PP214-0100
SAMPLE

Lab Sample ID: SY76J
LIMS ID: 11-11960
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 11:56
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 8.40 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 17.1%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	60	< 60 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	63.6%

FORM I

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB-PP213-0030
SAMPLE

Lab Sample ID: SY76K
LIMS ID: 11-11961
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 12:29
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.97 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 13.6%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	63	< 63 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	63.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB-PP213-0100
SAMPLE

Lab Sample ID: SY76L
LIMS ID: 11-11962
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 13:02
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.70 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 16.6%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	65	< 65 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	70.8%

FORM I

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: RI-SB22-PP401-0030
SAMPLE

Lab Sample ID: SY76M
LIMS ID: 11-11963
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 13:35
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.87 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 15.7%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	64	< 64 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	67.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB22-PP401-0100
SAMPLE

Lab Sample ID: SY76N
LIMS ID: 11-11964
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 14:07
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.92 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 21.7%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	63	300 J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	60.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP212-0030
SAMPLE

Lab Sample ID: SY76O
LIMS ID: 11-11965
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 14:40
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.97 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 12.9%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	63	< 63 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	67.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP212-0100
SAMPLE

Lab Sample ID: SY76P
LIMS ID: 11-11966
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 15:13
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 8.15 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 20.5%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	61	< 61 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	64.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP211-0030
SAMPLE

Lab Sample ID: SY76Q
LIMS ID: 11-11967
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 15:46
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.78 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 14.2%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	64	< 64 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	67.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP211-0100
SAMPLE

Lab Sample ID: SY76R
LIMS ID: 11-11968
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 16:19
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 8.03 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 21.4%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	62	210 J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	66.8%

STR 6/16/11

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: MB-060611
METHOD BLANK

Lab Sample ID: MB-060611
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Date Extracted: 06/06/11
Date Analyzed: 06/14/11 05:23
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.50 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	67	< 67 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	74.4%

ANALYTICAL RESOURCES INCORPORATED

SW8270 SEMIVOLATILES SOIL/SEDIMENT SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888

Client ID	NBZ	TOT OUT
MB-060611	74.4%	0
LCS-060611	72.8%	0
LCSD-060611	68.8%	0
RI-SB22-PP430-0030	69.6%	0
RI-SB22-PP430-0100	73.6%	0
RI-SB22-PP427-0030	72.8%	0
RI-SB22-PP427-0100	64.4%	0
RI-SB-PP215-0030	70.8%	0
RI-SB-PP215-0100	73.2%	0
RI-SB-PP217-0030	70.4%	0
RI-SB-PP217-0100	66.0%	0
RI-SB-PP214-0030	63.6%	0
RI-SB-PP214-0100	63.6%	0
RI-SB-PP213-0030	63.2%	0
RI-SB-PP213-0100	70.8%	0
RI-SB22-PP401-0030	67.2%	0
RI-SB22-PP401-0100	60.8%	0
RI-SB-PP212-0030	67.2%	0
RI-SB-PP212-0100	64.8%	0
RI-SB-PP211-0030	67.2%	0
RI-SB-PP211-0100	66.8%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(46-102)	(32-106)

Prep Method: SW3546
Log Number Range: 11-11951 to 11-11968

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: LCS-060611
LCS/LCSD

Lab Sample ID: LCS-060611
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted LCS/LCSD: 06/06/11

Date Analyzed LCS: 06/14/11 05:56
LCSD: 06/14/11 06:29
Instrument/Analyst LCS: NT6/JZ
LCSD: NT6/JZ
GPC Cleanup: Yes

Sample Amount LCS: 7.50 g
LCSD: 7.50 g
Final Extract Volume LCS: 0.5 mL
LCSD: 0.5 mL
Dilution Factor LCS: 1.00
LCSD: 1.00
Percent Moisture: NA

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
2-Methylnaphthalene	845	1670	50.6%	841	1670	50.4%	0.5%

Semivolatile Surrogate Recovery

	LCS	LCSD
d5-Nitrobenzene	72.8%	68.8%

Reported in µg/kg (ppb)
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID
Page 1 of 2
Matrix: Soil

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Received: 05/26/11

Data Release Authorized:
Reported: 06/08/11

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range	RL	Result
MB-060211	Method Blank	06/02/11	06/07/11	1.00	Diesel	5.0	< 5.0 U
11-11951	HC ID: ---		FID4A	1.0	Jet-A	5.0	< 5.0 U
					o-Terphenyl		117%
SY76A	RI-SB22-PP430-0030	06/02/11	06/07/11	1.00	**Diesel**	**5.7**	**29**
11-11951	HC ID: **DRO**		FID4A	1.0	Jet-A	11	< 11 U
					o-Terphenyl		97.4%
SY76B	RI-SB22-PP430-0100	06/02/11	06/07/11	2.00	**Diesel**	**54**	**60**
11-11952	HC ID: **DRO**		FID4A	5.0	Jet-A	110	< 110 U
					o-Terphenyl		107%
SY76C	RI-SB22-PP427-0030	06/02/11	06/07/11	1.00	**Diesel**	**5.7**	**12**
11-11953	HC ID: **DRO**		FID4A	1.0	Jet-A	11	< 11 U
					o-Terphenyl		108%
SY76D	RI-SB22-PP427-0100	06/02/11	06/07/11	2.00	**Diesel**	**16**	**240**
11-11954	HC ID: **DIESEL**		FID4A	1.0	**Jet-A**	**32**	**80**
					o-Terphenyl		90.7%
SY76E	RI-SB-PP215-0030	06/02/11	06/07/11	1.00	Diesel	5.6	< 5.6 U
11-11955	HC ID: ---		FID4A	1.0	Jet-A	11	< 11 U
					o-Terphenyl		99.1%
SY76F	RI-SB-PP215-0100	06/02/11	06/07/11	1.00	**Diesel**	**5.5**	**18**
11-11956	HC ID: **DRO**		FID4A	1.0	Jet-A	11	< 11 U
					o-Terphenyl		98.7%
SY76G	RI-SB-PP217-0030	06/02/11	06/07/11	1.00	Diesel	5.8	< 5.8 U
11-11957	HC ID: ---		FID4A	1.0	Jet-A	12	< 12 U
					o-Terphenyl		114%
SY76H	RI-SB-PP217-0100	06/02/11	06/07/11	1.00	**Diesel**	**6.4**	**37**
11-11958	HC ID: **DIESEL**		FID4A	1.0	**Jet-A**	**13**	**14**
					o-Terphenyl		99.8%
SY76I	RI-SB-PP214-0030	06/02/11	06/07/11	1.00	**Diesel**	**6.2**	**37**
11-11959	HC ID: **DRO**		FID4A	1.0	Jet-A	12	< 12 U
					o-Terphenyl		103%
SY76J	RI-SB-PP214-0100	06/02/11	06/07/11	1.00	**Diesel**	**5.9**	**57**
11-11960	HC ID: **DIESEL**		FID4A	1.0	**Jet-A**	**12**	**16**
					o-Terphenyl		102%
SY76K	RI-SB-PP213-0030	06/02/11	06/08/11	1.00	**Diesel**	**5.7**	**46**
11-11961	HC ID: **DIESEL**		FID4A	1.0	**Jet-A**	**11**	**16**
					o-Terphenyl		102%
SY76L	RI-SB-PP213-0100	06/02/11	06/08/11	1.00	**Diesel**	**5.9**	**20**
11-11962	HC ID: **DRO**		FID4A	1.0	Jet-A	12	< 12 U
					o-Terphenyl		102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID
Page 2 of 2
Matrix: Soil

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Received: 05/26/11

Data Release Authorized:
Reported: 06/08/11

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range	RL	Result
SY76M	RI-SB22-PP401-0030	06/02/11	06/08/11	2.00	**Diesel**	**58**	**240**
11-11963	HC ID: **DRO**		FID4A	5.0	Jet-A	120	< 120 U
					o-Terphenyl		101%
SY76N	RI-SB22-PP401-0100	06/02/11	06/08/11	2.00	**Diesel**	**64**	**580**
11-11964	HC ID: **DIESEL**		FID4A	5.0	**Jet-A**	**130**	**210**
					o-Terphenyl		97.1%
SY76O	RI-SB-PP212-0030	06/02/11	06/08/11	1.00	**Diesel**	**5.7**	**14**
11-11965	HC ID: **DRO**		FID4A	1.0	Jet-A	11	< 11 U
					o-Terphenyl		105%
SY76P	RI-SB-PP212-0100	06/02/11	06/08/11	1.00	**Diesel**	**6.2**	**35**
11-11966	HC ID: **DRO**		FID4A	1.0	Jet-A	12	< 12 U
					o-Terphenyl		103%
SY76Q	RI-SB-PP211-0030	06/02/11	06/08/11	1.00	**Diesel**	**5.8**	**32**
11-11967	HC ID: **DRO**		FID4A	1.0	Jet-A	12	< 12 U
					o-Terphenyl		103%
SY76R	RI-SB-PP211-0100	06/02/11	06/08/11	2.00	**Diesel**	**120**	**530**
11-11968	HC ID: **DRO**		FID4A	10	Jet-A	250	< 250 U
					o-Terphenyl		104%

Reported in mg/kg (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel quantitation on total peaks in the range from C12 to C24.
Jet-A quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicates results of organics or additional hydrocarbons in ranges are not identifiable.

ANALYTICAL RESOURCES INCORPORATED

TPHD SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888

Client ID	OTER	TOT OUT
060211MBS	117%	0
060211LCS	113%	0
060211LCSD	115%	0
RI-SB22-PP430-0030	97.4%	0
RI-SB22-PP430-0100	107%	0
RI-SB22-PP427-0030	108%	0
RI-SB22-PP427-0100	90.7%	0
RI-SB-PP215-0030	99.1%	0
RI-SB-PP215-0100	98.7%	0
RI-SB-PP217-0030	114%	0
RI-SB-PP217-0100	99.8%	0
RI-SB-PP214-0030	103%	0
RI-SB-PP214-0100	102%	0
RI-SB-PP213-0030	102%	0
RI-SB-PP213-0100	102%	0
RI-SB22-PP401-0030	101%	0
RI-SB22-PP401-0100	97.1%	0
RI-SB-PP212-0030	105%	0
RI-SB-PP212-0100	103%	0
RI-SB-PP211-0030	103%	0
RI-SB-PP211-0100	104%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(64-134)	(52-130)

Prep Method: SW3510C
Log Number Range: 11-11951 to 11-11968

FORM-II TPHD

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID
Page 1 of 1

Sample ID: LCS-060211
LCS/LCSD

Lab Sample ID: LCS-060211
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 06/02/11

Date Analyzed LCS: 06/07/11 21:20
LCSD: 06/07/11 21:43
Instrument/Analyst LCS: FID4A/MS
LCSD: FID4A/MS

Sample Amount LCS: 10.0 g-dry-wt
LCSD: 10.0 g-dry-wt
Final Extract Volume LCS: 1.0 mL
LCSD: 1.0 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Range	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Diesel	145	150	96.7%	148	150	98.7%	2.0%

TPHD Surrogate Recovery

	LCS	LCSD
o-Terphenyl	113%	115%

Results reported in mg/kg
RPD calculated using sample concentrations per SW846.

SY76:00075

ANALYTICAL RESOURCES INCORPORATED

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: SY76
Matrix: Soil
Project: Former Fuel Farm Investigation
Date Received: 05/26/11
8888

ARI ID	Client ID	Client Amt	Final Vol	Basis	Prep Date
11-11951-060211MB1	Method Blank	10.0 g	1.00 mL	-	06/02/11
11-11951-060211LCS1	Lab Control	10.0 g	1.00 mL	-	06/02/11
11-11951-060211LCSD1	Lab Control Dup	10.0 g	1.00 mL	-	06/02/11
11-11951-SY76A	RI-SB22-PP430-0030	8.83 g	1.00 mL	D	06/02/11
11-11952-SY76B	RI-SB22-PP430-0100	9.23 g	2.00 mL	D	06/02/11
11-11953-SY76C	RI-SB22-PP427-0030	8.84 g	1.00 mL	D	06/02/11
11-11954-SY76D	RI-SB22-PP427-0100	6.26 g	2.00 mL	D	06/02/11
11-11955-SY76E	RI-SB-PP215-0030	8.92 g	1.00 mL	D	06/02/11
11-11956-SY76F	RI-SB-PP215-0100	9.03 g	1.00 mL	D	06/02/11
11-11957-SY76G	RI-SB-PP217-0030	8.59 g	1.00 mL	D	06/02/11
11-11958-SY76H	RI-SB-PP217-0100	7.85 g	1.00 mL	D	06/02/11
11-11959-SY76I	RI-SB-PP214-0030	8.09 g	1.00 mL	D	06/02/11
11-11960-SY76J	RI-SB-PP214-0100	8.48 g	1.00 mL	D	06/02/11
11-11961-SY76K	RI-SB-PP213-0030	8.74 g	1.00 mL	D	06/02/11
11-11962-SY76L	RI-SB-PP213-0100	8.47 g	1.00 mL	D	06/02/11
11-11963-SY76M	RI-SB22-PP401-0030	8.68 g	2.00 mL	D	06/02/11
11-11964-SY76N	RI-SB22-PP401-0100	7.87 g	2.00 mL	D	06/02/11
11-11965-SY76O	RI-SB-PP212-0030	8.81 g	1.00 mL	D	06/02/11
11-11966-SY76P	RI-SB-PP212-0100	8.07 g	1.00 mL	D	06/02/11
11-11967-SY76Q	RI-SB-PP211-0030	8.62 g	1.00 mL	D	06/02/11
11-11968-SY76R	RI-SB-PP211-0100	8.10 g	2.00 mL	D	06/02/11

Basis: D=Dry Weight W=As Received

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB22-PP430-0030
SAMPLE

Lab Sample ID: SY76A
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 12.7%

Sample Amount: 8.92 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/13/11 15:37
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 18:53
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	< 2,200 U
C10-C12 Aliphatics	2,200	< 2,200 U
C12-C16 Aliphatics	2,200	< 2,200 U
C16-C21 Aliphatics	2,200	< 2,200 U
C21-C34 Aliphatics	2,200	< 2,200 U
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	< 2,200 U
C12-C16 Aromatics	2,200	< 2,200 U
C16-C21 Aromatics	2,200	< 2,200 U
C21-C34 Aromatics	2,200	< 2,200 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	75.6%
Aromatic	o-Terphenyl	74.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB22-PP430-0100
SAMPLE

Lab Sample ID: SY76B
LIMS ID: 11-11952
Matrix: Soil
Data Release Authorized:
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 10.3%

Sample Amount: 9.15 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 08:22
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 19:18
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	< 2,200 U
C10-C12 Aliphatics	2,200	< 2,200 U
C12-C16 Aliphatics	**2,200**	**2,400**
C16-C21 Aliphatics	**2,200**	**5,400**
C21-C34 Aliphatics	**2,200**	**64,000**
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	< 2,200 U
C12-C16 Aromatics	2,200	< 2,200 U
C16-C21 Aromatics	**2,200**	**6,100**
C21-C34 Aromatics	**2,200**	**51,000**

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	70.5%
Aromatic	o-Terphenyl	75.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB22-PP427-0030
SAMPLE

Lab Sample ID: SY76C
LIMS ID: 11-11953
Matrix: Soil
Data Release Authorized:
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 12.6%

Sample Amount: 8.75 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 08:47
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 19:43
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,300	< 2,300 U
C10-C12 Aliphatics	2,300	< 2,300 U
C12-C16 Aliphatics	2,300	< 2,300 U
C16-C21 Aliphatics	2,300	< 2,300 U
C21-C34 Aliphatics	2,300	< 2,300 U
C8-C10 Aromatics	2,300	< 2,300 U
C10-C12 Aromatics	2,300	< 2,300 U
C12-C16 Aromatics	2,300	< 2,300 U
C16-C21 Aromatics	2,300	< 2,300 U
C21-C34 Aromatics	2,300	< 2,300 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	65.4%
Aromatic	o-Terphenyl	71.6%

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Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB22-PP427-0100
SAMPLE

Lab Sample ID: SY76D
LIMS ID: 11-11954
Matrix: Soil
Data Release Authorized:
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 38.9%

Sample Amount: 6.25 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 09:12
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 20:08
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	3,200	< 3,200 U
C10-C12 Aliphatics	**3,200**	**5,000**
C12-C16 Aliphatics	**3,200**	**8,200**
C16-C21 Aliphatics	**3,200**	**13,000**
C21-C34 Aliphatics	**3,200**	**150,000**
C8-C10 Aromatics	3,200	< 3,200 U
C10-C12 Aromatics	3,200	< 3,200 U
C12-C16 Aromatics	**3,200**	**4,000**
C16-C21 Aromatics	**3,200**	**17,000**
C21-C34 Aromatics	**3,200**	**96,000**

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	67.9%
Aromatic	o-Terphenyl	71.5%

ANALYTICAL RESOURCES INCORPORATED

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Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP215-0030
SAMPLE

Lab Sample ID: SY76E
LIMS ID: 11-11955
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 11.2%

Sample Amount: 8.98 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 11:20
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 22:14
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	< 2,200 U
C10-C12 Aliphatics	2,200	< 2,200 U
C12-C16 Aliphatics	2,200	< 2,200 U
C16-C21 Aliphatics	2,200	< 2,200 U
C21-C34 Aliphatics	2,200	< 2,200 U
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	< 2,200 U
C12-C16 Aromatics	2,200	< 2,200 U
C16-C21 Aromatics	2,200	< 2,200 U
C21-C34 Aromatics	2,200	< 2,200 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	74.9%
Aromatic	o-Terphenyl	77.0%

ANALYTICAL RESOURCES INCORPORATED

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Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP215-0100
SAMPLE

Lab Sample ID: SY76F
LIMS ID: 11-11956
Matrix: Soil
Data Release Authorized:
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 11.9%

Sample Amount: 8.86 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 11:45
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 22:39
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,300	< 2,300 U
C10-C12 Aliphatics	2,300	< 2,300 U
C12-C16 Aliphatics	2,300	< 2,300 U
C16-C21 Aliphatics	2,300	< 2,300 U
C21-C34 Aliphatics	2,300	< 2,300 U
C8-C10 Aromatics	2,300	< 2,300 U
C10-C12 Aromatics	2,300	< 2,300 U
C12-C16 Aromatics	2,300	< 2,300 U
C16-C21 Aromatics	2,300	< 2,300 U
C21-C34 Aromatics	2,300	< 2,300 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	69.6%
Aromatic	o-Terphenyl	71.1%

ANALYTICAL RESOURCES INCORPORATED

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Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP217-0030
SAMPLE

Lab Sample ID: SY76G
LIMS ID: 11-11957
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 16.8%

Sample Amount: 8.48 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 12:10
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 23:04
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,400	< 2,400 U
C10-C12 Aliphatics	2,400	< 2,400 U
C12-C16 Aliphatics	2,400	< 2,400 U
C16-C21 Aliphatics	2,400	< 2,400 U
C21-C34 Aliphatics	2,400	< 2,400 U
C8-C10 Aromatics	2,400	< 2,400 U
C10-C12 Aromatics	2,400	< 2,400 U
C12-C16 Aromatics	2,400	< 2,400 U
C16-C21 Aromatics	2,400	< 2,400 U
C21-C34 Aromatics	2,400	< 2,400 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	74.7%
Aromatic	o-Terphenyl	84.5%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP217-0100
SAMPLE

Lab Sample ID: SY76H
LIMS ID: 11-11958
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 22.0%

Sample Amount: 7.84 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 12:35
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 23:30
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,600	< 2,600 U
C10-C12 Aliphatics	2,600	< 2,600 U
C12-C16 Aliphatics	2,600	< 2,600 U
C16-C21 Aliphatics	2,600	< 2,600 U
C21-C34 Aliphatics	**2,600**	**7,300**
C8-C10 Aromatics	2,600	< 2,600 U
C10-C12 Aromatics	2,600	< 2,600 U
C12-C16 Aromatics	2,600	< 2,600 U
C16-C21 Aromatics	2,600	< 2,600 U
C21-C34 Aromatics	**2,600**	**2,700**

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	75.2%
Aromatic	o-Terphenyl	78.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP214-0030
SAMPLE

Lab Sample ID: SY76I
LIMS ID: 11-11959
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 19.3%

Sample Amount: 8.09 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 13:01
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 23:55
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,500	< 2,500 U
C10-C12 Aliphatics	2,500	< 2,500 U
C12-C16 Aliphatics	2,500	< 2,500 U
C16-C21 Aliphatics	**2,500**	**3,300**
C21-C34 Aliphatics	**2,500**	**8,900**
C8-C10 Aromatics	2,500	< 2,500 U
C10-C12 Aromatics	2,500	< 2,500 U
C12-C16 Aromatics	2,500	< 2,500 U
C16-C21 Aromatics	2,500	< 2,500 U
C21-C34 Aromatics	2,500	< 2,500 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	70.7%
Aromatic	o-Terphenyl	74.3%

SY76:8888

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH

Sample ID: RI-SB-PP214-0100
SAMPLE

Lab Sample ID: SY76J
LIMS ID: 11-11960
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 17.1%

Sample Amount: 8.54 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 13:26
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/12/11 00:20
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	**2,300**	**3,000**
C10-C12 Aliphatics	2,300	< 2,300 U
C12-C16 Aliphatics	**2,300**	**2,500**
C16-C21 Aliphatics	**2,300**	**6,000**
C21-C34 Aliphatics	**2,300**	**2,300**
C8-C10 Aromatics	2,300	< 2,300 U
C10-C12 Aromatics	2,300	< 2,300 U
C12-C16 Aromatics	2,300	< 2,300 U
C16-C21 Aromatics	2,300	< 2,300 U
C21-C34 Aromatics	2,300	< 2,300 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	74.4%
Aromatic	o-Terphenyl	79.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH

Sample ID: RI-SB-PP213-0030
SAMPLE

Lab Sample ID: SY76K
LIMS ID: 11-11961
Matrix: Soil
Data Release Authorized:
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 13.6%

Sample Amount: 8.75 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 13:51
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/12/11 00:45
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	**2,300**	**5,100**
C10-C12 Aliphatics	2,300	< 2,300 U
C12-C16 Aliphatics	2,300	< 2,300 U
C16-C21 Aliphatics	2,300	< 2,300 U
C21-C34 Aliphatics	**2,300**	**3,400**
C8-C10 Aromatics	2,300	< 2,300 U
C10-C12 Aromatics	2,300	< 2,300 U
C12-C16 Aromatics	2,300	< 2,300 U
C16-C21 Aromatics	**2,300**	**2,700**
C21-C34 Aromatics	**2,300**	**2,500**

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	60.5%
Aromatic	o-Terphenyl	72.4%

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ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP213-0100
SAMPLE

Lab Sample ID: SY76L
LIMS ID: 11-11962
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 16.6%

Sample Amount: 8.46 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 14:16
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/12/11 01:35
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,400	< 2,400 U
C10-C12 Aliphatics	2,400	< 2,400 U
C12-C16 Aliphatics	2,400	< 2,400 U
C16-C21 Aliphatics	2,400	< 2,400 U
C21-C34 Aliphatics	2,400	< 2,400 U
C8-C10 Aromatics	2,400	< 2,400 U
C10-C12 Aromatics	2,400	< 2,400 U
C12-C16 Aromatics	2,400	< 2,400 U
C16-C21 Aromatics	2,400	< 2,400 U
C21-C34 Aromatics	2,400	< 2,400 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	71.0%
Aromatic	o-Terphenyl	0.1%

DNR TD 7/29/11

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ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP213-0100
REEXTRACT

Lab Sample ID: SY76L
LIMS ID: 11-11962
Matrix: Soil
Data Release Authorized:
Reported: 06/20/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/14/11
Percent Moisture: 16.6%

Sample Amount: 8.40 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/16/11 23:32
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/17/11 07:04
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,400	< 2,400 U
C10-C12 Aliphatics	2,400	< 2,400 U
C12-C16 Aliphatics	2,400	< 2,400 U
C16-C21 Aliphatics	2,400	< 2,400 U
C21-C34 Aliphatics	2,400	< 2,400 U
C8-C10 Aromatics	2,400	< 2,400 U
C10-C12 Aromatics	2,400	< 2,400 U
C12-C16 Aromatics	2,400	< 2,400 U
C16-C21 Aromatics	2,400	< 2,400 U
C21-C34 Aromatics	2,400	< 2,400 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	84.7%
Aromatic	o-Terphenyl	82.2%

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ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB22-PP401-0030
SAMPLE

Lab Sample ID: SY76M
LIMS ID: 11-11963
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 15.7%

Sample Amount: 8.59 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 15:06
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/12/11 02:01
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,300	< 2,300 U
C10-C12 Aliphatics	2,300	< 2,300 U
C12-C16 Aliphatics	**2,300**	**8,000**
C16-C21 Aliphatics	**2,300**	**37,000**
C21-C34 Aliphatics	**2,300**	**160,000**
C8-C10 Aromatics	2,300	< 2,300 U
C10-C12 Aromatics	2,300	< 2,300 U
C12-C16 Aromatics	2,300	< 2,300 U
C16-C21 Aromatics	**2,300**	**14,000**
C21-C34 Aromatics	**2,300**	**86,000**

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	72.4%
Aromatic	o-Terphenyl	68.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB22-PP401-0100
SAMPLE

Lab Sample ID: SY76N
LIMS ID: 11-11964
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 21.7%

Sample Amount: 7.90 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 15:32
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/12/11 02:26
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,500	< 2,500 U
C10-C12 Aliphatics	**2,500**	**3,900**
C12-C16 Aliphatics	**2,500**	**61,000**
C16-C21 Aliphatics	**2,500**	**100,000**
C21-C34 Aliphatics	**2,500**	**160,000**
C8-C10 Aromatics	2,500	< 2,500 U
C10-C12 Aromatics	2,500	< 2,500 U
C12-C16 Aromatics	**2,500**	**3,900**
C16-C21 Aromatics	**2,500**	**35,000**
C21-C34 Aromatics	**2,500**	**100,000**

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	74.2%
Aromatic	o-Terphenyl	76.2%

SY76 : MWM

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ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP212-0030
SAMPLE

Lab Sample ID: SY76O
LIMS ID: 11-11965
Matrix: Soil
Data Release Authorized:
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 12.9%

Sample Amount: 8.75 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 15:56
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/12/11 02:51
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,300	< 2,300 U
C10-C12 Aliphatics	2,300	< 2,300 U
C12-C16 Aliphatics	2,300	< 2,300 U
C16-C21 Aliphatics	2,300	< 2,300 U
C21-C34 Aliphatics	2,300	< 2,300 U
C8-C10 Aromatics	2,300	< 2,300 U
C10-C12 Aromatics	2,300	< 2,300 U
C12-C16 Aromatics	2,300	< 2,300 U
C16-C21 Aromatics	2,300	< 2,300 U
C21-C34 Aromatics	2,300	< 2,300 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	74.4%
Aromatic	o-Terphenyl	75.3%

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ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP212-0100
SAMPLE

Lab Sample ID: SY76P
LIMS ID: 11-11966
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 20.5%

Sample Amount: 8.05 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 16:22
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/12/11 03:16
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,500	< 2,500 U
C10-C12 Aliphatics	2,500	< 2,500 U
C12-C16 Aliphatics	2,500	< 2,500 U
C16-C21 Aliphatics	**2,500**	**6,200**
C21-C34 Aliphatics	**2,500**	**36,000**
C8-C10 Aromatics	2,500	< 2,500 U
C10-C12 Aromatics	2,500	< 2,500 U
C12-C16 Aromatics	2,500	< 2,500 U
C16-C21 Aromatics	2,500	< 2,500 U
C21-C34 Aromatics	2,500	< 2,500 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	71.1%
Aromatic	o-Terphenyl	74.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP211-0030
SAMPLE

Lab Sample ID: SY76Q
LIMS ID: 11-11967
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 14.2%

Sample Amount: 8.64 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 16:47
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/12/11 03:41
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,300	< 2,300 U
C10-C12 Aliphatics	2,300	< 2,300 U
C12-C16 Aliphatics	2,300	< 2,300 U
C16-C21 Aliphatics	**2,300**	**2,900**
C21-C34 Aliphatics	**2,300**	**5,700**
C8-C10 Aromatics	2,300	< 2,300 U
C10-C12 Aromatics	2,300	< 2,300 U
C12-C16 Aromatics	2,300	< 2,300 U
C16-C21 Aromatics	2,300	< 2,300 U
C21-C34 Aromatics	**2,300**	**2,800**

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	75.6%
Aromatic	o-Terphenyl	70.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH

Sample ID: RI-SB-PP211-0100
SAMPLE

Lab Sample ID: SY76R
LIMS ID: 11-11968
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/26/11
Date Received: 05/26/11

Date Extracted: 06/06/11
Percent Moisture: 21.4%

Sample Amount: 7.96 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 17:12
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/12/11 04:05
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	**2,500**	**4,200**
C10-C12 Aliphatics	**2,500**	**6,200**
C12-C16 Aliphatics	**2,500**	**60,000**
C16-C21 Aliphatics	**2,500**	**140,000**
C21-C34 Aliphatics	**2,500**	**490,000**
C8-C10 Aromatics	2,500	< 2,500 U
C10-C12 Aromatics	2,500	< 2,500 U
C12-C16 Aromatics	**2,500**	**2,800**
C16-C21 Aromatics	**2,500**	**17,000**
C21-C34 Aromatics	**2,500**	**72,000**

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	70.6%
Aromatic	o-Terphenyl	75.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH

Sample ID: MB-060611
METHOD BLANK

Lab Sample ID: MB-060611
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized: MW
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Date Extracted: 06/06/11
Percent Moisture: NA

Sample Amount: 10.0 g-as-rec
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 09:38
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 20:34
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,000	< 2,000 U
C10-C12 Aliphatics	2,000	< 2,000 U
C12-C16 Aliphatics	2,000	< 2,000 U
C16-C21 Aliphatics	2,000	< 2,000 U
C21-C34 Aliphatics	2,000	< 2,000 U
C8-C10 Aromatics	2,000	< 2,000 U
C10-C12 Aromatics	2,000	< 2,000 U
C12-C16 Aromatics	2,000	< 2,000 U
C16-C21 Aromatics	2,000	< 2,000 U
C21-C34 Aromatics	2,000	< 2,000 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	77.3%
Aromatic	o-Terphenyl	76.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: MB-061411
METHOD BLANK

Lab Sample ID: MB-061411
LIMS ID: 11-11962
Matrix: Soil
Data Release Authorized:
Reported: 06/20/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Date Extracted: 06/14/11
Percent Moisture: NA

Sample Amount: 10.0 g-as-rec
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/17/11 00:23
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/17/11 07:55
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,000	< 2,000 U
C10-C12 Aliphatics	2,000	< 2,000 U
C12-C16 Aliphatics	2,000	< 2,000 U
C16-C21 Aliphatics	2,000	< 2,000 U
C21-C34 Aliphatics	2,000	< 2,000 U
C8-C10 Aromatics	2,000	< 2,000 U
C10-C12 Aromatics	2,000	< 2,000 U
C12-C16 Aromatics	2,000	< 2,000 U
C16-C21 Aromatics	2,000	< 2,000 U
C21-C34 Aromatics	2,000	< 2,000 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	82.9%
Aromatic	o-Terphenyl	79.9%

ANALYTICAL RESOURCES INCORPORATED

ALEPH SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888

Client ID	COD	TOT OUT
MB-060611	77.3%	0
LCS-060611	75.3%	0
RI-SB22-PP430-0030	75.6%	0
RI-SB22-PP430-0100	70.5%	0
RI-SB22-PP427-0030	65.4%	0
RI-SB22-PP427-0100	67.9%	0
RI-SB-PP215-0030	74.9%	0
RI-SB-PP215-0100	69.6%	0
RI-SB-PP217-0030	74.7%	0
RI-SB-PP217-0100	75.2%	0
RI-SB-PP214-0030	70.7%	0
RI-SB-PP214-0100	74.4%	0
RI-SB-PP213-0030	60.5%	0
MB-061411	82.9%	0
LCS-061411	81.6%	0
RI-SB-PP213-0100	71.0%	0
RI-SB-PP213-0100RE	84.7%	0
RI-SB22-PP401-0030	72.4%	0
RI-SB22-PP401-0100	74.2%	0
RI-SB-PP212-0030	74.4%	0
RI-SB-PP212-0100	71.1%	0
RI-SB-PP211-0030	75.6%	0
RI-SB-PP211-0100	70.6%	0

	LCS/MB LIMITS	QC LIMITS
(COD) = 1-Chlorooctadecane	(27-128)	(39-131)

Prep Method: SW3550C
Log Number Range: 11-11951 to 11-11968

FORM-II ALEPH

ANALYTICAL RESOURCES INCORPORATED

AREPH SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation
8888

Client ID	OTER	TOT OUT
MB-060611	76.3%	0
LCS-060611	73.4%	0
RI-SB22-PP430-0030	74.2%	0
RI-SB22-PP430-0100	75.8%	0
RI-SB22-PP427-0030	71.6%	0
RI-SB22-PP427-0100	71.5%	0
RI-SB-PP215-0030	77.0%	0
RI-SB-PP215-0100	71.1%	0
RI-SB-PP217-0030	84.5%	0
RI-SB-PP217-0100	78.6%	0
RI-SB-PP214-0030	74.3%	0
RI-SB-PP214-0100	79.4%	0
RI-SB-PP213-0030	72.4%	0
MB-061411	79.9%	0
LCS-061411	84.6%	0
RI-SB-PP213-0100	0.1%*	1
RI-SB-PP213-0100 RE	82.2%	0
RI-SB22-PP401-0030	68.4%	0
RI-SB22-PP401-0100	76.2%	0
RI-SB-PP212-0030	75.3%	0
RI-SB-PP212-0100	74.9%	0
RI-SB-PP211-0030	70.9%	0
RI-SB-PP211-0100	75.6%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(34-133)	(10-143)

Prep Method: SW3550C
Log Number Range: 11-11951 to 11-11968

FORM-II AREPH

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: LCS-060611
LAB CONTROL

Lab Sample ID: LCS-060611
LIMS ID: 11-11951
Matrix: Soil
Data Release Authorized:
Reported: 06/14/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Date Extracted: 06/06/11

Sample Amount: 10.0 g-as-rec
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/11/11 10:03
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/11/11 20:59
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	Lab Control	Spike Added	Recovery
C8-C10 Aliphatics	11000	15000	73.3%
C10-C12 Aliphatics	11000	15000	73.3%
C12-C16 Aliphatics	13000	15000	86.7%
C16-C21 Aliphatics	12000	15000	80.0%
C10-C12 Aromatics	9900	15000	66.0%
C12-C16 Aromatics	11500	15000	76.7%
C16-C21 Aromatics	24300	30000	81.0%
C21-C34 Aromatics	23500	30000	78.3%

Results reported in µg/kg

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	75.3%
Aromatic	o-Terphenyl	73.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: LCS-061411
LAB CONTROL

Lab Sample ID: LCS-061411
LIMS ID: 11-11962
Matrix: Soil
Data Release Authorized:
Reported: 06/20/11

QC Report No: SY76-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Date Extracted: 06/14/11

Sample Amount: 10.0 g-as-rec
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/16/11 23:57
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/17/11 07:30
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	Lab Control	Spike Added	Recovery
C8-C10 Aliphatics	13000	15000	86.7%
C10-C12 Aliphatics	12000	15000	80.0%
C12-C16 Aliphatics	14000	15000	93.3%
C16-C21 Aliphatics	14000	15000	93.3%
C10-C12 Aromatics	10100	15000	67.3%
C12-C16 Aromatics	12400	15000	82.7%
C16-C21 Aromatics	28300	30000	94.3%
C21-C34 Aromatics	27200	30000	90.7%

Results reported in µg/kg

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	81.6%
Aromatic	o-Terphenyl	84.6%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

June 21, 2011

David R. Haddock
Geomatrix Consultants, Inc.
One Union Square
600 University Street, Suite 1020
Seattle, WA 98101

RE: Client Project: Boeing Renton Former Fuel Farm Investigation
ARI Job No: SY90

Dear Mr. Haddock:

Please find enclosed original Chain of Custody (COC) and the analytical results for the project referenced above. Analytical Resources, Inc. accepted eighteen soil samples and a trip blank in good condition on May 27, 2011. Samples were frozen to protect holding times.

The samples were analyzed for VOCs, EPH, VPH, SVOCs and NWTPH-Dx plus Jet-A, as requested on the COC.

The SVOCs LCS and LCSD are out of control low for 2-Methylnaphthalene. The recoveries were within allowable marginal exceedance limits and no further action was taken.

The matrix spike and matrix spike duplicate EPH RPD for C8-C10 Aliphatics is outside the +/-40% control limit for sample RI-SB22-PP405-0030.

The EPH method blank contained analyte in the C21-C34 aliphatics range. All associated samples that contain analyte have been flagged with a "B" wualifier.

There were no other anomalies associated with the samples.

Copies of these reports and all associated raw data will be kept on file. 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

cc: Carl Bach, The Boeing Company, P.O. Box 3707, M/S 1W-12, Seattle, WA 98124-2207
Raymond Power, The Boeing Company, PO Box 3707, M/S 63-41, Seattle, WA 98124

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 5490	Turn-around Requested: Standard	Page: 1 of 2	
ARI Client Company: Boeing	Phone: 206-342-1760	Date: 5/27/11	Ice Present? Y
Client Contact: Nik Bacher AGMX (for Boeing)		No. of Coolers: 2	Cooler Temps: 1.8, 3.8
Client Project Name: Former Fuel Farm Investigation			
Client Project #: 38858	Samplers: N. Bacher		

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: TPH-Dx (incl. Jet Fuel)	BTEX	2-methyl naphthalene	VPH	EPH				Notes/Comments
R1-SB-PP216-0030	5/27/11	0805	Soil	6	X	X	X	X	X				
R1-SB-PP216-0150		0825		6	X	X	X	X	X				
R1-SB-PP218-0030		0835		6	X	X	X	X	X				
R1-SB-PP218-0080		0855		6	X	X	X	X	X				
R1-SB-PP210-0030		0905		6	X	X	X	X	X				
R1-SB-PP210-0150		0925		6	X	X	X	X	X				
R1-SB-PP219-0030		0935		6	X	X	X	X	X				
R1-SB-PP219-0150		0955		6	X	X	X	X	X				
R1-SB-PP226-0030		1005		6	X	X	X	X	X				
R1-SB-PP226-0090		1030		6	X	X	X	X	X				

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
Please homogenize 16oz. jars before analyzing. Include Jet-Fuel in TPH-Dx analysis	Printed Name: Nik Bacher	Printed Name: Jennifer Mittsap	Printed Name:	Printed Name:
	Company: AGMX	Company: ARI	Company:	Company:
	Date & Time: 5/27/11 1450	Date & Time: 5/27/11 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.

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 5490	Turn-around Requested: Standard	Page: 2 of 2	
ARI Client Company: Boeing	Phone: 206-342-1760	Date: 5/27/11	Ice Present? Y
Client Contact: Nik Bacher AGMX (for Boeing)		No. of Coolers: 2	Cooler Temps: 1.8, 3.8
Client Project Name: Former Fuel Farm Investigation			
Client Project #: 8888	Samplers: N. Bacher		

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: TPH-Dx w/ Jet Fuel	BTEX	2-methyl naphthalene	VPH	EPH				Notes/Comments
R1-SB-PP226-1090	5/27/11	1035	Soil	5		X	X	X					
R1-SB-PP227-0030		1036		6	X	X	X	X	X				
R1-SB-PP227-0090		1110		6	X	X	X	X	X				
R1-SB22-PP405-0030		1120		6	X	X	X	X	X				
R1-SB22-PP405-0090		1145		6	X	X	X	X	X				
R1-SB22-PP405-1090		1150		5		X	X	X					
R1-SB22-PP420-0030		1200		6	X	X	X	X	X				
R1-SB22-PP420-0090		1220		6	X	X	X	X	X				

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
Please homogenize 16 oz. jars before analysis. Include Jet-Fuel in TPH-Dx analysis	Printed Name: Nik Bacher	Printed Name: Jennifer Millsap	Printed Name:	Printed Name:
	Company: AGMX	Company: ARI	Company:	Company:
	Date & Time: 5/27/11 1450	Date & Time: 5/27/11 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.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Boeing
Project Name: Former Fuel Farm Investigation
COC No(s): _____ (NA)
Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____
Assigned ARI Job No: SY90
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)	1.8 3.8 ___ ___	
If cooler temperature is out of compliance fill out form 00070F	Temp Gun ID#:	90944160179

Cooler Accepted by: JN Date: 5/27/11 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	5/23/11	

Was Sample Split by ARI : (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

Samples Logged by: JM Date: 5/27/11 Time: 1530

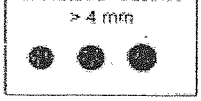
***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

Samples RI-SB-PP226-1090 & RI-SB22-PP405-1090 requested SVOA analysis. Only VOAs were received. SVOA not logged for these 2 samples

By: JM Date: 5/27/11

Small Air Bubbles ~2mm	Peabubbles 2-4 mm	LARGE Air Bubbles > 4 mm	
			Small → "sm"
			Peabubbles → "pb"
			Large → "lg"
			Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: SY90
Client: The Boeing Company
Project Event: 8888
Project Name: Former Fuel Farm Investigation

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	RI-SB-PP216-0030	SY90A	11-12049	Soil	05/27/11 08:05	05/27/11 14:50
2.	RI-SB-PP216-0100	SY90B	11-12050	Soil	05/27/11 08:25	05/27/11 14:50
3.	RI-SB-PP218-0030	SY90C	11-12051	Soil	05/27/11 08:35	05/27/11 14:50
4.	RI-SB-PP218-0080	SY90D	11-12052	Soil	05/27/11 08:55	05/27/11 14:50
5.	RI-SB-PP210-0030	SY90E	11-12053	Soil	05/27/11 09:05	05/27/11 14:50
6.	RI-SB-PP210-0100	SY90F	11-12054	Soil	05/27/11 09:25	05/27/11 14:50
7.	RI-SB-PP219-0030	SY90G	11-12055	Soil	05/27/11 09:35	05/27/11 14:50
8.	RI-SB-PP219-0100	SY90H	11-12056	Soil	05/27/11 09:55	05/27/11 14:50
9.	RI-SB-PP226-0030	SY90I	11-12057	Soil	05/27/11 10:05	05/27/11 14:50
10.	RI-SB-PP226-0090	SY90J	11-12058	Soil	05/27/11 10:30	05/27/11 14:50
11.	RI-SB-PP226-1090	SY90K	11-12059	Soil	05/27/11 10:35	05/27/11 14:50
12.	RI-SB-PP227-0030	SY90L	11-12060	Soil	05/27/11 10:36	05/27/11 14:50
13.	RI-SB-PP227-0090	SY90M	11-12061	Soil	05/27/11 11:10	05/27/11 14:50
14.	RI-SB22-PP405-0030	SY90N	11-12062	Soil	05/27/11 11:20	05/27/11 14:50
15.	RI-SB22-PP405-0090	SY90O	11-12063	Soil	05/27/11 11:45	05/27/11 14:50
16.	RI-SB22-PP405-1090	SY90P	11-12064	Soil	05/27/11 11:50	05/27/11 14:50
17.	RI-SB22-PP420-0030	SY90Q	11-12065	Soil	05/27/11 12:00	05/27/11 14:50
18.	RI-SB22-PP420-0090	SY90R	11-12066	Soil	05/27/11 12:20	05/27/11 14:50
19.	Trip Blank	SY90S	11-12067	Water	05/27/11	05/27/11 14:50

Printed 05/27/11

Data Reporting Qualifiers

Effective 2/14/2011

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S	Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte
NA	The flagged analyte was not analyzed for
NR	Spiked compound recovery is not reported due to chromatographic interference
NS	The flagged analyte was not spiked into the sample
M	Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses
M2	The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"
Y	The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.
EMPC	Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**
C	The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column
P	The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference
X	Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**
Z	Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A	The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP216-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90A
LIMS ID: 11-12049
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 18:04

Sample Amount: 4.46 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 14.9%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.1**	**2.1**	
108-88-3	Toluene	1.1	< 1.1	U
100-41-4	Ethylbenzene	1.1	< 1.1	U
179601-23-1	m,p-Xylene	1.1	< 1.1	U
95-47-6	o-Xylene	1.1	< 1.1	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	118%
d8-Toluene	97.0%
Bromofluorobenzene	88.1%
d4-1,2-Dichlorobenzene	97.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP216-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90B
LIMS ID: 11-12050
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 18:32

Sample Amount: 4.34 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 14.9%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.2	< 1.2	U
108-88-3	Toluene	1.2	< 1.2	U
100-41-4	Ethylbenzene	1.2	< 1.2	U
179601-23-1	**m,p-Xylene**	**1.2**	**1.9**	
95-47-6	o-Xylene	1.2	< 1.2	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	118%
d8-Toluene	101%
Bromofluorobenzene	95.3%
d4-1,2-Dichlorobenzene	99.1%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP218-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90C
LIMS ID: 11-12051
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 18:59

Sample Amount: 3.50 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 21.2%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.4**	**9.9**	
108-88-3	**Toluene**	**1.4**	**3.5**	
100-41-4	Ethylbenzene	1.4	< 1.4	U
179601-23-1	m,p-Xylene	1.4	< 1.4	U
95-47-6	o-Xylene	1.4	< 1.4	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	113%
d8-Toluene	101%
Bromofluorobenzene	76.5%
d4-1,2-Dichlorobenzene	108%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP218-0080**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90D
LIMS ID: 11-12052
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 19:27

Sample Amount: 4.60 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 20.3%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.1**	**1.7**	
108-88-3	Toluene	1.1	< 1.1	U
100-41-4	Ethylbenzene	1.1	< 1.1	U
179601-23-1	m,p-Xylene	1.1	< 1.1	U
95-47-6	o-Xylene	1.1	< 1.1	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	120%
d8-Toluene	101%
Bromofluorobenzene	96.2%
d4-1,2-Dichlorobenzene	100%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP210-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90E
LIMS ID: 11-12053
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 19:54

Sample Amount: 4.31 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 15.9%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.2	< 1.2	U
108-88-3	Toluene	1.2	< 1.2	U
100-41-4	Ethylbenzene	1.2	< 1.2	U
179601-23-1	m,p-Xylene	1.2	< 1.2	U
95-47-6	o-Xylene	1.2	< 1.2	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	125%
d8-Toluene	102%
Bromofluorobenzene	98.9%
d4-1,2-Dichlorobenzene	103%

SY90: 05/27/11

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP210-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90F
LIMS ID: 11-12054
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 20:21

Sample Amount: 4.48 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 11.8%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.1	< 1.1	U
108-88-3	Toluene	1.1	< 1.1	U
100-41-4	Ethylbenzene	1.1	< 1.1	U
179601-23-1	m,p-Xylene	1.1	< 1.1	U
95-47-6	o-Xylene	1.1	< 1.1	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	134%
d8-Toluene	105%
Bromofluorobenzene	95.3%
d4-1,2-Dichlorobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP219-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90G
LIMS ID: 11-12055
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 20:49

Sample Amount: 4.18 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 9.8%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.2	< 1.2	U
108-88-3	Toluene	1.2	< 1.2	U
100-41-4	Ethylbenzene	1.2	< 1.2	U
179601-23-1	m,p-Xylene	1.2	< 1.2	U
95-47-6	o-Xylene	1.2	< 1.2	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	126%
d8-Toluene	102%
Bromofluorobenzene	96.6%
d4-1,2-Dichlorobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP219-0100**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90H
LIMS ID: 11-12056
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 21:16

Sample Amount: 5.76 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 9.3%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**0.9**	**0.9**	
108-88-3	Toluene	0.9	< 0.9	U
100-41-4	Ethylbenzene	0.9	< 0.9	U
179601-23-1	**m,p-Xylene**	**0.9**	**1.8**	
95-47-6	o-Xylene	0.9	< 0.9	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	134%
d8-Toluene	103%
Bromofluorobenzene	91.7%
d4-1,2-Dichlorobenzene	99.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP226-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90I
LIMS ID: 11-12057
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 21:43

Sample Amount: 5.46 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 11.6%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	0.9	< 0.9	U
108-88-3	Toluene	0.9	< 0.9	U
100-41-4	Ethylbenzene	0.9	< 0.9	U
179601-23-1	m,p-Xylene	0.9	< 0.9	U
95-47-6	o-Xylene	0.9	< 0.9	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	134%
d8-Toluene	103%
Bromofluorobenzene	96.9%
d4-1,2-Dichlorobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP226-0090**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90J
LIMS ID: 11-12058
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 22:10

Sample Amount: 2.33 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 41.0%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	2.1	< 2.1	U
108-88-3	Toluene	2.1	< 2.1	U
100-41-4	Ethylbenzene	2.1	< 2.1	U
179601-23-1	m,p-Xylene	2.1	< 2.1	U
95-47-6	o-Xylene	2.1	< 2.1	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	135%
d8-Toluene	106%
Bromofluorobenzene	97.8%
d4-1,2-Dichlorobenzene	103%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP226-1090**
 SAMPLE

Lab Sample ID: SY90K
LIMS ID: 11-12059
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 22:38

Sample Amount: 3.06 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 41.0%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.6	< 1.6	U
108-88-3	Toluene	1.6	< 1.6	U
100-41-4	Ethylbenzene	1.6	< 1.6	U
179601-23-1	m,p-Xylene	1.6	< 1.6	U
95-47-6	o-Xylene	1.6	< 1.6	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	135%
d8-Toluene	104%
Bromofluorobenzene	96.0%
d4-1,2-Dichlorobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP227-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90L
LIMS ID: 11-12060
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 23:05

Sample Amount: 4.74 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 6.1%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.1	< 1.1	U
108-88-3	Toluene	1.1	< 1.1	U
100-41-4	Ethylbenzene	1.1	< 1.1	U
179601-23-1	m,p-Xylene	1.1	< 1.1	U
95-47-6	o-Xylene	1.1	< 1.1	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	137%
d8-Toluene	104%
Bromofluorobenzene	99.3%
d4-1,2-Dichlorobenzene	104%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB-PP227-0090**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90M
LIMS ID: 11-12061
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 23:32

Sample Amount: 5.38 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 7.8%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	0.9	< 0.9	U
108-88-3	Toluene	0.9	< 0.9	U
100-41-4	Ethylbenzene	0.9	< 0.9	U
179601-23-1	m,p-Xylene	0.9	< 0.9	U
95-47-6	o-Xylene	0.9	< 0.9	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	137%
d8-Toluene	103%
Bromofluorobenzene	100%
d4-1,2-Dichlorobenzene	104%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP405-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90N
LIMS ID: 11-12062
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 23:59

Sample Amount: 4.45 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 9.0%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.1	< 1.1	U
108-88-3	Toluene	1.1	< 1.1	U
100-41-4	Ethylbenzene	1.1	< 1.1	U
179601-23-1	m,p-Xylene	1.1	< 1.1	U
95-47-6	o-Xylene	1.1	< 1.1	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	134%
d8-Toluene	102%
Bromofluorobenzene	98.1%
d4-1,2-Dichlorobenzene	104%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP405-0090**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY900
LIMS ID: 11-12063
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/07/11 00:27

Sample Amount: 5.56 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 9.1%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	0.9	< 0.9	U
108-88-3	Toluene	0.9	< 0.9	U
100-41-4	Ethylbenzene	0.9	< 0.9	U
179601-23-1	m,p-Xylene	0.9	< 0.9	U
95-47-6	o-Xylene	0.9	< 0.9	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	142%
d8-Toluene	104%
Bromofluorobenzene	97.3%
d4-1,2-Dichlorobenzene	103%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP405-1090**
 SAMPLE

Lab Sample ID: SY90P
LIMS ID: 11-12064
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/07/11 14:01

Sample Amount: 5.91 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 9.1%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	0.8	< 0.8	U
108-88-3	Toluene	0.8	< 0.8	U
100-41-4	Ethylbenzene	0.8	< 0.8	U
179601-23-1	m,p-Xylene	0.8	< 0.8	U
95-47-6	o-Xylene	0.8	< 0.8	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	118%
d8-Toluene	99.6%
Bromofluorobenzene	95.8%
d4-1,2-Dichlorobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP420-0030**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90Q
LIMS ID: 11-12065
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/07/11 14:36

Sample Amount: 4.16 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 8.1%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.2	< 1.2	U
108-88-3	Toluene	1.2	< 1.2	U
100-41-4	Ethylbenzene	1.2	< 1.2	U
179601-23-1	m,p-Xylene	1.2	< 1.2	U
95-47-6	o-Xylene	1.2	< 1.2	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	122%
d8-Toluene	102%
Bromofluorobenzene	97.3%
d4-1,2-Dichlorobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP420-0090**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90R
LIMS ID: 11-12066
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/07/11 16:09

Sample Amount: 86.5 mg-dry-wt
Purge Volume: 5.0 mL
Moisture: 14.6%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	58	< 58	U
108-88-3	Toluene	58	< 58	U
100-41-4	**Ethylbenzene**	**58**	**94**	
179601-23-1	**m,p-Xylene**	**58**	**190**	
95-47-6	o-Xylene	58	< 58	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	106%
d8-Toluene	98.0%
Bromofluorobenzene	107%
d4-1,2-Dichlorobenzene	97.5%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP420-0090**
Page 1 of 1 **MATRIX SPIKE**

Lab Sample ID: SY90R
LIMS ID: 11-12066
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/07/11 20:21

Sample Amount: 86.5 mg-dry-wt
Purge Volume: 5.0 mL
Moisture: 14.6%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	58	---	
108-88-3	Toluene	58	---	
100-41-4	Ethylbenzene	58	---	
179601-23-1	m,p-Xylene	58	---	
95-47-6	o-Xylene	58	---	

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	126%
d8-Toluene	105%
Bromofluorobenzene	111%
d4-1,2-Dichlorobenzene	101%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP420-0090**
 MATRIX SPIKE DUP

Lab Sample ID: SY90R
LIMS ID: 11-12066
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/07/11 20:49

Sample Amount: 86.5 mg-dry-wt
Purge Volume: 5.0 mL
Moisture: 14.6%

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	58	---	
108-88-3	Toluene	58	---	
100-41-4	Ethylbenzene	58	---	
179601-23-1	m,p-Xylene	58	---	
95-47-6	o-Xylene	58	---	

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	123%
d8-Toluene	104%
Bromofluorobenzene	110%
d4-1,2-Dichlorobenzene	101%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: Trip Blank**
Page 1 of 1 **SAMPLE**

Lab Sample ID: SY90S
LIMS ID: 11-12067
Matrix: Water
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/07/11 15:34

Sample Amount: 5.00 mL
Purge Volume: 5.0 mL

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.0	< 1.0	U
108-88-3	Toluene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
179601-23-1	m,p-Xylene	2.0	< 2.0	U
95-47-6	o-Xylene	1.0	< 1.0	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	107%
d8-Toluene	104%
Bromofluorobenzene	102%
d4-1,2-Dichlorobenzene	98.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: MB-060611**
Page 1 of 1 **METHOD BLANK**

Lab Sample ID: MB-060611
LIMS ID: 11-12049
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/06/11 15:21

Sample Amount: 5.00 g-dry-wt
Purge Volume: 5.0 mL
Moisture: NA

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.0	< 1.0	U
108-88-3	Toluene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
179601-23-1	m,p-Xylene	1.0	< 1.0	U
95-47-6	o-Xylene	1.0	< 1.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	111%
d8-Toluene	101%
Bromofluorobenzene	97.5%
d4-1,2-Dichlorobenzene	100%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: MB-060711**
Page 1 of 1 **METHOD BLANK**

Lab Sample ID: MB-060711
LIMS ID: 11-12064
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/07/11 13:12

Sample Amount: 5.00 g-dry-wt
Purge Volume: 5.0 mL
Moisture: NA

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.0	< 1.0	U
108-88-3	Toluene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
179601-23-1	m,p-Xylene	1.0	< 1.0	U
95-47-6	o-Xylene	1.0	< 1.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	105%
d8-Toluene	101%
Bromofluorobenzene	97.5%
d4-1,2-Dichlorobenzene	99.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: MB-060711**
 METHOD BLANK

Lab Sample ID: MB-060711
LIMS ID: 11-12066
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Instrument/Analyst: FINN5/PAB
Date Analyzed: 06/07/11 13:12

Sample Amount: 100 mg-dry-wt
Purge Volume: 5.0 mL
Moisture: NA

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	50	< 50	U
108-88-3	Toluene	50	< 50	U
100-41-4	Ethylbenzene	50	< 50	U
179601-23-1	m,p-Xylene	50	< 50	U
95-47-6	o-Xylene	50	< 50	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	105%
d8-Toluene	101%
Bromofluorobenzene	97.5%
d4-1,2-Dichlorobenzene	99.4%

ANALYTICAL RESOURCES INCORPORATED

VOA SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888

ARI ID	Client ID	Level	DCE	TOL	BFB	DCB	TOT OUT
MB-060611	Method Blank	Low	111%	101%	97.5%	100%	0
LCS-060611	Lab Control	Low	106%	103%	101%	101%	0
LCSD-060611	Lab Control Dup	Low	105%	102%	100%	99.9%	0
SY90A	RI-SB-PP216-0030	Low	118%	97.0%	88.1%	97.4%	0
SY90B	RI-SB-PP216-0100	Low	118%	101%	95.3%	99.1%	0
SY90C	RI-SB-PP218-0030	Low	113%	101%	76.5%	108%	0
SY90D	RI-SB-PP218-0080	Low	120%	101%	96.2%	100%	0
SY90E	RI-SB-PP210-0030	Low	125%	102%	98.9%	103%	0
SY90F	RI-SB-PP210-0100	Low	134%	105%	95.3%	102%	0
SY90G	RI-SB-PP219-0030	Low	126%	102%	96.6%	102%	0
SY90H	RI-SB-PP219-0100	Low	134%	103%	91.7%	99.3%	0
SY90I	RI-SB-PP226-0030	Low	134%	103%	96.9%	102%	0
SY90J	RI-SB-PP226-0090	Low	135%	106%	97.8%	103%	0
SY90K	RI-SB-PP226-1090	Low	135%	104%	96.0%	102%	0
SY90L	RI-SB-PP227-0030	Low	137%	104%	99.3%	104%	0
SY90M	RI-SB-PP227-0090	Low	137%	103%	100%	104%	0
SY90N	RI-SB22-PP405-0030	Low	134%	102%	98.1%	104%	0
SY90O	RI-SB22-PP405-0090	Low	142%	104%	97.3%	103%	0
MB-060711	Method Blank	Low	105%	101%	97.5%	99.4%	0
LCS-060711	Lab Control	Low	104%	101%	99.8%	100%	0
LCSD-060711	Lab Control Dup	Low	108%	101%	99.1%	101%	0
SY90P	RI-SB22-PP405-1090	Low	118%	99.6%	95.8%	102%	0
SY90Q	RI-SB22-PP420-0030	Low	122%	102%	97.3%	102%	0
MB-060711	Method Blank	Med	105%	101%	97.5%	99.4%	0
LCS-060711	Lab Control	Med	104%	101%	99.8%	100%	0
LCSD-060711	Lab Control Dup	Med	108%	101%	99.1%	101%	0
SY90R	RI-SB22-PP420-0090	Med	106%	98.0%	107%	97.5%	0
SY90RMS	RI-SB22-PP420-0090	Med	126%*	105%	111%	101%	1
SY90RMSD	RI-SB22-PP420-0090	Med	123%*	104%	110%	101%	1

SW8260C	LCS/MB LIMITS Low	LCS/MB LIMITS Med	QC LIMITS Low	QC LIMITS Med
(DCE) = d4-1,2-Dichloroethane	79-121	76-120	75-152	69-120
(TOL) = d8-Toluene	80-120	80-120	82-115	80-120
(BFB) = Bromofluorobenzene	80-120	80-120	64-120	76-128
(DCB) = d4-1,2-Dichlorobenzene	80-120	80-120	80-120	80-120

Log Number Range: 11-12049 to 11-12066

ANALYTICAL RESOURCES INCORPORATED

VOA SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888

ARI ID	Client ID	PV	DCE	TOL	BFB	DCB	TOT OUT
SY90S	Trip Blank	5	107%	104%	102%	98.8%	0

SW8260C	LCS/MB LIMITS	QC LIMITS
(DCE) = d4-1,2-Dichloroethane	80-122	80-125
(TOL) = d8-Toluene	80-120	80-120
(BFB) = Bromofluorobenzene	80-120	80-120
(DCB) = d4-1,2-Dichlorobenzene	80-120	80-120

Prep Method: SW5030B
Log Number Range: 11-12067 to 11-12067

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: LCS-060611**
 LAB CONTROL SAMPLE

Lab Sample ID: LCS-060611
LIMS ID: 11-12049
Matrix: Soil
Data Release Authorized: MW
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: FINN5/PAB
LCSD: FINN5/PAB
Date Analyzed LCS: 06/06/11 14:19
LCSD: 06/06/11 14:54

Sample Amount LCS: 5.00 g-dry-wt
LCSD: 5.00 g-dry-wt
Purge Volume LCS: 5.0 mL
LCSD: 5.0 mL
Moisture: NA

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzene	49.3	50.0	98.6%	52.1	50.0	104%	5.5%
Toluene	50.2	50.0	100%	53.6	50.0	107%	6.6%
Ethylbenzene	51.3	50.0	103%	55.2	50.0	110%	7.3%
m,p-Xylene	98.8	100	98.8%	106	100	106%	7.0%
o-Xylene	49.4	50.0	98.8%	52.8	50.0	106%	6.7%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

Volatile Surrogate Recovery

	LCS	LCSD
d4-1,2-Dichloroethane	106%	105%
d8-Toluene	103%	102%
Bromofluorobenzene	101%	100%
d4-1,2-Dichlorobenzene	101%	99.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: LCS-060711**
Page 1 of 1 **LAB CONTROL SAMPLE**

Lab Sample ID: LCS-060711
LIMS ID: 11-12064
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: FINN5/PAB
LCSD: FINN5/PAB
Date Analyzed LCS: 06/07/11 12:10
LCSD: 06/07/11 12:44

Sample Amount LCS: 5.00 g-dry-wt
LCSD: 5.00 g-dry-wt
Purge Volume LCS: 5.0 mL
LCSD: 5.0 mL
Moisture: NA

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzene	50.4	50.0	101%	51.4	50.0	103%	2.0%
Toluene	51.4	50.0	103%	52.1	50.0	104%	1.4%
Ethylbenzene	53.1	50.0	106%	52.8	50.0	106%	0.6%
m,p-Xylene	102	100	102%	105	100	105%	2.9%
o-Xylene	50.3	50.0	101%	50.8	50.0	102%	1.0%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

Volatile Surrogate Recovery

	LCS	LCSD
d4-1,2-Dichloroethane	104%	108%
d8-Toluene	101%	101%
Bromofluorobenzene	99.8%	99.1%
d4-1,2-Dichlorobenzene	100%	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: LCS-060711**
 LAB CONTROL SAMPLE

Lab Sample ID: LCS-060711
LIMS ID: 11-12066
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: FINN5/PAB
LCSD: FINN5/PAB
Date Analyzed LCS: 06/07/11 12:10
LCSD: 06/07/11 12:44

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt
Purge Volume LCS: 5.0 mL
LCSD: 5.0 mL
Moisture: NA

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzene	2520	2500	101%	2570	2500	103%	2.0%
Toluene	2570	2500	103%	2610	2500	104%	1.5%
Ethylbenzene	2650	2500	106%	2640	2500	106%	0.4%
m,p-Xylene	5100	5000	102%	5240	5000	105%	2.7%
o-Xylene	2510	2500	100%	2540	2500	102%	1.2%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

Volatile Surrogate Recovery

	LCS	LCSD
d4-1,2-Dichloroethane	104%	108%
d8-Toluene	101%	101%
Bromofluorobenzene	99.8%	99.1%
d4-1,2-Dichlorobenzene	100%	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RI-SB22-PP420-0090**
 MATRIX SPIKE

Lab Sample ID: SY90R
LIMS ID: 11-12066
Matrix: Soil
Data Release Authorized:
Reported: 06/08/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Instrument/Analyst MS: FINN5/PAB
MSD: FINN5/PAB
Date Analyzed MS: 06/07/11 20:21
MSD: 06/07/11 20:49

Sample Amount MS: 86.5 mg-dry-wt
MSD: 86.5 mg-dry-wt
Purge Volume MS: 5.0 mL
MSD: 5.0 mL
Moisture: 14.6%

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Benzene	< 57.8 U	2990	2890	103%	3030	2890	105%	1.3%
Toluene	< 57.8 U	3010	2890	104%	3020	2890	104%	0.3%
Ethylbenzene	93.7	3070	2890	103%	3140	2890	105%	2.3%
m,p-Xylene	194	5790	5780	96.8%	5880	5780	98.4%	1.5%
o-Xylene	< 57.8 U	2770	2890	95.8%	2840	2890	98.3%	2.5%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP216-0030
SAMPLE

Lab Sample ID: SY90A
LIMS ID: 11-12049
Matrix: Soil
Data Release Authorized:
Reported: 06/20/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/20/11 13:03
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 7.93 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 14.9%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	63	< 63 UJ

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	65.2%

TO 7/27/11

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP216-0100
SAMPLE

Lab Sample ID: SY90B
LIMS ID: 11-12050
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 02:54
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 7.88 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 14.9%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	64	67 J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	69.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP218-0030
SAMPLE

Lab Sample ID: SY90C
LIMS ID: 11-12051
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 03:26
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 7.96 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 21.2%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	63	< 63 UJ

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	77.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP218-0080
SAMPLE

Lab Sample ID: SY90D
LIMS ID: 11-12052
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 03:59
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 8.07 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 20.3%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	62	< 62 UJ

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	66.0%

SY90D: DMM 10-1-11

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP210-0030
SAMPLE

Lab Sample ID: SY90E
LIMS ID: 11-12053
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 04:31
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 7.81 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 15.9%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	64	< 64 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	78.4%

SY90E - 8888 TP 6/9/11

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP210-0100
SAMPLE

Lab Sample ID: SY90F
LIMS ID: 11-12054
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 05:04
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 8.19 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 11.8%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	61	< 61 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	69.6%

FORM I

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP219-0030
SAMPLE

Lab Sample ID: SY90G
LIMS ID: 11-12055
Matrix: Soil
Data Release Authorized:
Reported: 06/20/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/20/11 15:14
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 8.34 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 9.8%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	60	< 60 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	69.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB-PP219-0100
SAMPLE

Lab Sample ID: SY90H
LIMS ID: 11-12056
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 12:06
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 8.20 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 9.3%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	61	< 61 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	76.0%

TD 6/27/11
SY90 : 8888R

ANALYTICAL RESOURCES INCORPORATED

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Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB-PP226-0030
SAMPLE

Lab Sample ID: SY90I
LIMS ID: 11-12057
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 12:39
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 8.18 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 11.6%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	61	< 61 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	63.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP226-0090
SAMPLE

Lab Sample ID: SY90J
LIMS ID: 11-12058
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 13:12
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 7.79 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 41.0%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	64	99 J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	52.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: RI-SB-PP227-0030
SAMPLE

Lab Sample ID: SY90L
LIMS ID: 11-12060
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 13:44
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 7.91 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 6.1%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	63	< 63 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	66.4%

SY90:00049 TD 1/24/11

ANALYTICAL RESOURCES INCORPORATED

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Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB-PP227-0030
MATRIX SPIKE

Lab Sample ID: SY90L
LIMS ID: 11-12060
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 14:17
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 8.08 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 6.1%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	62	---

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	74.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP227-0030
MATRIX SPIKE DUPLICATE

Lab Sample ID: SY90L
LIMS ID: 11-12060
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 14:50
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 7.97 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 6.1%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	63	---

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	77.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP227-0090
SAMPLE

Lab Sample ID: SY90M
LIMS ID: 11-12061
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 15:22
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 8.35 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 7.8%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	60	< 60 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	67.6%

TO 7/23/11

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB22-PP405-0030
SAMPLE

Lab Sample ID: SY90N
LIMS ID: 11-12062
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 15:56
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 8.51 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 9.0%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	59	< 59 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	66.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB22-PP405-0090
SAMPLE

Lab Sample ID: SY90O
LIMS ID: 11-12063
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 17:34
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 8.90 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 9.1%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	56	< 56 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	63.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB22-PP420-0030
SAMPLE

Lab Sample ID: SY90Q
LIMS ID: 11-12065
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 18:06
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 8.45 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 8.1%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	59	< 59 U J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	60.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
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Sample ID: RI-SB22-PP420-0090
SAMPLE

Lab Sample ID: SY90R
LIMS ID: 11-12066
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 18:39
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 7.88 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 14.6%

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	64	3,100 J

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	72.0%

SY90 : PP420

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: MB-060711
METHOD BLANK

Lab Sample ID: MB-060711
LIMS ID: 11-12060
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Date Extracted: 06/07/11
Date Analyzed: 06/15/11 00:43
Instrument/Analyst: NT6/JZ
GPC Cleanup: No

Sample Amount: 7.50 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	67	< 67 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	59.6%

ANALYTICAL RESOURCES INCORPORATED

SW8270 SEMIVOLATILES SOIL/SEDIMENT SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888

Client ID	NBZ	TOT OUT
RI-SB-PP216-0030	65.2%	0
RI-SB-PP216-0100	69.2%	0
RI-SB-PP218-0030	77.6%	0
RI-SB-PP218-0080	66.0%	0
RI-SB-PP210-0030	78.4%	0
RI-SB-PP210-0100	69.6%	0
RI-SB-PP219-0030	69.2%	0
RI-SB-PP219-0100	76.0%	0
RI-SB-PP226-0030	63.6%	0
RI-SB-PP226-0090	52.0%	0
MB-060711	59.6%	0
LCS-060711	71.2%	0
LCSD-060711	64.0%	0
RI-SB-PP227-0030	66.4%	0
RI-SB-PP227-0030 MS	74.4%	0
RI-SB-PP227-0030 MSD	77.2%	0
RI-SB-PP227-0090	67.6%	0
RI-SB22-PP405-0030	66.8%	0
RI-SB22-PP405-0090	63.6%	0
RI-SB22-PP420-0030	60.4%	0
RI-SB22-PP420-0090	72.0%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(46-102)	(32-106)

Prep Method: SW3546
Log Number Range: 11-12049 to 11-12066

FORM-II SW8270

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: RI-SB-PP227-0030
MS/MSD

Lab Sample ID: SY90L
LIMS ID: 11-12060
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted MS/MSD: 06/07/11

Date Analyzed MS: 06/15/11 14:17
MSD: 06/15/11 14:50
Instrument/Analyst MS: NT6/JZ
MSD: NT6/JZ
GPC Cleanup: No

Sample Amount MS: 8.08 g-dry-wt
MSD: 7.97 g-dry-wt
Final Extract Volume MS: 0.5 mL
MSD: 0.5 mL
Dilution Factor MS: 1.00
MSD: 1.00
Percent Moisture: 6.1 %

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
2-Methylnaphthalene	< 63.2 U	914	1550	59.0%	947	1570	60.3%	3.5%

Reported in µg/kg (ppb)
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: LCS-060711
LCS/LCSD

Lab Sample ID: LCS-060711
LIMS ID: 11-12060
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted LCS/LCSD: 06/07/11

Date Analyzed LCS: 06/15/11 01:15
LCSD: 06/15/11 01:48
Instrument/Analyst LCS: NT6/JZ
LCSD: NT6/JZ
GPC Cleanup: No

Sample Amount LCS: 7.50 g
LCSD: 7.50 g
Final Extract Volume LCS: 0.5 mL
LCSD: 0.5 mL
Dilution Factor LCS: 1.00
LCSD: 1.00
Percent Moisture: NA

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
2-Methylnaphthalene	873	1670	52.3%	848	1670	50.8%	2.9%

Semivolatile Surrogate Recovery

	LCS	LCSD
d5-Nitrobenzene	71.2%	64.0%

Reported in µg/kg (ppb)
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB-PP216-0030
SAMPLE

Lab Sample ID: SY90A
LIMS ID: 11-12049
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 14.9%

Sample Amount: 8.56 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/13/11 19:10
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 05:41
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result	
C8-C10 Aliphatics	2,300	< 2,300	U
C10-C12 Aliphatics	2,300	< 2,300	U
C12-C16 Aliphatics	**2,300**	**4,000**	
C16-C21 Aliphatics	**2,300**	**25,000**	
C21-C34 Aliphatics	**2,300**	**110,000**	**B**
C8-C10 Aromatics	2,300	< 2,300	U
C10-C12 Aromatics	2,300	< 2,300	U
C12-C16 Aromatics	2,300	< 2,300	U
C16-C21 Aromatics	**2,300**	**12,000**	
C21-C34 Aromatics	**2,300**	**70,000**	

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	71.7%
Aromatic	o-Terphenyl	80.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB-PP216-0100
SAMPLE

Lab Sample ID: SY90B
LIMS ID: 11-12050
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 14.9%

Sample Amount: 8.54 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/13/11 19:34
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 06:06
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,300	< 2,300 U
C10-C12 Aliphatics	2,300	< 2,300 U
C12-C16 Aliphatics	**2,300**	**2,900**
C16-C21 Aliphatics	2,300	< 2,300 U
C21-C34 Aliphatics	2,300	< 2,300 U
C8-C10 Aromatics	2,300	< 2,300 U
C10-C12 Aromatics	2,300	< 2,300 U
C12-C16 Aromatics	2,300	< 2,300 U
C16-C21 Aromatics	2,300	< 2,300 U
C21-C34 Aromatics	2,300	< 2,300 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	83.1%
Aromatic	o-Terphenyl	79.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB-PP218-0030
SAMPLE

Lab Sample ID: SY90C
LIMS ID: 11-12051
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 21.2%

Sample Amount: 7.92 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/13/11 19:59
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 06:31
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,500	< 2,500 U
C10-C12 Aliphatics	2,500	< 2,500 U
C12-C16 Aliphatics	2,500	< 2,500 U
C16-C21 Aliphatics	2,500	< 2,500 U
C21-C34 Aliphatics	**2,500**	**4,700 B**
C8-C10 Aromatics	2,500	< 2,500 U
C10-C12 Aromatics	2,500	< 2,500 U
C12-C16 Aromatics	2,500	< 2,500 U
C16-C21 Aromatics	2,500	< 2,500 U
C21-C34 Aromatics	2,500	< 2,500 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	75.7%
Aromatic	o-Terphenyl	78.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB-PP218-0080
SAMPLE

Lab Sample ID: SY90D
LIMS ID: 11-12052
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 20.3%

Sample Amount: 7.97 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/13/11 20:25
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 06:57
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,500	< 2,500 U
C10-C12 Aliphatics	2,500	< 2,500 U
C12-C16 Aliphatics	2,500	< 2,500 U
C16-C21 Aliphatics	2,500	< 2,500 U
C21-C34 Aliphatics	2,500	< 2,500 U
C8-C10 Aromatics	2,500	< 2,500 U
C10-C12 Aromatics	2,500	< 2,500 U
C12-C16 Aromatics	2,500	< 2,500 U
C16-C21 Aromatics	2,500	< 2,500 U
C21-C34 Aromatics	2,500	< 2,500 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	81.7%
Aromatic	o-Terphenyl	81.5%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH

Sample ID: RI-SB-PP210-0030
SAMPLE

Lab Sample ID: SY90E
LIMS ID: 11-12053
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 15.9%

Sample Amount: 8.44 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/13/11 20:50
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 07:22
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,400	< 2,400 U
C10-C12 Aliphatics	2,400	< 2,400 U
C12-C16 Aliphatics	2,400	< 2,400 U
C16-C21 Aliphatics	2,400	< 2,400 U
C21-C34 Aliphatics	2,400	< 2,400 U
C8-C10 Aromatics	2,400	< 2,400 U
C10-C12 Aromatics	2,400	< 2,400 U
C12-C16 Aromatics	2,400	< 2,400 U
C16-C21 Aromatics	2,400	< 2,400 U
C21-C34 Aromatics	2,400	< 2,400 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	80.4%
Aromatic	o-Terphenyl	88.1%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
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Sample ID: RI-SB-PP210-0100
SAMPLE

Lab Sample ID: SY90F
LIMS ID: 11-12054
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 11.8%

Sample Amount: 8.82 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/13/11 21:15
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 07:47
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,300	< 2,300 U
C10-C12 Aliphatics	2,300	< 2,300 U
C12-C16 Aliphatics	2,300	< 2,300 U
C16-C21 Aliphatics	2,300	< 2,300 U
C21-C34 Aliphatics	**2,300**	**5,600 B**
C8-C10 Aromatics	2,300	< 2,300 U
C10-C12 Aromatics	2,300	< 2,300 U
C12-C16 Aromatics	2,300	< 2,300 U
C16-C21 Aromatics	2,300	< 2,300 U
C21-C34 Aromatics	2,300	< 2,300 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	83.1%
Aromatic	o-Terphenyl	84.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB-PP219-0030
SAMPLE

Lab Sample ID: SY90G
LIMS ID: 11-12055
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 9.8%

Sample Amount: 9.07 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/13/11 21:40
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 08:13
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	< 2,200 U
C10-C12 Aliphatics	2,200	< 2,200 U
C12-C16 Aliphatics	2,200	< 2,200 U
C16-C21 Aliphatics	2,200	< 2,200 U
C21-C34 Aliphatics	**2,200**	**3,900 B**
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	< 2,200 U
C12-C16 Aromatics	2,200	< 2,200 U
C16-C21 Aromatics	2,200	< 2,200 U
C21-C34 Aromatics	2,200	< 2,200 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	82.9%
Aromatic	o-Terphenyl	83.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB-PP219-0100
SAMPLE

Lab Sample ID: SY90H
LIMS ID: 11-12056
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 9.3%

Sample Amount: 9.15 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/13/11 22:05
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 08:38
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result	
C8-C10 Aliphatics	2,200	< 2,200	U
C10-C12 Aliphatics	2,200	< 2,200	U
C12-C16 Aliphatics	2,200	< 2,200	U
C16-C21 Aliphatics	**2,200**	**2,400**	
C21-C34 Aliphatics	**2,200**	**5,200**	**B**
C8-C10 Aromatics	2,200	< 2,200	U
C10-C12 Aromatics	2,200	< 2,200	U
C12-C16 Aromatics	2,200	< 2,200	U
C16-C21 Aromatics	2,200	< 2,200	U
C21-C34 Aromatics	**2,200**	**2,500**	

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	81.6%
Aromatic	o-Terphenyl	90.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH

Sample ID: RI-SB-PP226-0030
SAMPLE

Lab Sample ID: SY90I
LIMS ID: 11-12057
Matrix: Soil
Data Release Authorized:
Reported: 06/22/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 11.6%

Sample Amount: 8.88 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/14/11 00:11
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 10:43
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	< 2,200 U
C10-C12 Aliphatics	2,200	< 2,200 U
C12-C16 Aliphatics	2,200	< 2,200 U
C16-C21 Aliphatics	2,200	< 2,200 U
C21-C34 Aliphatics	**2,200**	**7,400 B**
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	< 2,200 U
C12-C16 Aromatics	2,200	< 2,200 U
C16-C21 Aromatics	2,200	< 2,200 U
C21-C34 Aromatics	2,200	< 2,200 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	81.5%
Aromatic	o-Terphenyl	82.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB-PP226-0090
SAMPLE

Lab Sample ID: SY90J
LIMS ID: 11-12058
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 41.0%

Sample Amount: 5.90 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/14/11 00:37
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 11:09
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	3,400	< 3,400 U
C10-C12 Aliphatics	3,400	< 3,400 U
C12-C16 Aliphatics	3,400	< 3,400 U
C16-C21 Aliphatics	3,400	< 3,400 U
C21-C34 Aliphatics	**3,400**	**4,200 B**
C8-C10 Aromatics	3,400	< 3,400 U
C10-C12 Aromatics	3,400	< 3,400 U
C12-C16 Aromatics	3,400	< 3,400 U
C16-C21 Aromatics	3,400	< 3,400 U
C21-C34 Aromatics	3,400	< 3,400 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	79.1%
Aromatic	o-Terphenyl	79.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB-PP227-0030
SAMPLE

Lab Sample ID: SY90L
LIMS ID: 11-12060
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 6.1%

Sample Amount: 9.42 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/14/11 01:02
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 11:34
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,100	< 2,100 U
C10-C12 Aliphatics	2,100	< 2,100 U
C12-C16 Aliphatics	2,100	< 2,100 U
C16-C21 Aliphatics	2,100	< 2,100 U
C21-C34 Aliphatics	2,100	< 2,100 U
C8-C10 Aromatics	2,100	< 2,100 U
C10-C12 Aromatics	2,100	< 2,100 U
C12-C16 Aromatics	2,100	< 2,100 U
C16-C21 Aromatics	2,100	< 2,100 U
C21-C34 Aromatics	2,100	< 2,100 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	79.0%
Aromatic	o-Terphenyl	83.5%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH

Sample ID: RI-SB-PP227-0090
SAMPLE

Lab Sample ID: SY90M
LIMS ID: 11-12061
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 7.8%

Sample Amount: 9.30 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/14/11 01:28
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 11:59
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	< 2,200 U
C10-C12 Aliphatics	2,200	< 2,200 U
C12-C16 Aliphatics	2,200	< 2,200 U
C16-C21 Aliphatics	2,200	< 2,200 U
C21-C34 Aliphatics	2,200	< 2,200 U
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	< 2,200 U
C12-C16 Aromatics	2,200	< 2,200 U
C16-C21 Aromatics	2,200	< 2,200 U
C21-C34 Aromatics	2,200	< 2,200 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	78.7%
Aromatic	o-Terphenyl	78.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB22-PP405-0030
SAMPLE

Lab Sample ID: SY90N
LIMS ID: 11-12062
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 9.0%

Sample Amount: 9.18 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/14/11 01:53
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 12:24
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	< 2,200 U
C10-C12 Aliphatics	2,200	< 2,200 U
C12-C16 Aliphatics	2,200	< 2,200 U
C16-C21 Aliphatics	2,200	< 2,200 U
C21-C34 Aliphatics	2,200	< 2,200 U
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	< 2,200 U
C12-C16 Aromatics	2,200	< 2,200 U
C16-C21 Aromatics	2,200	< 2,200 U
C21-C34 Aromatics	2,200	< 2,200 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	81.9%
Aromatic	o-Terphenyl	78.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB22-PP405-0030
MATRIX SPIKE

Lab Sample ID: SY90N
LIMS ID: 11-12062
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 9.0%

Sample Amount: 9.10 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/14/11 02:18
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 12:49
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	---
C10-C12 Aliphatics	2,200	---
C12-C16 Aliphatics	2,200	---
C16-C21 Aliphatics	2,200	---
C21-C34 Aliphatics	**2,200**	**13,000 B**
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	---
C12-C16 Aromatics	2,200	---
C16-C21 Aromatics	2,200	---
C21-C34 Aromatics	2,200	---

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	79.2%
Aromatic	o-Terphenyl	76.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB22-PP405-0030
MATRIX SPIKE DUP

Lab Sample ID: SY90N
LIMS ID: 11-12062
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 9.0%

Sample Amount: 9.18 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/14/11 02:44
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 13:14
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	---
C10-C12 Aliphatics	2,200	---
C12-C16 Aliphatics	2,200	---
C16-C21 Aliphatics	2,200	---
C21-C34 Aliphatics	**2,200**	**12,000 B**
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	---
C12-C16 Aromatics	2,200	---
C16-C21 Aromatics	2,200	---
C21-C34 Aromatics	2,200	---

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	83.9%
Aromatic	o-Terphenyl	82.1%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB22-PP405-0090
SAMPLE

Lab Sample ID: SY900
LIMS ID: 11-12063
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 9.1%

Sample Amount: 9.14 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/14/11 03:09
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 13:39
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	< 2,200 U
C10-C12 Aliphatics	2,200	< 2,200 U
C12-C16 Aliphatics	2,200	< 2,200 U
C16-C21 Aliphatics	2,200	< 2,200 U
C21-C34 Aliphatics	2,200	< 2,200 U
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	< 2,200 U
C12-C16 Aromatics	2,200	< 2,200 U
C16-C21 Aromatics	2,200	< 2,200 U
C21-C34 Aromatics	2,200	< 2,200 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	77.6%
Aromatic	o-Terphenyl	76.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB22-PP420-0030
SAMPLE

Lab Sample ID: SY90Q
LIMS ID: 11-12065
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 8.1%

Sample Amount: 9.23 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/14/11 03:35
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 14:04
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,200	< 2,200 U
C10-C12 Aliphatics	2,200	< 2,200 U
C12-C16 Aliphatics	2,200	< 2,200 U
C16-C21 Aliphatics	2,200	< 2,200 U
C21-C34 Aliphatics	2,200	< 2,200 U
C8-C10 Aromatics	2,200	< 2,200 U
C10-C12 Aromatics	2,200	< 2,200 U
C12-C16 Aromatics	2,200	< 2,200 U
C16-C21 Aromatics	2,200	< 2,200 U
C21-C34 Aromatics	2,200	< 2,200 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	81.3%
Aromatic	o-Terphenyl	90.7%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH

Sample ID: RI-SB22-PP420-0090
SAMPLE

Lab Sample ID: SY90R
LIMS ID: 11-12066
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted: 06/07/11
Percent Moisture: 14.6%

Sample Amount: 8.55 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/14/11 04:00
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 14:29
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	**2,300**	**44,000**
C10-C12 Aliphatics	**2,300**	**340,000**
C12-C16 Aliphatics	**2,300**	**440,000**
C16-C21 Aliphatics	**2,300**	**42,000**
C21-C34 Aliphatics	**2,300**	**21,000 B**
C8-C10 Aromatics	2,300	< 2,300 U
C10-C12 Aromatics	**2,300**	**19,000**
C12-C16 Aromatics	**2,300**	**81,000**
C16-C21 Aromatics	**2,300**	**31,000**
C21-C34 Aromatics	**2,300**	**3,700**

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	80.6%
Aromatic	o-Terphenyl	81.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH

Sample ID: MB-060711
METHOD BLANK

Lab Sample ID: MB-060711
LIMS ID: 11-12062
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: NA
Date Received: NA

Date Extracted: 06/07/11
Percent Moisture: NA

Sample Amount: 10.0 g-as-rec
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 06/13/11 23:21
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Aromatic
Date Analyzed: 06/14/11 09:54
Instrument/Analyst: FID8/MS

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	2,000	< 2,000 U
C10-C12 Aliphatics	2,000	< 2,000 U
C12-C16 Aliphatics	2,000	< 2,000 U
C16-C21 Aliphatics	2,000	< 2,000 U
C21-C34 Aliphatics	**2,000**	**2,300**
C8-C10 Aromatics	2,000	< 2,000 U
C10-C12 Aromatics	2,000	< 2,000 U
C12-C16 Aromatics	2,000	< 2,000 U
C16-C21 Aromatics	2,000	< 2,000 U
C21-C34 Aromatics	2,000	< 2,000 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	81.6%
Aromatic	o-Terphenyl	73.5%

ANALYTICAL RESOURCES INCORPORATED

ALEPH SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888

Client ID	COD	TOT OUT
RI-SB-PP216-0030	71.7%	0
RI-SB-PP216-0100	83.1%	0
RI-SB-PP218-0030	75.7%	0
RI-SB-PP218-0080	81.7%	0
RI-SB-PP210-0030	80.4%	0
RI-SB-PP210-0100	83.1%	0
RI-SB-PP219-0030	82.9%	0
RI-SB-PP219-0100	81.6%	0
RI-SB-PP226-0030	81.5%	0
RI-SB-PP226-0090	79.1%	0
RI-SB-PP227-0030	79.0%	0
RI-SB-PP227-0090	78.7%	0
MB-060711	81.6%	0
LCS-060711	81.6%	0
LCSD-060711	81.9%	0
RI-SB22-PP405-0030	81.9%	0
RI-SB22-PP405-0030 MS	79.2%	0
RI-SB22-PP405-0030 MSD	83.9%	0
RI-SB22-PP405-0090	77.6%	0
RI-SB22-PP420-0030	81.3%	0
RI-SB22-PP420-0090	80.6%	0

	LCS/MB LIMITS	QC LIMITS
(COD) = 1-Chlorooctadecane	(27-128)	(39-131)

Prep Method: SW3550C
Log Number Range: 11-12049 to 11-12066

ANALYTICAL RESOURCES INCORPORATED

AREPH SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888

Client ID	OTER	TOT OUT
RI-SB-PP216-0030	80.6%	0
RI-SB-PP216-0100	79.9%	0
RI-SB-PP218-0030	78.3%	0
RI-SB-PP218-0080	81.5%	0
RI-SB-PP210-0030	88.1%	0
RI-SB-PP210-0100	84.4%	0
RI-SB-PP219-0030	83.4%	0
RI-SB-PP219-0100	90.6%	0
RI-SB-PP226-0030	82.0%	0
RI-SB-PP226-0090	79.4%	0
RI-SB-PP227-0030	83.5%	0
RI-SB-PP227-0090	78.0%	0
MB-060711	73.5%	0
LCS-060711	82.1%	0
LCSD-060711	78.8%	0
RI-SB22-PP405-0030	78.9%	0
RI-SB22-PP405-0030 MS	76.6%	0
RI-SB22-PP405-0030 MSD	82.1%	0
RI-SB22-PP405-0090	76.6%	0
RI-SB22-PP420-0030	90.7%	0
RI-SB22-PP420-0090	81.2%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(34-133)	(10-143)

Prep Method: SW3550C
Log Number Range: 11-12049 to 11-12066

FORM-II AREPH

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: LCS-060711
LCS/LCSD

Lab Sample ID: LCS-060711
LIMS ID: 11-12062
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 06/07/11

Sample Amount LCS: 10.0 g-as-rec
LCSD: 10.0 g-as-rec
Final Extract Volume LCS: 1.0 mL
LCSD: 1.0 mL

Aliphatic
Date Analyzed LCS: 06/13/11 22:30
LCSD: 06/13/11 22:56
Instrument/Analyst LCS: FID8/MS
LCSD: FID8/MS

Dilution Factor LCS: 1.00
LCSD: 1.00

Aromatic
Date Analyzed LCS: 06/14/11 09:03
LCSD: 06/14/11 09:28
Instrument/Analyst LCS: FID8/MS
LCSD: FID8/MS

Dilution Factor LCS: 1.00
LCSD: 1.00

Range	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
C8-C10 Aliphatics	12000	15000	80.0%	11900	15000	79.3%	0.8%
C10-C12 Aliphatics	11000	15000	73.3%	11700	15000	78.0%	6.2%
C12-C16 Aliphatics	13000	15000	86.7%	13600	15000	90.7%	4.5%
C16-C21 Aliphatics	13000	15000	86.7%	13100	15000	87.3%	0.8%
C10-C12 Aromatics	8400	15000	56.0%	7900	15000	52.7%	6.1%
C12-C16 Aromatics	11200	15000	74.7%	10900	15000	72.7%	2.7%
C16-C21 Aromatics	26800	30000	89.3%	26200	30000	87.3%	2.3%
C21-C34 Aromatics	25200	30000	84.0%	25600	30000	85.3%	1.6%

EPH Surrogate Recovery

		LCS	LCSD
Aliphatic	1-Chlorooctadecane	81.6%	81.9%
Aromatic	o-Terphenyl	82.1%	78.8%

Results reported in µg/kg
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: RI-SB22-PP405-0030
MS/MSD

Lab Sample ID: SY90N
LIMS ID: 11-12062
Matrix: Soil
Data Release Authorized:
Reported: 06/16/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted MS/MSD: 06/07/11

Sample Amount MS: 9.10 g-dry-wt
MSD: 9.18 g-dry-wt
Final Extract Volume MS: 1.0 mL
MSD: 1.0 mL

Aliphatic
Date Analyzed MS: 06/14/11 02:18
MSD: 06/14/11 02:44
Instrument/Analyst MS: FID8/MS
MSD: FID8/MS

Dilution Factor MS: 1.00
MSD: 1.00

Aromatic
Date Analyzed MS: 06/14/11 12:49
MSD: 06/14/11 13:14
Instrument/Analyst MS: FID8/MS
MSD: FID8/MS

Dilution Factor MS: 1.00
MSD: 1.00

Range	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
C8-C10 Aliphatics	< 2180	12400	16500	75.2%	6750	16300	41.3%	59.0%
C10-C12 Aliphatics	< 2180	12700	16500	77.0%	13000	16300	79.6%	2.3%
C12-C16 Aliphatics	< 2180	14900	16500	90.4%	15500	16300	94.9%	3.9%
C16-C21 Aliphatics	< 2180	14200	16500	86.1%	14900	16300	91.2%	4.8%
C10-C12 Aromatics	< 2180	9340	16500	56.7%	9370	16300	57.3%	0.3%
C12-C16 Aromatics	< 2180	12300	16500	74.6%	12700	16300	77.7%	3.2%
C16-C21 Aromatics	< 2180	28000	33000	84.9%	30000	32700	91.8%	6.9%
C21-C34 Aromatics	< 2180	27800	33000	84.3%	28500	32700	87.2%	2.5%

Results reported in µg/kg
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID
Page 1 of 2
Matrix: Soil

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Received: 05/27/11

Data Release Authorized:
Reported: 06/10/11

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range	RL	Result
SY90A	RI-SB-PP216-0030	06/02/11	06/08/11	1.00	**Diesel**	**5.8**	**90**
11-12049	HC ID: **DRO**		FID4A	1.0	**Jet-A**	**5.8**	**16**
					o-Terphenyl		106%
SY90B	RI-SB-PP216-0100	06/02/11	06/08/11	1.00	**Diesel**	**5.8**	**28**
11-12050	HC ID: **JETA**		FID4A	1.0	**Jet-A**	**5.8**	**22**
					o-Terphenyl		112%
SY90C	RI-SB-PP218-0030	06/02/11	06/08/11	1.00	**Diesel**	**6.2**	**59**
11-12051	HC ID: **DRO**		FID4A	1.0	**Jet-A**	**6.2**	**14**
					o-Terphenyl		98.8%
SY90D	RI-SB-PP218-0080	06/02/11	06/08/11	1.00	**Diesel**	**6.2**	**20**
11-12052	HC ID: **DRO**		FID4A	1.0	Jet-A	6.2	< 6.2 U
					o-Terphenyl		106%
SY90E	RI-SB-PP210-0030	06/02/11	06/08/11	1.00	**Diesel**	**5.9**	**21**
11-12053	HC ID: **DRO**		FID4A	1.0	**Jet-A**	**5.9**	**6.2**
					o-Terphenyl		111%
SY90F	RI-SB-PP210-0100	06/02/11	06/08/11	1.00	**Diesel**	**5.5**	**23**
11-12054	HC ID: **DRO**		FID4A	1.0	Jet-A	5.5	< 5.5 U
					o-Terphenyl		109%
SY90G	RI-SB-PP219-0030	06/02/11	06/09/11	1.00	**Diesel**	**5.4**	**14**
11-12055	HC ID: **DRO**		FID4A	1.0	Jet-A	5.4	< 5.4 U
					o-Terphenyl		112%
SY90H	RI-SB-PP219-0100	06/02/11	06/09/11	1.00	**Diesel**	**5.3**	**24**
11-12056	HC ID: **DRO**		FID4A	1.0	**Jet-A**	**5.3**	**5.6**
					o-Terphenyl		105%
SY90I	RI-SB-PP226-0030	06/02/11	06/09/11	1.00	Diesel	5.6	< 5.6 U
11-12057	HC ID: ---		FID4A	1.0	Jet-A	5.6	< 5.6 U
					o-Terphenyl		113%
SY90J	RI-SB-PP226-0090	06/02/11	06/09/11	1.00	**Diesel**	**8.4**	**110**
11-12058	HC ID: **DIESEL**		FID4A	1.0	**Jet-A**	**8.4**	**56**
					o-Terphenyl		93.8%
SY90L	RI-SB-PP227-0030	06/02/11	06/09/11	1.00	Diesel	5.2	< 5.2 U
11-12060	HC ID: ---		FID4A	1.0	Jet-A	5.2	< 5.2 U
					o-Terphenyl		115%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID
Page 2 of 2
Matrix: Soil

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Received: 05/27/11

Data Release Authorized:
Reported: 06/10/11

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range	RL	Result
MB-060211	Method Blank	06/02/11	06/09/11	1.00	Diesel	5.0	< 5.0 U
11-12061	HC ID: ---		FID4A	1.0	Jet-A	5.0	< 5.0 U
					o-Terphenyl		114%
SY90M	RI-SB-PP227-0090	06/02/11	06/09/11	1.00	Diesel	5.4	< 5.4 U
11-12061	HC ID: ---		FID4A	1.0	Jet-A	5.4	< 5.4 U
					o-Terphenyl		113%
SY90N	RI-SB22-PP405-0030	06/02/11	06/09/11	1.00	Diesel	5.3	< 5.3 U
11-12062	HC ID: ---		FID4A	1.0	Jet-A	5.3	< 5.3 U
					o-Terphenyl		114%
SY90O	RI-SB22-PP405-0090	06/02/11	06/09/11	1.00	Diesel	5.5	< 5.5 U
11-12063	HC ID: ---		FID4A	1.0	Jet-A	5.5	< 5.5 U
					o-Terphenyl		116%
SY90Q	RI-SB22-PP420-0030	06/02/11	06/09/11	1.00	Diesel	5.4	< 5.4 U
11-12065	HC ID: ---		FID4A	1.0	Jet-A	5.4	< 5.4 U
					o-Terphenyl		117%
SY90R	RI-SB22-PP420-0090	06/02/11	06/10/11	1.00	**Diesel**	**120**	**1,100**
11-12066	HC ID: **JETA**		FID4A	20	**Jet-A**	**120**	**1,300**
					o-Terphenyl		90.7%

Reported in mg/kg (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel quantitation on total peaks in the range from C12 to C24.
Jet-A quantitation on total peaks in the range from C10 to C38.
HC ID: DRO/RRO indicates results of organics or additional hydrocarbons in ranges are not identifiable.

ANALYTICAL RESOURCES INCORPORATED

TPHD SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888

Client ID	OTER	TOT OUT
RI-SB-PP216-0030	106%	0
RI-SB-PP216-0100	112%	0
RI-SB-PP218-0030	98.8%	0
RI-SB-PP218-0080	106%	0
RI-SB-PP210-0030	111%	0
RI-SB-PP210-0100	109%	0
RI-SB-PP219-0030	112%	0
RI-SB-PP219-0100	105%	0
RI-SB-PP226-0030	113%	0
RI-SB-PP226-0090	93.8%	0
RI-SB-PP227-0030	115%	0
060211MBS	114%	0
060211LCS	114%	0
060211LCSD	108%	0
RI-SB-PP227-0090	113%	0
RI-SB-PP227-0090 MS	109%	0
RI-SB-PP227-0090 MSD	103%	0
RI-SB22-PP405-0030	114%	0
RI-SB22-PP405-0090	116%	0
RI-SB22-PP420-0030	117%	0
RI-SB22-PP420-0090	90.7%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(64-134)	(52-130)

Prep Method: SW3546
Log Number Range: 11-12049 to 11-12066

FORM-II TPHD

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID
Page 1 of 1

Sample ID: LCS-060211
LCS/LCSD

Lab Sample ID: LCS-060211
LIMS ID: 11-12061
Matrix: Soil
Data Release Authorized:
Reported: 06/10/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 06/02/11

Sample Amount LCS: 10.0 g-dry-wt
LCSD: 10.0 g-dry-wt

Date Analyzed LCS: 06/09/11 00:59
LCSD: 06/09/11 01:23

Final Extract Volume LCS: 1.0 mL
LCSD: 1.0 mL

Instrument/Analyst LCS: FID4A/MS
LCSD: FID4A/MS

Dilution Factor LCS: 1.00
LCSD: 1.00

Range	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Diesel	148	150	98.7%	146	150	97.3%	1.4%

TPHD Surrogate Recovery

	LCS	LCSD
o-Terphenyl	114%	108%

Results reported in mg/kg
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID
Page 1 of 1

Sample ID: RI-SB-PP227-0090
MS/MSD

Lab Sample ID: SY90M
LIMS ID: 11-12061
Matrix: Soil
Data Release Authorized:
Reported: 06/10/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Extracted MS/MSD: 06/02/11

Date Analyzed MS: 06/09/11 04:54
MSD: 06/09/11 05:17
Instrument/Analyst MS: FID4A/MS
MSD: FID4A/MS

Sample Amount MS: 9.31 g-dry-wt
MSD: 9.33 g-dry-wt
Final Extract Volume MS: 1.0 mL
MSD: 1.0 mL
Dilution Factor MS: 1.00
MSD: 1.00
Percent Moisture: 7.8%

Range	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Diesel	< 5.4 U	150	161	93.2%	154	161	95.7%	2.6%

TPHD Surrogate Recovery

	MS	MSD
o-Terphenyl	109 %	103 %

Results reported in mg/kg
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

Matrix: Soil
Date Received: 05/27/11

ARI Job: SY90
Project: Former Fuel Farm Investigation 8888

ARI ID	Client ID	Client Amt	Final Vol	Basis	Prep Date
11-12049-SY90A	RI-SB-PP216-0030	8.56 g	1.00 mL	D	06/02/11
11-12050-SY90B	RI-SB-PP216-0100	8.61 g	1.00 mL	D	06/02/11
11-12051-SY90C	RI-SB-PP218-0030	8.10 g	1.00 mL	D	06/02/11
11-12052-SY90D	RI-SB-PP218-0080	8.03 g	1.00 mL	D	06/02/11
11-12053-SY90E	RI-SB-PP210-0030	8.48 g	1.00 mL	D	06/02/11
11-12054-SY90F	RI-SB-PP210-0100	9.16 g	1.00 mL	D	06/02/11
11-12055-SY90G	RI-SB-PP219-0030	9.26 g	1.00 mL	D	06/02/11
11-12056-SY90H	RI-SB-PP219-0100	9.38 g	1.00 mL	D	06/02/11
11-12057-SY90I	RI-SB-PP226-0030	8.91 g	1.00 mL	D	06/02/11
11-12058-SY90J	RI-SB-PP226-0090	5.95 g	1.00 mL	D	06/02/11
11-12060-SY90L	RI-SB-PP227-0030	9.69 g	1.00 mL	D	06/02/11
11-12061-060211MB1	Method Blank	10.0 g	1.00 mL	-	06/02/11
11-12061-060211LCS1	Lab Control	10.0 g	1.00 mL	-	06/02/11
11-12061-060211LCSD1	Lab Control Dup	10.0 g	1.00 mL	-	06/02/11
11-12061-SY90M	RI-SB-PP227-0090	9.32 g	1.00 mL	D	06/02/11
11-12061-SY90MMS	RI-SB-PP227-0090	9.31 g	1.00 mL	D	06/02/11
11-12061-SY90MMSD	RI-SB-PP227-0090	9.33 g	1.00 mL	D	06/02/11
11-12062-SY90N	RI-SB22-PP405-0030	9.36 g	1.00 mL	D	06/02/11
11-12063-SY90O	RI-SB22-PP405-0090	9.15 g	1.00 mL	D	06/02/11
11-12065-SY90Q	RI-SB22-PP420-0030	9.30 g	1.00 mL	D	06/02/11
11-12066-SY90R	RI-SB22-PP420-0090	8.64 g	1.00 mL	D	06/02/11

Basis: D=Dry Weight W=As Received

Diesel Extraction Report

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH
Page 1 of 1

Sample ID: RI-SB-PP216-0030
SAMPLE

Lab Sample ID: SY90A
LIMS ID: 11-12049
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 09:29
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 46.8 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2100	< 2,100 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	n-Decane	1100	< 1,100 U
112-40-3	n-Dodecane	1100	< 1,100 U

Range	RL	Result
C8-C10 Aromatics	11,000	< 11,000 U
C10-C12 Aromatics	11,000	< 11,000 U
C12-C13 Aromatics	11,000	< 11,000 U
C5-C6 Aliphatics	11,000	< 11,000 U
C6-C8 Aliphatics	11,000	< 11,000 U
C8-C10 Aliphatics	11,000	< 11,000 U
C10-C12 Aliphatics	11,000	< 11,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	107%
FID: 2,5-Dibromotoluene	97.0%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP216-0100
SAMPLE

Lab Sample ID: SY90B
LIMS ID: 11-12050
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 09:59
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 42.6 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1200	< 1,200 U
108-88-3	Toluene	1200	< 1,200 U
100-41-4	Ethylbenzene	1200	< 1,200 U
179601-23-1	m,p-Xylene	2300	< 2,300 U
95-47-6	o-Xylene	1200	< 1,200 U
1634-04-4	Methyl tert-Butyl Ether	1200	< 1,200 U
109-66-0	n-Pentane	1200	< 1,200 U
110-54-3	n-Hexane	1200	< 1,200 U
111-65-9	n-Octane	1200	< 1,200 U
124-18-5	n-Decane	1200	< 1,200 U
112-40-3	n-Dodecane	1200	< 1,200 U

Range	RL	Result
C8-C10 Aromatics	12,000	< 12,000 U
C10-C12 Aromatics	12,000	< 12,000 U
C12-C13 Aromatics	12,000	< 12,000 U
C5-C6 Aliphatics	12,000	< 12,000 U
C6-C8 Aliphatics	12,000	< 12,000 U
C8-C10 Aliphatics	12,000	< 12,000 U
C10-C12 Aliphatics	12,000	< 12,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	104%
FID: 2,5-Dibromotoluene	96.6%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP218-0030
SAMPLE

Lab Sample ID: SY90C
LIMS ID: 11-12051
Matrix: Soil
Data Release Authorized:
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 10:28
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 29.0 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1700	< 1,700 U
108-88-3	Toluene	1700	< 1,700 U
100-41-4	Ethylbenzene	1700	< 1,700 U
179601-23-1	m,p-Xylene	3400	< 3,400 U
95-47-6	o-Xylene	1700	< 1,700 U
1634-04-4	Methyl tert-Butyl Ether	1700	< 1,700 U
109-66-0	n-Pentane	1700	< 1,700 U
110-54-3	n-Hexane	1700	< 1,700 U
111-65-9	n-Octane	1700	< 1,700 U
124-18-5	n-Decane	1700	< 1,700 U
112-40-3	n-Dodecane	1700	< 1,700 U

Range	RL	Result
C8-C10 Aromatics	17,000	< 17,000 U
C10-C12 Aromatics	17,000	< 17,000 U
C12-C13 Aromatics	17,000	< 17,000 U
C5-C6 Aliphatics	17,000	< 17,000 U
C6-C8 Aliphatics	17,000	< 17,000 U
C8-C10 Aliphatics	17,000	< 17,000 U
C10-C12 Aliphatics	17,000	< 17,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	105%
FID: 2,5-Dibromotoluene	96.4%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP218-0080
SAMPLE

Lab Sample ID: SY90D
LIMS ID: 11-12052
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 10:57
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 41.6 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1200	< 1,200 U
108-88-3	Toluene	1200	< 1,200 U
100-41-4	Ethylbenzene	1200	< 1,200 U
179601-23-1	m,p-Xylene	2400	< 2,400 U
95-47-6	o-Xylene	1200	< 1,200 U
1634-04-4	Methyl tert-Butyl Ether	1200	< 1,200 U
109-66-0	n-Pentane	1200	< 1,200 U
110-54-3	n-Hexane	1200	< 1,200 U
111-65-9	n-Octane	1200	< 1,200 U
124-18-5	n-Decane	1200	< 1,200 U
112-40-3	n-Dodecane	1200	< 1,200 U

Range	RL	Result
C8-C10 Aromatics	12,000	< 12,000 U
C10-C12 Aromatics	12,000	< 12,000 U
C12-C13 Aromatics	12,000	< 12,000 U
C5-C6 Aliphatics	12,000	< 12,000 U
C6-C8 Aliphatics	12,000	< 12,000 U
C8-C10 Aliphatics	12,000	< 12,000 U
C10-C12 Aliphatics	12,000	< 12,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	104%
FID: 2,5-Dibromotoluene	90.2%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP210-0030
SAMPLE

Lab Sample ID: SY90E
LIMS ID: 11-12053
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 11:27
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 43.7 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2300	< 2,300 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	n-Decane	1100	< 1,100 U
112-40-3	n-Dodecane	1100	< 1,100 U

Range	RL	Result
C8-C10 Aromatics	11,000	< 11,000 U
C10-C12 Aromatics	11,000	< 11,000 U
C12-C13 Aromatics	11,000	< 11,000 U
C5-C6 Aliphatics	11,000	< 11,000 U
C6-C8 Aliphatics	11,000	< 11,000 U
C8-C10 Aliphatics	11,000	< 11,000 U
C10-C12 Aliphatics	11,000	< 11,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	98.2%
FID: 2,5-Dibromotoluene	91.2%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP210-0100
SAMPLE

Lab Sample ID: SY90F
LIMS ID: 11-12054
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 12:55
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 54.9 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	910	< 910 U
108-88-3	Toluene	910	< 910 U
100-41-4	Ethylbenzene	910	< 910 U
179601-23-1	m,p-Xylene	1800	< 1,800 U
95-47-6	o-Xylene	910	< 910 U
1634-04-4	Methyl tert-Butyl Ether	910	< 910 U
109-66-0	n-Pentane	910	< 910 U
110-54-3	n-Hexane	910	< 910 U
111-65-9	n-Octane	910	< 910 U
124-18-5	n-Decane	910	< 910 U
112-40-3	n-Dodecane	910	< 910 U

Range	RL	Result
C8-C10 Aromatics	9,100	< 9,100 U
C10-C12 Aromatics	9,100	< 9,100 U
C12-C13 Aromatics	9,100	< 9,100 U
C5-C6 Aliphatics	9,100	< 9,100 U
C6-C8 Aliphatics	9,100	< 9,100 U
C8-C10 Aliphatics	9,100	< 9,100 U
C10-C12 Aliphatics	9,100	< 9,100 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	93.4%
FID: 2,5-Dibromotoluene	88.4%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP219-0030
SAMPLE

Lab Sample ID: SY90G
LIMS ID: 11-12055
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 13:25
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 45.9 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2200	< 2,200 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	n-Decane	1100	< 1,100 U
112-40-3	n-Dodecane	1100	< 1,100 U

Range	RL	Result
C8-C10 Aromatics	11,000	< 11,000 U
C10-C12 Aromatics	11,000	< 11,000 U
C12-C13 Aromatics	11,000	< 11,000 U
C5-C6 Aliphatics	11,000	< 11,000 U
C6-C8 Aliphatics	11,000	< 11,000 U
C8-C10 Aliphatics	11,000	< 11,000 U
C10-C12 Aliphatics	11,000	< 11,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	101%
FID: 2,5-Dibromotoluene	92.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP219-0100
SAMPLE

Lab Sample ID: SY90H
LIMS ID: 11-12056
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 13:54
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 55.7 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	900	< 900 U
108-88-3	Toluene	900	< 900 U
100-41-4	Ethylbenzene	900	< 900 U
179601-23-1	m,p-Xylene	1800	< 1,800 U
95-47-6	o-Xylene	900	< 900 U
1634-04-4	Methyl tert-Butyl Ether	900	< 900 U
109-66-0	n-Pentane	900	< 900 U
110-54-3	n-Hexane	900	< 900 U
111-65-9	n-Octane	900	< 900 U
124-18-5	n-Decane	900	< 900 U
112-40-3	n-Dodecane	900	< 900 U

Range	RL	Result
C8-C10 Aromatics	9,000	< 9,000 U
C10-C12 Aromatics	9,000	< 9,000 U
C12-C13 Aromatics	9,000	< 9,000 U
C5-C6 Aliphatics	9,000	< 9,000 U
C6-C8 Aliphatics	9,000	< 9,000 U
C8-C10 Aliphatics	9,000	< 9,000 U
C10-C12 Aliphatics	9,000	< 9,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	101%
FID: 2,5-Dibromotoluene	93.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP226-0030
SAMPLE

Lab Sample ID: SY90I
LIMS ID: 11-12057
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 14:24
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 53.0 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	940	< 940 U
108-88-3	Toluene	940	< 940 U
100-41-4	Ethylbenzene	940	< 940 U
179601-23-1	m,p-Xylene	1900	< 1,900 U
95-47-6	o-Xylene	940	< 940 U
1634-04-4	Methyl tert-Butyl Ether	940	< 940 U
109-66-0	n-Pentane	940	< 940 U
110-54-3	n-Hexane	940	< 940 U
111-65-9	n-Octane	940	< 940 U
124-18-5	n-Decane	940	< 940 U
112-40-3	n-Dodecane	940	< 940 U

Range	RL	Result
C8-C10 Aromatics	9,400	< 9,400 U
C10-C12 Aromatics	9,400	< 9,400 U
C12-C13 Aromatics	9,400	< 9,400 U
C5-C6 Aliphatics	9,400	< 9,400 U
C6-C8 Aliphatics	9,400	< 9,400 U
C8-C10 Aliphatics	9,400	< 9,400 U
C10-C12 Aliphatics	9,400	< 9,400 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	86.0%
FID: 2,5-Dibromotoluene	80.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP226-0090
SAMPLE

Lab Sample ID: SY90J
LIMS ID: 11-12058
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 14:53
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 21.7 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	2300	< 2,300 U
108-88-3	Toluene	2300	< 2,300 U
100-41-4	Ethylbenzene	2300	< 2,300 U
179601-23-1	m,p-Xylene	4600	< 4,600 U
95-47-6	o-Xylene	2300	< 2,300 U
1634-04-4	Methyl tert-Butyl Ether	2300	< 2,300 U
109-66-0	n-Pentane	2300	< 2,300 U
110-54-3	n-Hexane	2300	< 2,300 U
111-65-9	n-Octane	2300	< 2,300 U
124-18-5	n-Decane	2300	< 2,300 U
112-40-3	n-Dodecane	2300	< 2,300 U

Range	RL	Result
C8-C10 Aromatics	23,000	< 23,000 U
C10-C12 Aromatics	23,000	< 23,000 U
C12-C13 Aromatics	23,000	< 23,000 U
C5-C6 Aliphatics	23,000	< 23,000 U
C6-C8 Aliphatics	23,000	< 23,000 U
C8-C10 Aliphatics	23,000	< 23,000 U
C10-C12 Aliphatics	23,000	< 23,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	93.2%
FID: 2,5-Dibromotoluene	91.4%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP226-1090
SAMPLE

Lab Sample ID: SY90K
LIMS ID: 11-12059
Matrix: Soil
Data Release Authorized:
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 15:23
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 24.6 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	2000	< 2,000 U
108-88-3	Toluene	2000	< 2,000 U
100-41-4	Ethylbenzene	2000	< 2,000 U
179601-23-1	m,p-Xylene	4100	< 4,100 U
95-47-6	o-Xylene	2000	< 2,000 U
1634-04-4	Methyl tert-Butyl Ether	2000	< 2,000 U
109-66-0	n-Pentane	2000	< 2,000 U
110-54-3	n-Hexane	2000	< 2,000 U
111-65-9	n-Octane	2000	< 2,000 U
124-18-5	n-Decane	2000	< 2,000 U
112-40-3	n-Dodecane	2000	< 2,000 U

Range	RL	Result
C8-C10 Aromatics	20,000	< 20,000 U
C10-C12 Aromatics	20,000	< 20,000 U
C12-C13 Aromatics	20,000	< 20,000 U
C5-C6 Aliphatics	20,000	< 20,000 U
C6-C8 Aliphatics	20,000	< 20,000 U
C8-C10 Aliphatics	20,000	< 20,000 U
C10-C12 Aliphatics	20,000	< 20,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	105%
FID: 2,5-Dibromotoluene	91.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB-PP227-0030
SAMPLE

Lab Sample ID: SY90L
LIMS ID: 11-12060
Matrix: Soil
Data Release Authorized:
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 15:52
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 55.8 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	900	< 900 U
108-88-3	Toluene	900	< 900 U
100-41-4	Ethylbenzene	900	< 900 U
179601-23-1	m,p-Xylene	1800	< 1,800 U
95-47-6	o-Xylene	900	< 900 U
1634-04-4	Methyl tert-Butyl Ether	900	< 900 U
109-66-0	n-Pentane	900	< 900 U
110-54-3	n-Hexane	900	< 900 U
111-65-9	n-Octane	900	< 900 U
124-18-5	n-Decane	900	< 900 U
112-40-3	n-Dodecane	900	< 900 U

Range	RL	Result
C8-C10 Aromatics	9,000	< 9,000 U
C10-C12 Aromatics	9,000	< 9,000 U
C12-C13 Aromatics	9,000	< 9,000 U
C5-C6 Aliphatics	9,000	< 9,000 U
C6-C8 Aliphatics	9,000	< 9,000 U
C8-C10 Aliphatics	9,000	< 9,000 U
C10-C12 Aliphatics	9,000	< 9,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	103%
FID: 2,5-Dibromotoluene	92.6%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH
Page 1 of 1

Sample ID: RI-SB-PP227-0090
SAMPLE

Lab Sample ID: SY90M
LIMS ID: 11-12061
Matrix: Soil
Data Release Authorized:
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 16:22
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 46.0 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2200	< 2,200 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	n-Decane	1100	< 1,100 U
112-40-3	n-Dodecane	1100	< 1,100 U

Range	RL	Result
C8-C10 Aromatics	11,000	< 11,000 U
C10-C12 Aromatics	11,000	< 11,000 U
C12-C13 Aromatics	11,000	< 11,000 U
C5-C6 Aliphatics	11,000	< 11,000 U
C6-C8 Aliphatics	11,000	< 11,000 U
C8-C10 Aliphatics	11,000	< 11,000 U
C10-C12 Aliphatics	11,000	< 11,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	96.0%
FID: 2,5-Dibromotoluene	91.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH
Page 1 of 1

Sample ID: RI-SB22-PP405-0030
SAMPLE

Lab Sample ID: SY90N
LIMS ID: 11-12062
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 16:51
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 56.6 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	880	< 880 U
108-88-3	Toluene	880	< 880 U
100-41-4	Ethylbenzene	880	< 880 U
179601-23-1	m,p-Xylene	1800	< 1,800 U
95-47-6	o-Xylene	880	< 880 U
1634-04-4	Methyl tert-Butyl Ether	880	< 880 U
109-66-0	n-Pentane	880	< 880 U
110-54-3	n-Hexane	880	< 880 U
111-65-9	n-Octane	880	< 880 U
124-18-5	n-Decane	880	< 880 U
112-40-3	n-Dodecane	880	< 880 U

Range	RL	Result
C8-C10 Aromatics	8,800	< 8,800 U
C10-C12 Aromatics	8,800	< 8,800 U
C12-C13 Aromatics	8,800	< 8,800 U
C5-C6 Aliphatics	8,800	< 8,800 U
C6-C8 Aliphatics	8,800	< 8,800 U
C8-C10 Aliphatics	8,800	< 8,800 U
C10-C12 Aliphatics	8,800	< 8,800 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	102%
FID: 2,5-Dibromotoluene	91.8%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB22-PP405-0090
SAMPLE

Lab Sample ID: SY90O
LIMS ID: 11-12063
Matrix: Soil
Data Release Authorized: YMW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 17:21
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 60.4 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	830	< 830 U
108-88-3	Toluene	830	< 830 U
100-41-4	Ethylbenzene	830	< 830 U
179601-23-1	m,p-Xylene	1700	< 1,700 U
95-47-6	o-Xylene	830	< 830 U
1634-04-4	Methyl tert-Butyl Ether	830	< 830 U
109-66-0	n-Pentane	830	< 830 U
110-54-3	n-Hexane	830	< 830 U
111-65-9	n-Octane	830	< 830 U
124-18-5	n-Decane	830	< 830 U
112-40-3	n-Dodecane	830	< 830 U

Range	RL	Result
C8-C10 Aromatics	8,300	< 8,300 U
C10-C12 Aromatics	8,300	< 8,300 U
C12-C13 Aromatics	8,300	< 8,300 U
C5-C6 Aliphatics	8,300	< 8,300 U
C6-C8 Aliphatics	8,300	< 8,300 U
C8-C10 Aliphatics	8,300	< 8,300 U
C10-C12 Aliphatics	8,300	< 8,300 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	100%
FID: 2,5-Dibromotoluene	89.2%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB22-PP405-1090
SAMPLE

Lab Sample ID: SY90P
LIMS ID: 11-12064
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 18:49
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 45.3 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2200	< 2,200 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	n-Decane	1100	< 1,100 U
112-40-3	n-Dodecane	1100	< 1,100 U

Range	RL	Result
C8-C10 Aromatics	11,000	< 11,000 U
C10-C12 Aromatics	11,000	< 11,000 U
C12-C13 Aromatics	11,000	< 11,000 U
C5-C6 Aliphatics	11,000	< 11,000 U
C6-C8 Aliphatics	11,000	< 11,000 U
C8-C10 Aliphatics	11,000	< 11,000 U
C10-C12 Aliphatics	11,000	< 11,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	95.8%
FID: 2,5-Dibromotoluene	89.2%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB22-PP420-0030
SAMPLE

Lab Sample ID: SY90Q
LIMS ID: 11-12065
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 19:19
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 41.2 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1200	< 1,200 U
108-88-3	Toluene	1200	< 1,200 U
100-41-4	Ethylbenzene	1200	< 1,200 U
179601-23-1	m,p-Xylene	2400	< 2,400 U
95-47-6	o-Xylene	1200	< 1,200 U
1634-04-4	Methyl tert-Butyl Ether	1200	< 1,200 U
109-66-0	n-Pentane	1200	< 1,200 U
110-54-3	n-Hexane	1200	< 1,200 U
111-65-9	n-Octane	1200	< 1,200 U
124-18-5	n-Decane	1200	< 1,200 U
112-40-3	n-Dodecane	1200	< 1,200 U

Range	RL	Result
C8-C10 Aromatics	12,000	< 12,000 U
C10-C12 Aromatics	12,000	< 12,000 U
C12-C13 Aromatics	12,000	< 12,000 U
C5-C6 Aliphatics	12,000	< 12,000 U
C6-C8 Aliphatics	12,000	< 12,000 U
C8-C10 Aliphatics	12,000	< 12,000 U
C10-C12 Aliphatics	12,000	< 12,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	94.0%
FID: 2,5-Dibromotoluene	88.6%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: RI-SB22-PP420-0090
SAMPLE

Lab Sample ID: SY90R
LIMS ID: 11-12066
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 19:48
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 45.1 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1100	< 1,100 U
108-88-3	Toluene	1100	< 1,100 U
100-41-4	Ethylbenzene	1100	< 1,100 U
179601-23-1	m,p-Xylene	2200	< 2,200 U
95-47-6	o-Xylene	1100	< 1,100 U
1634-04-4	Methyl tert-Butyl Ether	1100	< 1,100 U
109-66-0	n-Pentane	1100	< 1,100 U
110-54-3	n-Hexane	1100	< 1,100 U
111-65-9	n-Octane	1100	< 1,100 U
124-18-5	**n-Decane**	**1100**	**1,200**
112-40-3	**n-Dodecane**	**1100**	**16,000**

Range	RL	Result	
C8-C10 Aromatics	**11,000**	**36,000**	
C10-C12 Aromatics	**11,000**	**240,000**	
C12-C13 Aromatics	**11,000**	**150,000**	
C5-C6 Aliphatics	11,000	< 11,000	U
C6-C8 Aliphatics	11,000	< 11,000	U
C8-C10 Aliphatics	11,000	< 11,000	U
C10-C12 Aliphatics	11,000	< 11,000	U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	93.6%
FID: 2,5-Dibromotoluene	95.4%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: Trip Blank SAMPLE

Lab Sample ID: SY90S
LIMS ID: 11-12067
Matrix: Water
Data Release Authorized:
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation 8888
Date Sampled: 05/27/11
Date Received: 05/27/11

Date Analyzed: 06/01/11 09:00
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	5.0	< 5.0 U
108-88-3	Toluene	5.0	< 5.0 U
100-41-4	Ethylbenzene	5.0	< 5.0 U
179601-23-1	m,p-Xylene	10	< 10 U
95-47-6	o-Xylene	5.0	< 5.0 U
1634-04-4	Methyl tert-Butyl Ether	5.0	< 5.0 U
109-66-0	n-Pentane	5.0	< 5.0 U
110-54-3	n-Hexane	5.0	< 5.0 U
111-65-9	n-Octane	5.0	< 5.0 U
124-18-5	n-Decane	5.0	< 5.0 U
112-40-3	n-Dodecane	5.0	< 5.0 U

Range	RL	Result
C8-C10 Aromatics	50	< 50 U
C10-C12 Aromatics	50	< 50 U
C12-C13 Aromatics	50	< 50 U
C5-C6 Aliphatics	50	< 50 U
C6-C8 Aliphatics	50	< 50 U
C8-C10 Aliphatics	50	< 50 U
C10-C12 Aliphatics	50	< 50 U

Values reported in µg/L (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	107%
FID: 2,5-Dibromotoluene	96.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: MB-060111
METHOD BLANK

Lab Sample ID: MB-060111
LIMS ID: 11-12049
Matrix: Soil
Data Release Authorized: MW
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: NA
Date Received: NA

Date Analyzed: 06/01/11 08:17
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 111 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	450	< 450 U
108-88-3	Toluene	450	< 450 U
100-41-4	Ethylbenzene	450	< 450 U
179601-23-1	m,p-Xylene	900	< 900 U
95-47-6	o-Xylene	450	< 450 U
1634-04-4	Methyl tert-Butyl Ether	450	< 450 U
109-66-0	n-Pentane	450	< 450 U
110-54-3	n-Hexane	450	< 450 U
111-65-9	n-Octane	450	< 450 U
124-18-5	n-Decane	450	< 450 U
112-40-3	n-Dodecane	450	< 450 U

Range	RL	Result
C8-C10 Aromatics	4,500	< 4,500 U
C10-C12 Aromatics	4,500	< 4,500 U
C12-C13 Aromatics	4,500	< 4,500 U
C5-C6 Aliphatics	4,500	< 4,500 U
C6-C8 Aliphatics	4,500	< 4,500 U
C8-C10 Aliphatics	4,500	< 4,500 U
C10-C12 Aliphatics	4,500	< 4,500 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	89.8%
FID: 2,5-Dibromotoluene	89.2%

ANALYTICAL RESOURCES INCORPORATED

VPH SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888

Client ID	PDBT	FDBT	TOT OUT
MB-060111	89.8%	89.2%	0
LCS-060111	99.2%	98.8%	0
LCSD-060111	95.8%	95.8%	0
RI-SB-PP216-0030	107%	97.0%	0
RI-SB-PP216-0100	104%	96.6%	0
RI-SB-PP218-0030	105%	96.4%	0
RI-SB-PP218-0080	104%	90.2%	0
RI-SB-PP210-0030	98.2%	91.2%	0
RI-SB-PP210-0100	93.4%	88.4%	0
RI-SB-PP219-0030	101%	92.8%	0
RI-SB-PP219-0100	101%	93.8%	0
RI-SB-PP226-0030	86.0%	80.8%	0
RI-SB-PP226-0090	93.2%	91.4%	0
RI-SB-PP226-1090	105%	91.8%	0
RI-SB-PP227-0030	103%	92.6%	0
RI-SB-PP227-0090	96.0%	91.8%	0
RI-SB22-PP405-0030	102%	91.8%	0
RI-SB22-PP405-0090	100%	89.2%	0
RI-SB22-PP405-1090	95.8%	89.2%	0
RI-SB22-PP420-0030	94.0%	88.6%	0
RI-SB22-PP420-0090	93.6%	95.4%	0

	LCS/MB LIMITS	QC LIMITS
(PDBT) = 2,5-Dibromotoluene	(60-140)	(60-140)
(FDBT) = 2,5-Dibromotoluene	(60-140)	(60-140)

Prep Method: METHOD
Log Number Range: 11-12049 to 11-12066

FORM-II VPH

ANALYTICAL RESOURCES INCORPORATED

VPH SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888

ARI ID	Client ID	PDBT	FDBT	TOT OUT
SY90S	Trip Blank	107%	96.4%	0

	LCS/MB LIMITS	QC LIMITS
(PDBT) = 2,5-Dibromotoluene	(60-140)	(60-140)
(FDBT) = 2,5-Dibromotoluene	(60-140)	(60-140)

Prep Method: METHOD
Log Number Range: 11-12067 to 11-12067

FORM-II VPH

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH
Page 1 of 1

Sample ID: LCS-060111
LCS/LCSD

Lab Sample ID: LCS-060111
LIMS ID: 11-12049
Matrix: Soil
Data Release Authorized:
Reported: 06/02/11

QC Report No: SY90-The Boeing Company
Project: Former Fuel Farm Investigation
8888
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 06/01/11 06:49
Date Analyzed LCSD: 06/01/11 07:18
Instrument/Analyst: PID1/MH

Purge Volume: 10 mL
Sample Amount: 111 mg-dry-wt

Analyte/Range	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzene	4540	4500	101%	4510	4500	100%	0.7%
Toluene	4560	4500	101%	4530	4500	101%	0.7%
Ethylbenzene	4720	4500	105%	4640	4500	103%	1.7%
m,p-Xylene	9360	9010	104%	9270	9010	103%	1.0%
o-Xylene	4590	4500	102%	4530	4500	101%	1.3%
Methyl tert-Butyl Ether	4080	4500	90.7%	3980	4500	88.4%	2.5%
Naphthalene	4870	4500	108%	4540	4500	101%	7.0%
1,2,3-Trimethylbenzene	4850	4500	108%	4750	4500	106%	2.1%
1-Methylnaphthalene	5510	4500	122%	5260	4500	117%	4.6%
n-Pentane	5760	4500	128%	5800	4500	129%	0.7%
n-Hexane	5200	4500	116%	5140	4500	114%	1.2%
n-Octane	4950	4500	110%	4900	4500	109%	1.0%
n-Decane	5100	4500	113%	5300	4500	118%	3.8%
n-Dodecane	5260	4500	117%	5390	4500	120%	2.4%

Values reported in µg/kg (ppb)
RPD calculated using sample concentrations per SW846.

VPH Surrogate Recovery

	LCS	LCSD
PID: 2,5-Dibromotoluene	99.2%	95.8%
FID: 2,5-Dibromotoluene	98.8%	95.8%

Memo

To:	Dave Haddock, Project Manager	Project:	0088880080.0040
From:	Crystal Neirby	cc:	Project File
Tel:	(206) 342-1760		
Fax:	(206) 342-1761		
Date:	July 25, 2011		

Subject: Summary Data Quality Review
Former Fuel Farm – Boeing Renton Groundwater Sampling
ARI SDG: TC68

This memorandum presents the summary data quality review of seven primary groundwater samples and one trip blank collected on June 30, 2011. 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, ethylbenzene, toluene, and xylenes (BTEX) by EPA Method 8021;
- TPH as diesel (TPH-D), motor oil (TPH-O), and Jet-A by Ecology Method NWTPH-Dx (with acid and silica gel clean-up); and
- 2-Methylnaphthalene by EPA Method 8270D.

The samples and the analyses conducted on the samples are listed below.

Sample ID	Date Collected	Laboratory Sample ID	Requested Analyses
GW225-110630	6/30/2011	TC68A	all
GW221-110630	6/30/2011	TC68B	all
GW223-110630	6/30/2011	TC68C	all
GW220-110630	6/30/2011	TC68D	all
GW224-110630	6/30/2011	TC68E	all
GW219-110630	6/30/2011	TC68F	all
GW222-110630	6/30/2011	TC68G	all
Trip Blank	6/30/2011	TC68H	BTEX

Data were reviewed in accordance with the appropriate method procedures and criteria documented in the Quality Assurance Project Plan (QAPP) (Geomatrix, 2007). The control limits provided in the QAPP are advisory limits; therefore, the most current control limits

AMEC Geomatrix, Inc.
600 University Street, Suite 1020
Seattle, Washington
USA 98101-4107
Tel (206) 342-1760
Fax (206) 342-1761
www.amecgeomatrixinc.com

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.

Hold times, method/trip blanks, surrogate recoveries, laboratory control samples (LCS), laboratory 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 guidance documents (EPA, 2008).

Samples were submitted to ARI the day of sampling. The temperatures of the coolers were recorded upon receipt and were 12.6 and 14.6°C greater than the maximum acceptable temperature of 6°C. The samples were submitted to the laboratory approximately one hour after collection; therefore, the cooler temperature did not have adequate time to equilibrate to the lower temperature. Sample results are not affected and are not qualified.

Samples were analyzed for the analyses listed in the introduction to this report. Laboratory data were evaluated for the following parameters.

1. Preservation and Holding Times – Acceptable

2. Blanks – Acceptable

   A trip blank was not submitted for analysis of BTEX. The trip blank was free of contamination.

3. Surrogates – Acceptable

4. LCS/LCSD – Acceptable except as noted:

   SVOCs by EPA 8270D: The LCSD recovery for 2-methylnaphthalene was 44 percent, less than the control limit of 46 to 100 percent. The associated LCS recovery was acceptable, as was the LCS/LCSD relative percent difference. Sample results are not qualified based on acceptable LCS recoveries.

5. MS/MSD – Additional sample volume was not submitted for MS/MSD analyses. Therefore, the project frequency requirement of one MS/MSD for every 20 samples was not achieved with this sampling event.

6. Field Duplicates – Acceptable

   Field duplicates were not collected as part of the FFF groundwater sampling event. Therefore, the project frequency requirement of field duplicate for every 20 samples was not achieved with this sampling event.

7. Reporting Limits and Laboratory Flags – Acceptable

OVERALL ASSESSMENT OF DATA

The completeness of SDG TC68 is 100 percent. Evaluation of the usefulness of these data is based on EPA guidance documents listed in the introduction to this report. Few problems were identified, and analytical performance was generally within specified limits. The data are not qualified and meet the project's data quality objectives.

A summary of the data quality review is presented in the table below.

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
GW225-110630		none		
GW221-110630		none		
GW223-110630		none		
GW220-110630		none		
GW224-110630		none		
GW219-110630		none		
GW222-110630		none		
Trip Blank		none		

REFERENCES

Geomatrix (Geomatrix Consultants, Inc.), 2007, Quality Assurance Project Plan Addendum, Remedial Investigation Work Plan Addendum, Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, January.

EPA, 2008, US EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review: EPA 540-R-08-01, June.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

July 12, 2011

David R. Haddock
Geomatrix Consultants, Inc.
One Union Square
600 University Street, Suite 1020
Seattle, WA 98101

RE: Client Project: Boeing Renton Former Fuel Farm New Wells
ARI Job No: TC68

Dear Mr. Haddock:

Please find enclosed original Chain of Custody (COC) and the analytical results for the project referenced above. Analytical Resources, Inc. accepted seven water samples and a trip blank in good condition on June 30, 2011.

The samples were analyzed for BTEX, SVOCs, and NWTPH-Dx, as requested on the COC.

The SVOCs LCSD is out of control low for 2-Methylnaphthalene. The LCS is in control and no further action was taken.

There were no other anomalies associated with the samples.

Copies of these reports and all associated raw data will be kept on file. 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

cc: Carl Bach, The Boeing Company, P.O. Box 3707, M/S 1W-12, Seattle, WA 98124-2207
Raymond Power, The Boeing Company, PO Box 3707, M/S 63-41, Seattle, WA 98124

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: TC68	Turn-around Requested: NORMAL	Page: 1 of 1	
ARI Client Company: THE BOEING Co	Phone:	Date: JUNE 30 2011	Ice Present?
Client Contact: CARL BACH		No. of Coolers: 2	Cooler Temps: 12.5 14.6
Client Project Name: BENTON	NEW WELLS FORMER FUEL FARM		
Client Project #: 7KRENREM	Samplers: CHARLES HARDY		

Sample ID	JUNE Date 2011	Time	Matrix	No. Containers	Analysis Requested: BETX 8021	NWTPH Jet A Diesel STLO	w/ Silica Gel Acid Wash Cleanup	SVOC 8270 Methylnaphthalenes					Notes/Comments
GW 225 - 110630	6.30.11	710	Aq	6	X	X		X					
GW 221 - 110630	6.30.11	750	Aq	6	X	X		X					
GW 223 - 110630	6.30.11	845	Aq	6	X	X		X					
GW 220 - 110630	6.30.11	925	Aq	6	X	X		X					
GW 224 - 110630	6.30.11	1005	Aq	6	X	X		X					
GW 219 - 110630	6.30.11	1045	Aq	6	X	X		X					
GW 222 - 110630	6.30.11	1125	Aq	6	X	X		X					
/			/										
TRIP BLANKS	6.28.11	—	Aq	2	X								

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
	Printed Name: CHARLES HARDY	Printed Name: Tamsler Streeter	Printed Name:	Printed Name:
	Company: THE BOEING Co	Company: ARI	Company:	Company:
	Date & Time: JUNE 30, 2011 1235	Date & Time: 6-30-11 1235	Date & Time:	Date & Time:

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

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Boeing Project Name: Renton New wells former Fuel Farm

COC No(s): _____ NA Delivered by: Fed-Ex UPS Courier (Hand Delivered) Other: _____

Assigned ARI Job No: TC68 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)..... 12.6 14.6 ____ ____ ____ ____

If cooler temperature is out of compliance fill out form 00070F Temp Gun ID#: 90941619

Cooler Accepted by: TS Date: 6-30-11 Time: 1235

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	6/28/11	

Was Sample Split by ARI : (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

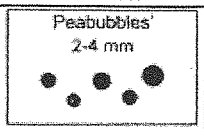
Samples Logged by: JM Date: 6/30/11 Time: 1523

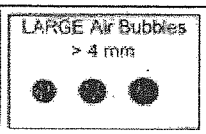
***** Notify Project Manager of discrepancies or concerns *****

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"

TC68 : 00003

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Temperature Compliance Form

TC68

Cooler#: 1 Temperature(°C): 14.6

Sample ID	Bottle Count	Bottle Type
GW224-110630	6	4-500 mL AG, 2-40 mL VOA
GW219-110630	6	" "
GW222-110630	6	" "
Trip Blanks	2	2-40 mL VOA

Cooler#: 2 Temperature(°C): 12.6

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: JM Date: 6/30/11 Time: 1523

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: TC68
Client: The Boeing Company
Project Event: 7KRENREM
Project Name: Renton Former Fuel Farm

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	GW225-110630	TC68A	11-14316	Groundwater	06/30/11 07:10	06/30/11 12:35
2.	GW221-110630	TC68B	11-14317	Groundwater	06/30/11 07:50	06/30/11 12:35
3.	GW223-110630	TC68C	11-14318	Groundwater	06/30/11 08:45	06/30/11 12:35
4.	GW220-110630	TC68D	11-14319	Groundwater	06/30/11 09:25	06/30/11 12:35
5.	GW224-110630	TC68E	11-14320	Groundwater	06/30/11 10:05	06/30/11 12:35
6.	GW219-110630	TC68F	11-14321	Groundwater	06/30/11 10:45	06/30/11 12:35
7.	GW222-110630	TC68G	11-14322	Groundwater	06/30/11 11:25	06/30/11 12:35
8.	Trip Blanks	TC68H	11-14323	Groundwater	06/30/11	06/30/11 12:35

Printed 06/30/11

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: GW225-110630
SAMPLE

Lab Sample ID: TC68A
LIMS ID: 11-14316
Matrix: Groundwater
Data Release Authorized: VD
Reported: 07/12/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Extracted: 07/05/11
Date Analyzed: 07/07/11 17:18
Instrument/Analyst: NT6/JZ

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	1.0	< 1.0 U

Reported in µg/L (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	67.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: GW221-110630
SAMPLE

Lab Sample ID: TC68B
LIMS ID: 11-14317
Matrix: Groundwater
Data Release Authorized: VTJ
Reported: 07/12/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Extracted: 07/05/11
Date Analyzed: 07/07/11 17:51
Instrument/Analyst: NT6/JZ

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	1.0	< 1.0 U

Reported in µg/L (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	58.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: GW223-110630
SAMPLE

Lab Sample ID: TC68C
LIMS ID: 11-14318
Matrix: Groundwater
Data Release Authorized: VM
Reported: 07/12/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Extracted: 07/05/11
Date Analyzed: 07/07/11 18:24
Instrument/Analyst: NT6/JZ

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	1.0	< 1.0 U

Reported in µg/L (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	73.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: GW220-110630
SAMPLE

Lab Sample ID: TC68D
LIMS ID: 11-14319
Matrix: Groundwater
Data Release Authorized: VJ
Reported: 07/12/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Extracted: 07/05/11
Date Analyzed: 07/08/11 13:04
Instrument/Analyst: NT6/JZ

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	1.0	< 1.0 U

Reported in µg/L (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	73.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: GW224-110630
SAMPLE

Lab Sample ID: TC68E
LIMS ID: 11-14320
Matrix: Groundwater
Data Release Authorized: VTB
Reported: 07/12/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Extracted: 07/05/11
Date Analyzed: 07/08/11 13:37
Instrument/Analyst: NT6/JZ

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	1.0	42

Reported in µg/L (ppb)

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	73.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: GW219-110630
SAMPLE

Lab Sample ID: TC68F
LIMS ID: 11-14321
Matrix: Groundwater
Data Release Authorized: VT
Reported: 07/12/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Extracted: 07/05/11
Date Analyzed: 07/08/11 14:10
Instrument/Analyst: NT6/JZ

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	1.0	4.1

Reported in µg/L (ppb)

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	60.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: GW222-110630
SAMPLE

Lab Sample ID: TC68G
LIMS ID: 11-14322
Matrix: Groundwater
Data Release Authorized: VB
Reported: 07/12/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Extracted: 07/05/11
Date Analyzed: 07/08/11 14:43
Instrument/Analyst: NT6/JZ

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	1.0	< 1.0 U

Reported in µg/L (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	69.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: MB-070511
METHOD BLANK

Lab Sample ID: MB-070511
LIMS ID: 11-14316
Matrix: Groundwater
Data Release Authorized: VB
Reported: 07/12/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM
Date Sampled: NA
Date Received: NA

Date Extracted: 07/05/11
Date Analyzed: 07/07/11 15:39
Instrument/Analyst: NT6/JZ

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
91-57-6	2-Methylnaphthalene	1.0	< 1.0 U

Reported in µg/L (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	67.6%

ANALYTICAL RESOURCES INCORPORATED

SW8270 SEMIVOLATILES WATER SURROGATE RECOVERY SUMMARY

Matrix: Groundwater

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM

Client ID	NBZ	TOT OUT
MB-070511	67.6%	0
LCS-070511	72.0%	0
LCSD-070511	60.8%	0
GW225-110630	67.2%	0
GW221-110630	58.4%	0
GW223-110630	73.2%	0
GW220-110630	73.6%	0
GW224-110630	73.2%	0
GW219-110630	60.8%	0
GW222-110630	69.2%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(46-100)	(39-100)

Prep Method: SW3520C
Log Number Range: 11-14316 to 11-14322

FORM-II SW8270

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: LCS-070511
LCS/LCSD

Lab Sample ID: LCS-070511
LIMS ID: 11-14316
Matrix: Groundwater
Data Release Authorized: VRS
Reported: 07/12/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Extracted LCS/LCSD: 07/05/11

Date Analyzed LCS: 07/07/11 16:12
LCSD: 07/07/11 16:45
Instrument/Analyst LCS: NT6/JZ
LCSD: NT6/JZ

Sample Amount LCS: 500 mL
LCSD: 500 mL
Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

GPC Cleanup: NO

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
2-Methylnaphthalene	12.4	25.0	49.6%	11.0	25.0	44.0%	12.0%

Semivolatile Surrogate Recovery

	LCS	LCSD
d5-Nitrobenzene	72.0%	60.8%

Results reported in µg/L
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1
Matrix: Groundwater

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM

Data Release Authorized:
Reported: 07/08/11

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range	RL	Result
MB-070511	Method Blank	07/05/11	07/06/11	1.00	Diesel	0.10	< 0.10 U
11-14316	HC ID: ---		FID9	1.0	Motor Oil	0.20	< 0.20 U
					Jet-A	0.10	< 0.10 U
					o-Terphenyl		76.6%
TC68A	GW225-110630	07/05/11	07/06/11	1.00	Diesel	0.10	< 0.10 U
11-14316	HC ID: ---		FID9	1.0	Motor Oil	0.20	< 0.20 U
					Jet-A	0.10	< 0.10 U
					o-Terphenyl		79.4%
TC68B	GW221-110630	07/05/11	07/06/11	1.00	**Diesel**	**0.10**	**0.68**
11-14317	HC ID: **DIESEL**		FID9	1.0	Motor Oil	0.20	< 0.20 U
					Jet-A	**0.10**	**0.62**
					o-Terphenyl		75.2%
TC68C	GW223-110630	07/05/11	07/06/11	1.00	Diesel	0.10	< 0.10 U
11-14318	HC ID: ---		FID9	1.0	Motor Oil	0.20	< 0.20 U
					Jet-A	0.10	< 0.10 U
					o-Terphenyl		78.3%
TC68D	GW220-110630	07/05/11	07/06/11	1.00	**Diesel**	**0.10**	**0.94**
11-14319	HC ID: **JETA**		FID9	1.0	**Motor Oil**	**0.20**	**0.20**
					Jet-A	**0.10**	**1.6**
					o-Terphenyl		78.5%
TC68E	GW224-110630	07/05/11	07/06/11	1.00	**Diesel**	**0.10**	**0.77**
11-14320	HC ID: **JETA**		FID9	1.0	Motor Oil	0.20	< 0.20 U
					Jet-A	**0.10**	**1.6**
					o-Terphenyl		74.0%
TC68F	GW219-110630	07/05/11	07/06/11	1.00	**Diesel**	**0.10**	**1.2**
11-14321	HC ID: **JETA**		FID9	1.0	**Motor Oil**	**0.20**	**0.46**
					Jet-A	**0.10**	**1.6**
					o-Terphenyl		81.1%
TC68G	GW222-110630	07/05/11	07/06/11	1.00	Diesel	0.10	< 0.10 U
11-14322	HC ID: ---		FID9	1.0	Motor Oil	0.20	< 0.20 U
					Jet-A	0.10	< 0.10 U
					o-Terphenyl		78.5%

Reported in mg/L (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel quantitation on total peaks in the range from C12 to C24.
Motor Oil quantitation on total peaks in the range from C24 to C38.
Jet-A quantitation on total peaks in the range from C10 to C18.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

ANALYTICAL RESOURCES INCORPORATED

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Groundwater

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM

Client ID	OTER	TOT OUT
MB-070511	76.6%	0
LCS-070511	83.6%	0
LCSD-070511	75.9%	0
GW225-110630	79.4%	0
GW221-110630	75.2%	0
GW223-110630	78.3%	0
GW220-110630	78.5%	0
GW224-110630	74.0%	0
GW219-110630	81.1%	0
GW222-110630	78.5%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(50-150)	(50-150)

Prep Method: SW3510C
Log Number Range: 11-14316 to 11-14322

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned **Sample ID: LCS-070511**
Page 1 of 1 **LCS/LCSD**

Lab Sample ID: LCS-070511
LIMS ID: 11-14316
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Extracted LCS/LCSD: 07/05/11
Date Analyzed LCS: 07/06/11 17:55
LCSD: 07/06/11 18:17
Instrument/Analyst LCS: FID/MS
LCSD: FID/MS

Sample Amount LCS: 500 mL
LCSD: 500 mL
Final Extract Volume LCS: 1.0 mL
LCSD: 1.0 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Range	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Diesel	2.04	3.00	68.0%	2.04	3.00	68.0%	0.0%

TPHD Surrogate Recovery

	LCS	LCSD
o-Terphenyl	83.6%	75.9%

Results reported in mg/L
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

Matrix: Groundwater
Date Received: 06/30/11

ARI Job: TC68
Project: Renton Former Fuel Farm
7KRENREM

ARI ID	Client ID	Samp Amt	Final Vol	Prep Date
11-14316-070511MB1	Method Blank	500 mL	1.00 mL	07/05/11
11-14316-070511LCS1	Lab Control	500 mL	1.00 mL	07/05/11
11-14316-070511LCSD1	Lab Control Dup	500 mL	1.00 mL	07/05/11
11-14316-TC68A	GW225-110630	500 mL	1.00 mL	07/05/11
11-14317-TC68B	GW221-110630	500 mL	1.00 mL	07/05/11
11-14318-TC68C	GW223-110630	500 mL	1.00 mL	07/05/11
11-14319-TC68D	GW220-110630	500 mL	1.00 mL	07/05/11
11-14320-TC68E	GW224-110630	500 mL	1.00 mL	07/05/11
11-14321-TC68F	GW219-110630	500 mL	1.00 mL	07/05/11
11-14322-TC68G	GW222-110630	500 mL	1.00 mL	07/05/11

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: GW225-110630
SAMPLE

Lab Sample ID: TC68A
LIMS ID: 11-14316
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Analyzed: 07/05/11 14:04
Instrument/Analyst: PID1/MH

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	0.25	< 0.25 U
108-88-3	Toluene	0.25	< 0.25 U
100-41-4	Ethylbenzene	0.25	< 0.25 U
179601-23-1	m,p-Xylene	0.50	< 0.50 U
95-47-6	o-Xylene	0.25	< 0.25 U

BETX Surrogate Recovery

Trifluorotoluene	92.9%
Bromobenzene	91.8%

BETX values reported in µg/L (ppb)

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod **Sample ID: GW221-110630**
Page 1 of 1 **SAMPLE**

Lab Sample ID: TC68B
LIMS ID: 11-14317
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Analyzed: 07/05/11 14:33
Instrument/Analyst: PID1/MH

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	0.25	< 0.25 U
108-88-3	Toluene	0.25	< 0.25 U
100-41-4	Ethylbenzene	0.25	< 0.25 U
179601-23-1	m,p-Xylene	0.50	< 0.50 U
95-47-6	o-Xylene	0.25	< 0.25 U

BETX Surrogate Recovery

Trifluorotoluene	93.3%
Bromobenzene	93.9%

BETX values reported in µg/L (ppb)

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod **Sample ID: GW223-110630**
Page 1 of 1 **SAMPLE**

Lab Sample ID: TC68C
LIMS ID: 11-14318
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Analyzed: 07/05/11 15:03
Instrument/Analyst: PID1/MH

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	0.25	< 0.25 U
108-88-3	Toluene	0.25	< 0.25 U
100-41-4	Ethylbenzene	0.25	< 0.25 U
179601-23-1	m,p-Xylene	0.50	< 0.50 U
95-47-6	o-Xylene	0.25	< 0.25 U

BETX Surrogate Recovery

Trifluorotoluene	89.9%
Bromobenzene	88.5%

BETX values reported in µg/L (ppb)

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: GW220-110630
SAMPLE

Lab Sample ID: TC68D
LIMS ID: 11-14319
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Analyzed: 07/05/11 15:32
Instrument/Analyst: PID1/MH

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	0.25	< 0.25 U
108-88-3	Toluene	0.25	< 0.25 U
100-41-4	Ethylbenzene	0.25	< 0.25 U
179601-23-1	m,p-Xylene	0.50	< 0.50 U
95-47-6	o-Xylene	0.25	< 0.25 U

BETX Surrogate Recovery

Trifluorotoluene	91.5%
Bromobenzene	90.4%

BETX values reported in µg/L (ppb)

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: GW224-110630
SAMPLE

Lab Sample ID: TC68E
LIMS ID: 11-14320
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Analyzed: 07/05/11 16:01
Instrument/Analyst: PID1/MH

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	0.25	< 0.25 U
108-88-3	**Toluene**	**0.25**	**1.3**
100-41-4	Ethylbenzene	0.25	< 0.25 U
179601-23-1	m,p-Xylene	0.50	< 0.50 U
95-47-6	o-Xylene	0.25	< 0.25 U

BETX Surrogate Recovery

Trifluorotoluene	91.7%
Bromobenzene	94.6%

BETX values reported in µg/L (ppb)

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod **Sample ID: GW219-110630**
Page 1 of 1 **SAMPLE**

Lab Sample ID: TC68F
LIMS ID: 11-14321
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Analyzed: 07/05/11 16:30
Instrument/Analyst: PID1/MH

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	0.25	< 0.25 U
108-88-3	Toluene	0.25	< 0.25 U
100-41-4	**Ethylbenzene**	**0.25**	**0.42**
179601-23-1	m,p-Xylene	0.50	< 0.50 U
95-47-6	o-Xylene	0.25	< 0.25 U

BETX Surrogate Recovery

Trifluorotoluene	92.3%
Bromobenzene	93.1%

BETX values reported in µg/L (ppb)

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod

Sample ID: GW222-110630
SAMPLE

Lab Sample ID: TC68G
LIMS ID: 11-14322
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Analyzed: 07/05/11 16:59
Instrument/Analyst: PID1/MH

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	0.25	< 0.25 U
108-88-3	Toluene	0.25	< 0.25 U
100-41-4	Ethylbenzene	0.25	< 0.25 U
179601-23-1	m,p-Xylene	0.50	< 0.50 U
95-47-6	o-Xylene	0.25	< 0.25 U

BETX Surrogate Recovery

Trifluorotoluene	90.8%
Bromobenzene	87.4%

BETX values reported in µg/L (ppb)

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: Trip Blanks
SAMPLE

Lab Sample ID: TC68H
LIMS ID: 11-14323
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM
Date Sampled: 06/30/11
Date Received: 06/30/11

Date Analyzed: 07/05/11 13:35
Instrument/Analyst: PID1/MH

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	0.25	< 0.25 U
108-88-3	Toluene	0.25	< 0.25 U
100-41-4	Ethylbenzene	0.25	< 0.25 U
179601-23-1	m,p-Xylene	0.50	< 0.50 U
95-47-6	o-Xylene	0.25	< 0.25 U

BETX Surrogate Recovery

Trifluorotoluene	93.1%
Bromobenzene	91.8%

BETX values reported in µg/L (ppb)

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: MB-070511
METHOD BLANK

Lab Sample ID: MB-070511
LIMS ID: 11-14316
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM
Date Sampled: NA
Date Received: NA

Date Analyzed: 07/05/11 07:56
Instrument/Analyst: PID1/MH

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
71-43-2	Benzene	0.25	< 0.25 U
108-88-3	Toluene	0.25	< 0.25 U
100-41-4	Ethylbenzene	0.25	< 0.25 U
179601-23-1	m,p-Xylene	0.50	< 0.50 U
95-47-6	o-Xylene	0.25	< 0.25 U

BETX Surrogate Recovery

Trifluorotoluene	87.2%
Bromobenzene	89.5%

BETX values reported in µg/L (ppb)

ANALYTICAL RESOURCES INCORPORATED

BETX WATER SURROGATE RECOVERY SUMMARY

ARI Job: TC68
Matrix: Groundwater

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM

Client ID	TFT	BBZ	TOT OUT
MB-070511	87.2%	89.5%	0
LCS-070511	91.8%	91.2%	0
LCSD-070511	91.1%	89.8%	0
GW225-110630	92.9%	91.8%	0
GW221-110630	93.3%	93.9%	0
GW223-110630	89.9%	88.5%	0
GW220-110630	91.5%	90.4%	0
GW224-110630	91.7%	94.6%	0
GW219-110630	92.3%	93.1%	0
GW222-110630	90.8%	87.4%	0
Trip Blanks	93.1%	91.8%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(79-120)	(80-120)
(BBZ) = Bromobenzene	(79-120)	(80-120)

Log Number Range: 11-14316 to 11-14323

FORM II BETX

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: LCS-070511
LAB CONTROL SAMPLE

Lab Sample ID: LCS-070511
LIMS ID: 11-14316
Matrix: Groundwater
Data Release Authorized:
Reported: 07/08/11

QC Report No: TC68-The Boeing Company
Project: Renton Former Fuel Farm
Event: 7KRENREM
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 07/05/11 06:58
LCSD: 07/05/11 07:27
Instrument/Analyst LCS: PID1/MH
LCSD: PID1/MH

Purge Volume: 5.0 mL

Dilution Factor LCS: 1.0
LCSD: 1.0

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzene	3.29	3.70	88.9%	3.24	3.70	87.6%	1.5%
Toluene	36.7	36.5	101%	36.3	36.5	99.5%	1.1%
Ethylbenzene	10.8	10.7	101%	10.6	10.7	99.1%	1.9%
m,p-Xylene	39.3	40.1	98.0%	38.9	40.1	97.0%	1.0%
o-Xylene	18.0	18.1	99.4%	17.8	18.1	98.3%	1.1%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

BETX Surrogate Recovery

	LCS	LCSD
Trifluorotoluene	91.8%	91.1%
Bromobenzene	91.2%	89.8%

Appendix D-2: September 25, 2012 Memorandum

Memo

To:	Carl Bach, Boeing	Project:	0088880080
From:	Larry McGaughey	cc:	Ray Power, Boeing Project File
Tel:	(206) 342-1760		
Fax:	(206) 342-1761		
Date:	September 25, 2012		

Subject: Former Fuel Farm Cleanup Action Investigation
Additional Investigation Summary
Boeing Renton Facility
Renton, Washington

1.0 INTRODUCTION

This memorandum summarizes the results of additional soil characterization performed at the Former Fuel Farm (FFF) area of concern; the FFF was part of the Boeing Commercial Airplane Group Renton Plant (Facility) located in the City of Renton, Washington (Figure 1) and addressed by Agreed Order No. DE97HZ-N233. AMEC Environment & Infrastructure, Inc. (AMEC), prepared this memorandum on behalf of The Boeing Company (Boeing). The additional investigation was conducted to address comments from the Washington State Department of Ecology (Ecology) regarding a previous investigation completed at the FFF in May and June 2011 (Ecology, 2011). This additional investigation also was conducted to evaluate soil constituents of concern (COCs) in the area between the two previously identified FFF source areas (Figure 1). Bosair, LLC (Bosair) currently leases a portion of the FFF from the City of Renton and would like to redevelop and expand one of the hanger buildings located on the north side of the FFF area.

Boeing has been working with Ecology under the terms of the Agreed Order to address historic releases of hazardous substances at the Boeing Renton Facility. The *Draft Final Cleanup Action Plan* (AMEC Geomatrix, 2010) identified monitored natural attenuation (Alternative 3) as the preferred cleanup alternative for the FFF. The *Former Fuel Farm Cleanup Action Work Plan* (Work Plan) (AMEC Geomatrix, 2011a) described the work needed to implement the preferred cleanup alternative and presented a detailed history of previous investigations and cleanup actions at the FFF. The preferred alternative addresses FFF areas that Bosair plans to redevelop (Bosair, 2011). The purpose of the additional soil investigation in the redevelopment area was to determine whether any of the soils in this area contain concentrations of COCs that exceed the cleanup levels listed in the *Draft Final Cleanup Action Plan*.

The *Former Fuel Farm Cleanup Action Investigation Summary* (AMEC Geomatrix, 2011b), which was submitted to Ecology in July 2011, summarized the soil sampling results from the Work Plan. Following review of this report and the letter from Bosair, Ecology issued a letter to Mr. Kurt Boswell of

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

Bosair, LLC, dated December 6, 2011, requesting additional investigation at the FFF to further evaluate subsurface conditions.

AMEC prepared a Work Plan addendum in January 2012 to address Ecology's comments (AMEC, 2012). This memorandum summarizes the results of the additional investigation conducted to implement the Work Plan addendum.

2.0 OBJECTIVES AND SCOPE

The objective of the additional investigation was to assess subsurface conditions at selected locations where elevated photoionization detector (PID) readings were noted at depth during the sampling conducted in May and June 2011.

During the additional investigation, subsurface samples were collected from push-probe borings at seven locations where samples collected during the May/June 2011 investigation exhibited elevated PID readings: PP401, PP405, PP420, PP211, PP213, PP216, and PP217 (Figure 2). The investigation in May/June 2011 included collecting soil samples from the vadose zone extending 3-10 feet below the ground surface (bgs) and from the saturated zone at approximately 12 ft bgs. Headspace measurements were taken in the field using a PID calibrated with 100 parts per million (ppm) by volume isobutylene. Elevated PID readings ranging from 446 to 3,189 ppm were identified in soil samples collected from the seven push-probe locations in 2011.

The additional investigation outlined in the Work Plan addendum and reported in this memorandum consisted of:

- Advancing push probe borings at the seven sampling locations that had elevated PID readings in May/June 2011 (PP401, PP405, PP420, PP211, PP213, PP216, and PP217).
- Performing headspace screening at depths from approximately 10 feet bgs to a maximum of 20 feet bgs at 2-foot intervals (10, 12, 14 feet bgs, etc.).
- Collecting a soil sample from the interval with the highest measured PID screening result at each boring.
- Collecting a second soil sample from the borings if the PID reading for the first sample was greater than 400 ppm. The second soil sample was to be collected from the next depth interval below the primary sample depth and where the PID reading was less than 400 ppm.
- Analyzing the collected soil samples for the analytes listed below in Section 3.0.

3.0 SAMPLING AND ANALYSIS

This section describes field activities associated with soil sampling. The soil sampling was conducted on May 22 and May 31, 2012.

Cascade advanced a total of seven direct-push probes during the investigation, each to a total depth of 20 feet bgs. All push probes were advanced at the same locations where borings PP401, PP405, PP420, PP211, PP213, PP216, and PP217 were placed in earlier investigations. Locations of the push-probe borings are shown on Figure 1. Copies of the lithologic boring logs are provided in Attachment 1.

AMEC staff logged each boring continuously for lithology and field-screened soil at 1- to 2-foot intervals using PID testing of headspace. The PID testing results are presented in Table 1 and on the boring logs provided in Attachment 1. One to two soil samples were then collected from each boring for laboratory analysis in general accordance with the Work Plan addendum dated January 23, 2012, with the following exceptions:

- PID readings were collected from 1-foot intervals, starting from 1 foot bgs, rather than every 2 feet starting at 10 feet bgs.
- The highest PID reading from the PP213 boring was 1,713 ppm at 15 feet bgs. According to the Work Plan, a sample should have been collected at 15 feet bgs and a second sample at 17 feet bgs. The samples collected from this boring are from 14 and 16 feet bgs.
- The highest PID reading from the PP401 boring (1,670 ppm) was at 14 feet bgs. The second sample collected from this boring was collected from 16 feet bgs, and had a PID reading above 400 ppm.
- The highest PID reading from the PP405 boring (117 ppm) was at a depth of 12 feet bgs. An extra soil sample was collected from this boring for chemical analysis at a depth of 14 feet bgs.
- The highest PID reading from the PP420 boring (754 ppm) was at a depth of 13 feet bgs. Soil samples were collected for chemical analysis at depths of 10 and 13 feet bgs; no sample was collected below 13 feet in depth.

Soil samples were collected as described above and in accordance with the Ecology-approved *Remedial Investigation Work Plan* (Weston, 1998 and as amended) for the Boeing Renton Facility, which specifies field methods for sample collection, sample designation, equipment decontamination, and documentation. Samples were collected directly from the liner of the direct-push probe using laboratory-provided disposable sampling equipment and stainless steel spoons.

The soil samples were analyzed for the same COCs analyzed for in the 2011 investigation:

- Total petroleum hydrocarbons (TPH) as jet fuel A (TPH-Jet A),
- TPH as diesel (TPH-D),
- Benzene, toluene, ethylbenzene, and xylenes (BTEX), and
- 2-methylnapthalene.

Soil samples also were analyzed for TPH as volatile petroleum hydrocarbon (VPH) and extractable petroleum hydrocarbon (EPH) fractions using Ecology methodology. Lancaster Laboratories, Inc., of Lancaster, Pennsylvania performed the analyses. Analytical data and a summary data quality review memorandum are provided in Attachment 2.

4.0 RESULTS

Table 2 presents soil analytical data for the 2012 additional investigation and compares the data to the cleanup levels presented in the *Draft Final Cleanup Action Plan* (AMEC, 2010). These results are shown on Figure 2 together with soil analytical results from previous investigations. As discussed below, samples collected from two borehole locations in the 2012 investigation exceeded cleanup levels; one sample from PP401 and one from PP217.

The concentration of m,p-xylene in the soil sample collected at 14 feet bgs in the PP401 boring was 9,700 micrograms per kilogram (µg/kg), which slightly exceeded the cleanup level of 9,000 µg/kg. The second sample from PP401, collected from a depth of 16 feet and with a PID reading of 783 ppm, was below the cleanup levels for all COCs.

The TPH-diesel and TPH-Jet A concentrations measured in the sample collected at 12 feet bgs in boring PP217 were 2,200 and 3,600 µg/kg, respectively, which exceeded the cleanup level of 2,000 mg/kg. The sample collected from this boring at a depth of 16 feet bgs was below the cleanup levels for all COCs.

The highest PID readings were observed in PP213 at depths ranging from 13 to 16 feet bgs. Two soil samples were collected from PP213, at depths of 14 and 16 feet bgs, with PID readings ranging from about 1,500 to about 1,700 ppm (Table 1). Given the typical variation observed for PID readings, these results indicate generally consistent soil conditions. As shown on Table 2, both soil samples collected at PP213 were below cleanup levels for all COCs. The results for VPH indicate that volatile aliphatic compounds were present in the 14-foot bgs sample depth, likely accounting for the PID readings observed in this borehole.

It should be noted that interferences from other hydrocarbons resulted in elevated reporting limits for benzene in soil samples that were collected at 5 locations (PP401, PP405, PP420, PP213, and PP217). The reporting limits were elevated above the soil cleanup level listed in the DCAP for benzene at the Former Fuel Farm (i.e., 12 µg/kg). The soil cleanup levels listed in the DCAP were established in accordance with the MTCA regulations to be protective of groundwater. The elevated reporting levels ranged from 35 µg/kg to 420 µg/kg. Thus, the results for these samples cannot be used to determine if benzene concentrations in the soil samples are above or below the benzene cleanup level for soil.

The analytical results from groundwater samples collected from Former Fuel Farm monitoring wells sampled since June 2011 have not detected benzene above the benzene reporting limits for groundwater. The benzene reporting limits ranged from 0.25 µg/L to 1.0 µg/L; no groundwater cleanup level has been established for benzene in the DCAP, as benzene has not been identified as a groundwater constituent of concern for the Former Fuel Farm. These groundwater data show that benzene levels in soil do not result in detectable concentrations in groundwater at the Former Fuel Farm. Benzene will continue to be monitored in the existing monitoring wells and in the replacement point of compliance well (GW22S) that will be installed after Bosair redevelopment work is complete.

5.0 HISTORICAL SOIL SAMPLE ANALYTICAL RESULTS

Figure 2 shows analytical results for soil samples collected during the 2012 investigation, together with results from previous investigations conducted in 2003 and 2011. During May and June 2011, soil samples were collected at 17 push-probe locations, including PP401 and PP217. Boring locations and the soil sampling results are presented in Table 3 and on Figure 2. Soil samples were also collected from PP401, PP405, PP420, PP427, and PP430 in June 2003 as part of quarterly sampling, and these results are also presented in Table 3 and on Figure 2. Concentrations of TPH-D, TPH-Jet-A, and benzene have attenuated significantly (by up to two orders of magnitude) from 2003 to 2011 at all locations sampled in 2003, except PP401. However, all constituents at PP401 (with the exception of the slight exceedance of m,p-xylene) are below cleanup levels. The significant reduction of TPH and benzene constituents throughout the FFF area can be interpreted as evidence for robust attenuation of COCs in subsurface soils.

6.0 CONCLUSIONS

As described in Section 4.0, three COCs were detected above their respective cleanup levels in two soil samples from PP401 and PP217. TPH-D, TPH-Jet-A, and m,p-xylene were detected above cleanup levels in soil samples collected below the water table at two push-probe locations. These boreholes are located within the known source area. While benzene was not detected above reporting limits in these soil samples, some of the reporting limits were elevated due to the presence of other hydrocarbons in the samples. These elevated reporting limits were higher than the benzene soil cleanup level. However, none of the groundwater samples collected from the Former Fuel Farm wells since June 2011 have contained detectable concentrations of benzene above 1 µg/L, which suggests that any benzene that may be present in soil has not affected groundwater.

A comparison of soil analytical data collected above the water table in 2003 and 2011 suggests significant attenuation of COCs, with decreases of up to two orders of magnitude in measured soil concentrations within the source areas. Boeing will proceed with the preferred cleanup alternative detailed for the FFF in the Draft Final Cleanup Action Plan; these soil analytical results will be reviewed with the City of Renton in conjunction with the planned redevelopment activities.

7.0 REFERENCES

AMEC Environment & Infrastructure, Inc. (AMEC), 2012, Former Fuel Farm Cleanup Action Work Plan Additional Investigation Addendum, Boeing Renton Facility, Renton, Washington, January 23.

AMEC Geomatrix, Inc. (AMEC Geomatrix), 2010, Draft Final Cleanup Action Plan, Boeing Renton Facility, Renton, Washington: Submitted to the Boeing Company, October.

AMEC Geomatrix, 2011a, Former Fuel Farm Cleanup Action Work Plan, Boeing Renton Facility, Renton, Washington: Submitted to the Boeing Company, May.

AMEC Geomatrix, 2011b, Former Fuel Farm Cleanup Action Investigation Summary, Boeing Renton Facility, Renton, Washington: Submitted to the Boeing Company, July.

Bosair, LLC, (Bosair), 2011, Letter from Kurt Boswell (Bosair) to Byung Maeng (Ecology), Hanger Construction at the Former Fuel Farm in the Renton Municipal Airport, November 16.

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

Washington State Department of Ecology (Ecology), 2011, Letter from Byung Maeng (Ecology) to Kurt Boswell (Bosair), Re: Hangar Construction at the Former Fuel Farm in the Renton Municipal Airport, December 6.

Attachments:

Table 1	Summary of PID Readings
Table 2	May 2012 Soil Analytical Results
Table 3	Historical Soil Analytical Results
Figure 1	Former Fuel Farm Site Map
Figure 2	Summary of 2011 and 2012 Soil Analytical Results, Former Fuel Farm
Attachment 1	Boring Logs
Attachment 2	Data Validation Memo and Laboratory Report

TABLE 1

SUMMARY OF PID READINGS[1, 2]

Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Boring	Depth (ft bgs)	PID Reading (ppm)	Analytical Sample Identification No.
PP211	1	0.4	NS
	2	0.4	NS
	4	0.2	NS
	5.5	0.3	NS
	7	0.3	NS
	8	0.4	NS
	10	5.8	RI-SB01-PP211-10
	16	0.7	NS
	18	0.9	NS
	20	--	NS
PP213	1	0.6	NS
	2	0.3	NS
	5	0.3	NS
	6	0.1	NS
	7	0.2	NS
	8	0.4	NS
	10	0.3	NS
	11	1.5	NS
	12	2.0	NS
	13	1674	NS
	14	1542	RI-SB01-PP213-14
	15	1713	NS
	16	1655	RI-SB01-PP213-16
	17	273	NS
	18	7.3	NS
	19	3.8	NS
	20	--	NS
PP216	1	3.4	NS
	4	2.3	NS
	5	0.9	NS
	6	0.9	NS
	8	0.5	NS
	10	0.2	NS
	12	0.7	NS
	13	0.0	NS
	14	9.7	RI-SB01-PP216-14
	16	0.6	NS
	18	0.3	NS
	20	--	NS

TABLE 1

SUMMARY OF PID READINGS[1, 2]

Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Boring	Depth (ft bgs)	PID Reading (ppm)	Analytical Sample Identification No.
PP217	1	0.7	NS
	2	0.5	NS
	3	0.5	NS
	5	0.9	NS
	6	0.5	NS
	7	0.4	NS
	8	11.3	NS
	10	0.4	NS
	11	266	NS
	12	663	RI-SB01-PP217-12
	15	609	NS
	16	342	RI-SB01-PP217-16
	17	173	NS
	18	155	NS
	20	--	NS
PP401	1.5	0.3	NS
	4	0.4	NS
	6	0.3	NS
	8	0.7	NS
	9.5	19.4	NS
	10	6.8	NS
	12	212	NS
	13	344	NS
	14	1670	RI-SB23-PP401-14
	15.75	73.9	NS
	16	783	RI-SB23-PP401-16
	18	485	NS
	20	--	NS
PP405	2	0.0	NS
	3.5	0.0	NS
	5	0.1	NS
	6	0	NS
	7	0.2	NS
	9	0.2	NS
	10	0	NS
	10.5	54.8	NS
	12	117	RI-SB23-PP405-12
	13.5	0.3	NS
	14	60.1	RI-SB23-PP405-14
	16	2.4	NS
	18	2.0	NS
	19.5	0.8	NS

TABLE 1

SUMMARY OF PID READINGS[1, 2]

Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Boring	Depth (ft bgs)	PID Reading (ppm)	Analytical Sample Identification No.
PP420	2	0.1	NS
	4	0.3	NS
	6	0.4	NS
	8	0.4	NS
	9.5	365	RI-SB23-PP420-10
	12	325	NS
	13	754	RI-SB23-PP420-13
	14	737	NS
	15	4.8-14.2	NS
	16	163	NS
	18	8.0	NS
	20	1.6	NS

Notes
1. All PID readings collected using a Photovac 2020 Pro Plus calibrated daily to 100 ppmv isobutylene gas.
2. All PID readings collected from headspace in ziploc bags filled with soil from the corresponding depth interval after a 5-minute waiting period.

Abbreviations
ft bgs = feet below ground surface
NS = not sampled
PID = photoionization detector
ppm = parts per million
ppmv = parts per million by volume

TABLE 2

MAY 2012 SOIL ANALYTICAL RESULTS [1,2]
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Location	PP401		PP405		PP420		PP211	PP213		PP216		PP217		MTCA Method A Industrial	MTCA Method A Unrestricted	Cleanup Level [4]
Sample ID	RI-SB23-PP401-14	RI-SB23-PP401-16	RI-SB23-PP405-12	RI-SB23-PP405-14	RI-SB23-PP420-10	RI-SB23-PP420-13	RI-SB01-PP211-10	RI-SB01-PP213-14	RI-SB01-PP213-16	RI-SB01-PP216-14	RI-SB01-PP216-9-14	RI-SB01-PP217-12	RI-SB01-PP217-16			
Sample Date	5/22/2012	5/22/2012	5/22/2012	5/22/2012	5/22/2012	5/22/2012	5/22/2012	5/31/2012	5/31/2012	5/22/2012	5/22/2012	5/31/2012	5/31/2012			
Depth (ft bgs)	14	16	12	14	10	13	10	14	16	14	14 (duplicate)	12	16			
Analyte PID Reading[3]	1670	783	117	60.1	365	754	5.8	1542	1655	9.7	9.7	663	342			
TPH (mg/kg)																
Diesel Range Hydrocarbons	130	36	22	16	330	510 J	20 J	8.7 U	8.4 U	8 U	7.4 U	**2,200 J**	450	2,000	2,000	2,000
Jet-A	150	51	34	28	480	890 J	9.1 U	31	8.4 U	8 U	7.4 U	**3,600 J**	650	2,000	2,000	2,000
BTEX (µg/kg)																
Benzene	420 U	86 U	85 U	8	90 U	98 U	0.8 U	230 U	0.6 U	0.5 U	0.8	35 U	39 U	30	30	12
Ethylbenzene	2,100 U	430 U	420 U	4 U	450 U	490 U	4 U	1,200 U	3 U	2 U	2 U	170 U	200 U	6,000	6,000	--
m,p-Xylene	**9,700**	430 U	420 U	4 U	450 U	490 U	4 U	1,200 U	3 U	2 U	2 U	170 U	200 U	--	--	9,000 [5]
o-Xylene	2,100 U	430 U	420 U	4 U	450 U	490 U	4 U	1,200 U	3 U	2 U	2 U	170 U	200 U	--	--	--
Toluene	2,100 U	430 U	420 U	4 U	450 U	490 U	4 U	1,200 U	3 U	2 U	2 U	170 U	200 U	7,000	7,000	--
EPH (µg/kg)																
C10-C12 Aliphatics	89,000	20,000	650,000	450,000	6,000 U	1,500,000	6,600 U	6,200 U	6,000 U	5,700 U	5,300 U	980,000	22,000	--	--	--
C12-C16 Aliphatics	270,000	58,000	620,000	470,000	16,000	1,500,000	6,600 U	6,200 U	6,000 U	5,700 U	5,300 U	1,900,000	110,000	--	--	--
C16-C21 Aliphatics	40,000	11,000	33,000 U	36,000	11,000	140,000 U	16,000	6,200 U	6,000 U	5,700 U	5,300 U	150,000 U	17,000	--	--	--
C21-C34 Aliphatics	13,000	12,000 U	65,000 U	23,000	100,000	290,000 U	62,000	12,000 U	12,000 U	11,000 U	11,000 U	310,000 U	12,000 U	--	--	--
C10-C12 Aromatics	6,500	6,000 U	70,000	34,000	6,000 U	85,000	6,600 U	6,200 U	6,000 U	5,700 U	5,300 U	32,000	6,000 U	--	--	--
C12-C16 Aromatics	50,000	14,000	210,000	110,000	6,000 U	330,000	6,600 U	6,200 U	6,000 U	5,700 U	5,300 U	170,000	7,000	--	--	--
C16-C21 Aromatics	17,000	6,000 U	31,000	19,000	6,000 U	58,000	11,000	6,200 U	6,000 U	5,700 U	5,300 U	55,000	7,200	--	--	--
C21-C34 Aromatics	8,200	6,000 U	11,000	9,800	48,000	27,000	49,000	6,200 U	6,000 U	5,700 U	5,300 U	22,000	6,000 U	--	--	--
VPH (µg/kg)																
Benzene	1,080 U	1,120 U	549 U	1,520 U	825 U	776 UJ	1,240 U	4,400 U	413 U	802 U	826 U	448 U	428 U	--	--	--
C5-C6 Aliphatics	10,800 U	11,200 U	5,490 U	15,200 U	8,250 U	7,760 UJ	12,400 UJ	44,000 U	4,130 U	8,020 U	8,260 U	4,480 U	4,280 U	--	--	--
C6-C8 Aliphatics	847,000 J	176,000 J	5,490 U	15,200 U	24,700	299,000 J	12,400 UJ	2,200,000	4,130 U	22600	20,500	4,480 U	8,080	--	--	--
C8-C10 Aliphatics	377,000	17,900 J	5,490 U	15,200 U	643,000	1,290,000 J	12,400 U	406,000	4,130 U	8510	8,850	42,100	125,000	--	--	--
C8-C10 Aromatics	192,000	11,200 U	5,490 U	15,200 U	309,000	887,000 J	12,400 U	161,000	4,130 U	8,020 U	8,260 U	29,100	94,700	--	--	--
Ethylbenzene	1,080 U	1,120 U	549 U	1,520 U	4,480	8,630 J	1,240 U	4,400 U	413 U	802 U	826 U	559	1,760	--	--	--
m,p-Xylene	3,760	2,240 U	1,100 U	3,030 U	1,650 U	1,550 UJ	2,470 U	8,810 U	827 U	1,600 U	1,650 U	897 U	857 U	--	--	--
Methyl tert-Butyl Ether	1,080 U	1,120 U	549 U	1,520 U	825 U	776 UJ	1,240 U	4,400 U	413 U	802 U	826 U	448 U	428 U	--	--	--
o-Xylene	1,530	1,120 U	549 U	1,520 U	1,680	3,680 J	1,240 U	4,400 U	413 U	802 U	826 U	568	2,520	--	--	--
Toluene	1,080 U	1,120 U	549 U	1,520 U	825 U	5,260 J	1,240 U	4,400 U	413 U	802 U	826 U	448 U	537	--	--	--
SVOCs (µg/kg)																
2-Methylnaphthalene	19,000	2,100	1,100	600	21 U	19 U	22 U	46	110	35 J	79 J	760	370	--	--	45,800

Notes
1. Laboratory data flags are as follows:
   J = Value shown is an estimated concentration.
   U = Analyte not detected at reporting limit given.
   UJ = Analyte not detected. Value shown is estimatd laboratory reporting limit.
   -- = not established.
2. Results presented in **bold** indicate value exceeds cleanup level from the DCAP (AMEC Geomatrix, 2010).
3. PID results are presented in parts per million (ppm).
4. Cleanup level is the cleanup level agreed upon with Ecology and presented in the DCAP.
5. Value presented is for total xylenes.

Abbreviations
µg/kg = micrograms per kilogram
BTEX = benzene, toluene, ethylbenzene, xylenes
DCAP = Draft Final Cleanup Action Plan
EPH = extractable petroleum hydrocarbons
ft bgs= feet below ground surface
mg/kg = milligrams per kilogram
MTCA = Model Toxics Control Act
PID = photoionization detector
ppm = parts per million
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons
VPH = volatile petroluem hydrocarbons

TABLE 3

HISTORICAL SOIL ANALYTICAL RESULTS [1, 2]
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Location	PP401			PP405			PP420	PP420 (field dup)	PP420		MTCA Method A Industrial	MTCA Method A Residential	Cleanup Level [3]
Sample ID	I-SB21-PP401-0100	RI-SB22-PP401-0030	RI-SB22-PP401-0100	I-SB21-PP405-0100	RI-SB22-PP405-0030	RI-SB22-PP405-0090	I-SB21-PP420-0100	I-SB21-PP420-1100	RI-SB22-PP420-0030	RI-SB22-PP420-0090			
Sample Date	6/17/2003	5/26/2011	5/26/2011	6/17/2003	5/27/2011	5/27/2011	6/17/2003	6/17/2003	5/27/2011	5/27/2011			
Constituent Depth (ft bgs)	10	3	10	10	3	9	10	10	3	9			
TPH (mg/kg)													
Diesel range	120	240	580	**3,800**	5.3 U	5.5 U	1,500	**2,400**	5.4 U	1100	2,000	2,000	2,000
Motor oil	56	NA	NA	140	NA	NA	76	140	NA	NA	2,000	2,000	2,000
Jet A	94	120 U	210	**6,400**	5.3 U	5.5 U	**2,400**	**4,100**	5.4 U	1300	2,000	2,000	2,000
BTEX (µg/kg)													
Benzene	29 U	5.4	1.9	35 U	1.1 U	0.9 U	29 U	29 U	1.2 U	58 U	30	30	12
Ethylbenzene	51	1.8	1 U	1,100	1.1 U	0.9 U	1,200	1,200	1.2 U	94	6,000	6,000	--
m,p-Xylene	57 U	9.5	2.2	110	1.1 U	0.9 U	100	100	1.2 U	190	--	--	9,000 [4]
o-Xylene	100	1.8	1 U	1,100	1.1 U	0.9 U	1,300	1,200	1.2 U	58 U	--	--	--
Toluene	29 U	1.2 U	1 U	77	1.1 U	0.9 U	150	160	1.2 U	58 U	7,000	7,000	--
EPH (µg/kg)													
C8-C10 Aliphatics	7,200	2,300 U	2,500 U	560,000	2,200 U	2,200 U	230,000	450,000	2,200 U	44,000	--	--	--
C8-C10 Aromatics	4,300 U	2,300 U	2,500 U	23,000	2,200 U	2,200 U	12,000 U	11,000 U	2,200 U	2,300 U	--	--	--
C10-C12 Aliphatics	10,000	2,300 U	3,900	1,600,000	2,200 U	2,200 U	600,000	1,400,000	2,200 U	340,000	--	--	--
C10-C12 Aromatics	4,300 U	2,300 U	2,500 U	360,000	2,200 U	2,200 U	91,000	220,000	2,200 U	19,000	--	--	--
C12-C16 Aliphatics	23,000	8,000	61,000	1,500,000	2,200 U	2,200 U	620,000	1,100,000	2,200 U	440,000	--	--	--
C12-C16 Aromatics	4,300 U	2,300 U	3,900	740,000	2,200 U	2,200 U	240,000	460,000	2,200 U	81,000	--	--	--
C16-C21 Aliphatics	10,000	37,000	100,000	140,000	2,200 U	2,200 U	64,000	99,000	2,200 U	42,000	--	--	--
C16-C21 Aromatics	4,300 U	14,000	35,000	60,000	2,200 U	2,200 U	36,000	81,000	2,200 U	31,000	--	--	--
C21-C34 Aliphatics	13,000	160,000	160,000	110,000	2,200 U	2,200 U	57,000	87,000	2,200 U	21,000	--	--	--
C21-C34 Aromatics	4,300 U	86,000	100,000	21,000 U	2,200 U	2,200 U	12,000 U	55,000	2,200 U	3,700	--	--	--
VPH (µg/kg)													
C5-C6 Aliphatics	5,000 U	12,000 U	12,000 U	5,000 U	8,800 U	8,300 U	5,000 U	5,000 U	12,000 U	11,000 U	--	--	--
C6-C8 Aliphatics	15,000	12,000 U	12,000 U	5,000 U	8,800 U	8,300 U	220,000	110,000	12,000 U	11,000 U	--	--	--
C8-C10 Aliphatics	13,000	12,000 U	12,000 U	5,000 U	8,800 U	8,300 U	190,000	71,000	12,000 U	11,000 U	--	--	--
C8-C10 Aromatics	140,000	12,000 U	12,000 U	5,000 U	8,800 U	8,300 U	830,000	390,000	12,000 U	36,000	--	--	--
C10-C12 Aliphatics	330,000	12,000 U	12,000 U	7,600	8,800 U	8,300 U	1,500,000	760,000	12,000 U	11,000 U	--	--	--
C10-C12 Aromatics	330,000	12,000 U	26,000	7,200	8,800 U	8,300 U	1,500,000	770,000	12,000 U	240,000	--	--	--
C12-C13 Aromatics	280,000	12,000 U	36,000	14,000	8,800 U	8,300 U	960,000	480,000	12,000 U	150,000	--	--	--
Benzene	**150**	1,200 U	1,200 U	11 U	880 U	830 U	**490**	**84**	1,200 U	1,100 U	30	30	12
Ethylbenzene	500 U	1,200 U	1,200 U	5,000 U	880 U	830 U	1,200	520	1,200 U	1,100 U	6,000	6,000	--
m,p-Xylene	2,600	2,400 U	2,500 U	5,000 U	1,800 U	1,700 U	7,800	3,600	2,400 U	2,200 U	--	--	9,000 [4]
Methyl tert-Butyl Ether	120 U	1,200 U	1,200 U	56 U	880 U	830 U	120 U	120 U	1,200 U	1,100 U	--	--	--
n-Decane	NA	1,200 U	1,200 U	NA	880 U	830 U	NA	NA	1,200 U	1,200	--	--	--
n-Dodecane	NA	1,200 U	2,300	NA	880 U	830 U	NA	NA	1,200 U	16,000	--	--	--
n-Hexane	NA	1,200 U	1,200 U	NA	880 U	830 U	NA	NA	1,200 U	1,100 U	--	--	--
n-Octane	NA	1,200 U	1,200 U	NA	880 U	830 U	NA	NA	1,200 U	1,100 U	--	--	--
n-Pentane	NA	1,200 U	1,200 U	NA	880 U	830 U	NA	NA	1,200 U	1,100 U	--	--	--
o-Xylene	700	1,200 U	1,200 U	5,000 U	880 U	830 U	7,100	3,400	1,200 U	1,100 U	--	--	--
Toluene	500 U	1,200 U	1,200 U	5,000 U	880 U	830 U	730	500 U	1,200 U	1,100 U	7,000	7,000	--
SVOCs (µg/kg)													
2-Methylnaphthalene	86	64 UJ	300 J	8,300	59 UJ	56 UJ	140	400	59 UJ	3,100 J	--	--	45,800

TABLE 3

HISTORICAL SOIL ANALYTICAL RESULTS [1, 2]
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Location	PP427			PP430			PP210		PP211		PP212		MTCA Method A Industrial	MTCA Method A Residential	Cleanup Level [3]
Sample ID	I-SB21-PP427-0100	RI-SB22-PP427-0030	RI-SB22-PP427-0100	I-SB21-PP430-0100	RI-SB22-PP430-0030	RI-SB22-PP430-0100	RI-SB-PP210-0030	RI-SB-PP210-0100	RI-SB-PP211-0030	RI-SB-PP211-0100	RI-SB-PP212-0030	RI-SB-PP212-0100			
Sample Date	6/17/2003	5/26/2011	5/26/2011	6/17/2003	5/26/2011	5/26/2011	5/27/2011	5/27/2011	5/26/2011	5/26/2011	5/26/2011	5/26/2011			
Constituent Depth (ft bgs)	10	3	10	10	3	10	3	10	3	10	3	10			
TPH (mg/kg)															
Diesel range	1,900	12	240	**2,900**	29	60	21	23	32	530	14	35	2,000	2,000	2,000
Motor oil	85 J	NA	NA	30 J	NA	NA							2,000	2,000	2,000
Jet A	1,400	11 U	80	**2,400**	11 U	110 U	6.2	5.5 U	12 U	250 U	11 U	12 U	2,000	2,000	2,000
BTEX (µg/kg)															
Benzene	29 U	0.9 U	1.9	18 U	1.2 U	1 U	1.2 U	1.1 U	1.4 U	4.2	**13**	1.5	30	30	12
Ethylbenzene	29 U	0.9 U	1.4 U	79	1.2 U	1 U	1.2 U	1.1 U	1.4 U	1.1 U	1 U	1.3 U	6,000	6,000	--
m,p-Xylene	58 U	0.9 U	3.7	35 U	1.2 U	1 U	1.2 U	1.1 U	1.4 U	2.9	1 U	1.3 U	--	--	9,000 [4]
o-Xylene	76	0.9 U	1.4 U	75	1.2 U	1 U	1.2 U	1.1 U	1.4 U	1.1 U	1 U	1.3 U	--	--	--
Toluene	29 U	0.9 U	3.2	18 U	1.2 U	1 U	1.2 U	1.1 U	1.4 U	1.2	3.3	1.3 U	7,000	7,000	--
EPH (µg/kg)															
C8-C10 Aliphatics	37,000	2,300 U	3,200 U	39,000	2,200 U	2,200 U	2,400 U	2,300 U	2,300 U	4,200	2,300 U	2,500 U	--	--	--
C8-C10 Aromatics	4,100 U	2,300 U	3,200 U	4,000 U	2,200 U	2,200 U	2,400 U	2,300 U	2,300 U	2500 U	2,300 U	2,500 U	--	--	--
C10-C12 Aliphatics	150,000	2,300 U	5,000	150,000	2,200 U	2,200 U	2,400 U	2,300 U	2,300 U	6,200	2,300 U	2,500 U	--	--	--
C10-C12 Aromatics	4,100 U	2,300 U	3,200 U	4,400	2,200 U	2,200 U	2,400 U	2,300 U	2,300 U	2500 U	2,300 U	2,500 U	--	--	--
C12-C16 Aliphatics	920,000	2,300 U	8,200	710,000	2,200 U	2,400	2,400 U	2,300 U	2,300 U	60,000	2,300 U	2,500 U	--	--	--
C12-C16 Aromatics	26,000	2,300 U	4,000	87,000	2,200 U	2,200 U	2,400 U	2,300 U	2,300 U	2,800	2,300 U	2,500 U	--	--	--
C16-C21 Aliphatics	960,000	2,300 U	13,000	400,000	2,200 U	5,400	2,400 U	2,300 U	2,900	140,000	2,300 U	6,200	--	--	--
C16-C21 Aromatics	170,000	2,300 U	17,000	390,000	2,200 U	6,100	2,400 U	2,300 U	2,300 U	17,000	2,300 U	2,500 U	--	--	--
C21-C34 Aliphatics	170,000	2,300 U	150,000	44,000	2,200 U	64,000	2,400 U	5,600	5,700	490,000	2,300 U	36,000	--	--	--
C21-C34 Aromatics	41,000	2,300 U	96,000	4,000 U	2,200 U	51,000	2,400 U	2,300 U	2,800	72,000	2,300 U	2,500 U	--	--	--
VPH (µg/kg)															
C5-C6 Aliphatics	5,000 U	9,700 U	19,000 U	5,000 U	14,000 U	10,000 U	11,000 U	9,100 U	11,000 U	13,000 U	10,000 U	12,000 U	--	--	--
C6-C8 Aliphatics	12,000	9,700 U	19,000 U	30,000	14,000 U	10,000 U	11,000 U	9,100 U	11,000 U	13,000 U	10,000 U	12,000 U	--	--	--
C8-C10 Aliphatics	5,000 U	9,700 U	19,000 U	16,000	14,000 U	10,000 U	11,000 U	9,100 U	11,000 U	13,000 U	10,000 U	12,000 U	--	--	--
C8-C10 Aromatics	40,000	9,700 U	19,000 U	94,000	14,000 U	10,000 U	11,000 U	9,100 U	11,000 U	13,000 U	10,000 U	12,000 U	--	--	--
C10-C12 Aliphatics	100,000	9,700 U	19,000 U	200,000	14,000 U	10,000 U	11,000 U	9,100 U	11,000 U	13,000 U	10,000 U	12,000 U	--	--	--
C10-C12 Aromatics	130,000	9,700 U	19,000 U	220,000	14,000 U	10,000 U	11,000 U	9,100 U	11,000 U	13,000 U	10,000 U	12,000 U	--	--	--
C12-C13 Aromatics	160,000	9,700 U	19,000 U	290,000	14,000 U	10,000 U	11,000 U	9,100 U	11,000 U	13,000 U	10,000 U	12,000 U	--	--	--
Benzene	23 U	970 U	1,900 U	**130**	1,400 U	1,000 U	1,100 U	910 U	1,100 U	1,300 U	1,000 U	1,200 U	30	30	12
Ethylbenzene	500 U	970 U	1,900 U	500 U	1,400 U	1,000 U	1,100 U	910 U	1,100 U	1,300 U	1,000 U	1,200 U	6,000	6,000	--
m,p-Xylene	500 U	1,900 U	3800 U	890	2,700 U	2,000 U	2,300 U	1,800 U	2,200 U	2,700 U	2,100 U	2,400 U	--	--	9,000 [4]
Methyl tert-Butyl Ether	110 U	970 U	1,900 U	130 U	1,400 U	1,000 U	1,100 U	910 U	1,100 U	1,300 U	1,000 U	1,200 U	--	--	--
n-Decane	NA	970 U	1,900 U	NA	1,400 U	1,000 U	1,100 U	910 U	1,100 U	1,300 U	1,000 U	1,200 U	--	--	--
n-Dodecane	NA	970 U	1,900 U	NA	1,400 U	1,000 U	1,100 U	910 U	1,100 U	1,300 U	1,000 U	1,200 U	--	--	--
n-Hexane	NA	970 U	1,900 U	NA	1,400 U	1,000 U	1,100 U	910 U	1,100 U	1,300 U	1,000 U	1,200 U	--	--	--
n-Octane	NA	970 U	1,900 U	NA	1,400 U	1,000 U	1,100 U	910 U	1,100 U	1,300 U	1,000 U	1,200 U	--	--	--
n-Pentane	NA	970 U	1,900 U	NA	1,400 U	1,000 U	1,100 U	910 U	1,100 U	1,300 U	1,000 U	1,200 U	--	--	--
o-Xylene	500 U	970 U	1,900 U	940	1,400 U	1,000 U	1,100 U	910 U	1,100 U	1,300 U	1,000 U	1,200 U	--	--	--
Toluene	500 U	970 U	1,900 U	500 U	1,400 U	1,000 U	1,100 U	910 U	1,100 U	1,300 U	1,000 U	1,200 U	7,000	7,000	--
SVOCs (µg/kg)															
2-Methylnaphthalene	69	63 UJ	62 UJ	30 U	61 UJ	61 UJ	64 UJ	61 UJ	64 UJ	210 J	63 UJ	61 UJ	--	--	45,800

TABLE 3

HISTORICAL SOIL ANALYTICAL RESULTS [1, 2]
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Location	PP213		PP214		PP215		PP216		PP217		PP218		MTCA Method A Industrial	MTCA Method A Residential	Cleanup Level [3]
Sample ID	RI-SB-PP213-0030	RI-SB-PP213-0100	RI-SB-PP214-0030	RI-SB-PP214-0100	RI-SB-PP215-0030	RI-SB-PP215-0100	RI-SB-PP216-0030	RI-SB-PP216-0100	RI-SB-PP217-0030	RI-SB-PP217-0100	RI-SB-PP218-0030	RI-SB-PP218-0080			
Sample Date	5/26/2011	5/26/2011	5/26/2011	5/26/2011	5/26/2011	5/26/2011	5/27/2011	5/27/2011	5/26/2011	5/26/2011	5/27/2011	5/27/2011			
Constituent Depth (ft bgs)	3	10	3	10	3	10	3	10	3	10	3	8			
TPH (mg/kg)															
Diesel range	46	20	37	57	5.6 U	18	90	28	5.8 U	37	59	20	2,000	2,000	2,000
Motor oil													2,000	2,000	2,000
Jet A	16	12 U	12 U	16	11 U	11 U	16	22	12 U	14	14	6.2 U	2,000	2,000	2,000
BTEX (µg/kg)															
Benzene	1.1 U	1.2 U	2	1.1 U	1.2 U	1 U	2.1	1.2 U	1.2 U	**19**	9.9	1.7	30	30	12
Ethylbenzene	1.1 U	1.2 U	1.2 U	1.1 U	1.2 U	1 U	1.1 U	1.2 U	1.2 U	1.7	1.4 U	1.1 U	6,000	6,000	--
m,p-Xylene	1.9	1.2 U	1.2 U	1.1 U	1.2 U	1 U	1.1 U	1.9	1.2 U	3.5	1.4 U	1.1 U	--	--	9,000 [4]
o-Xylene	1.1 U	1.2 U	1.2 U	1.1 U	1.2 U	1 U	1.1 U	1.2 U	1.2 U	1.7 U	1.4 U	1.1 U	--	--	--
Toluene	1.1 U	1.2 U	1.2 U	1.1 U	1.2 U	1 U	1.1 U	1.2 U	1.2 U	2.6	3.5	1.1 U	7,000	7,000	--
EPH (µg/kg)															
C8-C10 Aliphatics	5,100	2,400 U	2,500 U	3,000	2,200 U	2,300 U	2,300 U	2,300 U	2,400 U	2,600 U	2,500 U	2,500 U	--	--	--
C8-C10 Aromatics	2,300 U	2,400 U	2,500 U	2,300 U	2,200 U	2,300 U	2,300 U	2,300 U	2,400 U	2,600 U	2,500 U	2,500 U	--	--	--
C10-C12 Aliphatics	2,300 U	2,400 U	2,500 U	2,300 U	2,200 U	2,300 U	2,300 U	2,300 U	2,400 U	2,600 U	2,500 U	2,500 U	--	--	--
C10-C12 Aromatics	2,300 U	2,400 U	2,500 U	2,300 U	2,200 U	2,300 U	2,300 U	2,300 U	2,400 U	2,600 U	2,500 U	2,500 U	--	--	--
C12-C16 Aliphatics	2,300 U	2,400 U	2,500 U	2,500	2,200 U	2,300 U	4,000	2,900	2,400 U	2,600 U	2,500 U	2,500 U	--	--	--
C12-C16 Aromatics	2,300 U	2,400 U	2,500 U	2,300 U	2,200 U	2,300 U	2,300 U	2,300 U	2,400 U	2,600 U	2,500 U	2,500 U	--	--	--
C16-C21 Aliphatics	2,300 U	2,400 U	3,300	6,000	2,200 U	2,300 U	25,000	2,300 U	2,400 U	2,600 U	2,500 U	2,500 U	--	--	--
C16-C21 Aromatics	2,700	2,400 U	2,500 U	2,300 U	2,200 U	2,300 U	12,000	2,300 U	2,400 U	2,600 U	2,500 U	2,500 U	--	--	--
C21-C34 Aliphatics	3,400	2,400 U	8,900	2,300	2,200 U	2,300 U	110,000	2,300 U	2,400 U	7,300	4,700	2,500 U	--	--	--
C21-C34 Aromatics	2,500	2,400 U	2,500 U	2,300 U	2,200 U	2,300 U	70,000	2,300 U	2,400 U	2,700	2,500 U	2,500 U	--	--	--
VPH (µg/kg)															
C5-C6 Aliphatics	11,000 U	12,000 U	12,000 U	12,000 U	11,000 U	11,000 U	11,000 U	12,000 U	11,000 U	12,000 U	17,000 U	12,000 U	--	--	--
C6-C8 Aliphatics	19,000	12,000 U	12,000 U	12,000 U	11,000 U	11,000 U	11,000 U	12,000 U	11,000 U	12,000 U	17,000 U	12,000 U	--	--	--
C8-C10 Aliphatics	11,000 U	12,000 U	12,000 U	12,000 U	11,000 U	11,000 U	11,000 U	12,000 U	11,000 U	12,000 U	17,000 U	12,000 U	--	--	--
C8-C10 Aromatics	11,000 U	12,000 U	12,000 U	12,000 U	11,000 U	11,000 U	11,000 U	12,000 U	11,000 U	12,000 U	17,000 U	12,000 U	--	--	--
C10-C12 Aliphatics	11,000 U	12,000 U	12,000 U	12,000 U	11,000 U	11,000 U	11,000 U	12,000 U	11,000 U	12,000 U	17,000 U	12,000 U	--	--	--
C10-C12 Aromatics	11,000 U	12,000 U	12,000 U	12,000 U	11,000 U	11,000 U	11,000 U	12,000 U	11,000 U	12,000 U	17,000 U	12,000 U	--	--	--
C12-C13 Aromatics	11,000 U	12,000 U	12,000 U	12,000 U	11,000 U	11,000 U	11,000 U	12,000 U	11,000 U	12,000 U	17,000 U	12,000 U	--	--	--
Benzene	1,100 U	1,200 U	1,200 U	1,200 U	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,200 U	1,700 U	1,200 U	30	30	12
Ethylbenzene	1,100 U	1,200 U	1,200 U	1,200 U	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,200 U	1,700 U	1,200 U	6,000	6,000	--
m,p-Xylene	2,300 U	2,300 U	2,400 U	2,400 U	2,300 U	2,100 U	2,100 U	2,300 U	2,300 U	2,400 U	3,400 U	2,400 U	--	--	9,000 [4]
Methyl tert-Butyl Ether	1,100 U	1,200 U	1,200 U	1,200 U	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,200 U	1,700 U	1,200 U	--	--	--
n-Decane	1,100 U	1,200 U	1,200 U	1,200 U	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,200 U	1,700 U	1,200 U	--	--	--
n-Dodecane	1,100 U	1,200 U	1,200 U	1,200 U	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,200 U	1,700 U	1,200 U	--	--	--
n-Hexane	1,100 U	1,200 U	1,200 U	1,200 U	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,200 U	1,700 U	1,200 U	--	--	--
n-Octane	1,100 U	1,200 U	1,200 U	1,200 U	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,200 U	1,700 U	1,200 U	--	--	--
n-Pentane	1,100 U	1,200 U	1,200 U	1,200 U	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,200 U	1,700 U	1,200 U	--	--	--
o-Xylene	1,100 U	1,200 U	1,200 U	1,200 U	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,200 U	1,700 U	1,200 U	--	--	--
Toluene	1,100 U	1,200 U	1,200 U	1,200 U	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,200 U	1,700 U	1,200 U	7,000	7,000	--
SVOCs (µg/kg)															
2-Methylnaphthalene	63 UJ	65 UJ	61 UJ	60 UJ	62 UJ	63 UJ	63 UJ	67 J	58 UJ	63 UJ	63 UJ	62 UJ	--	--	45,800

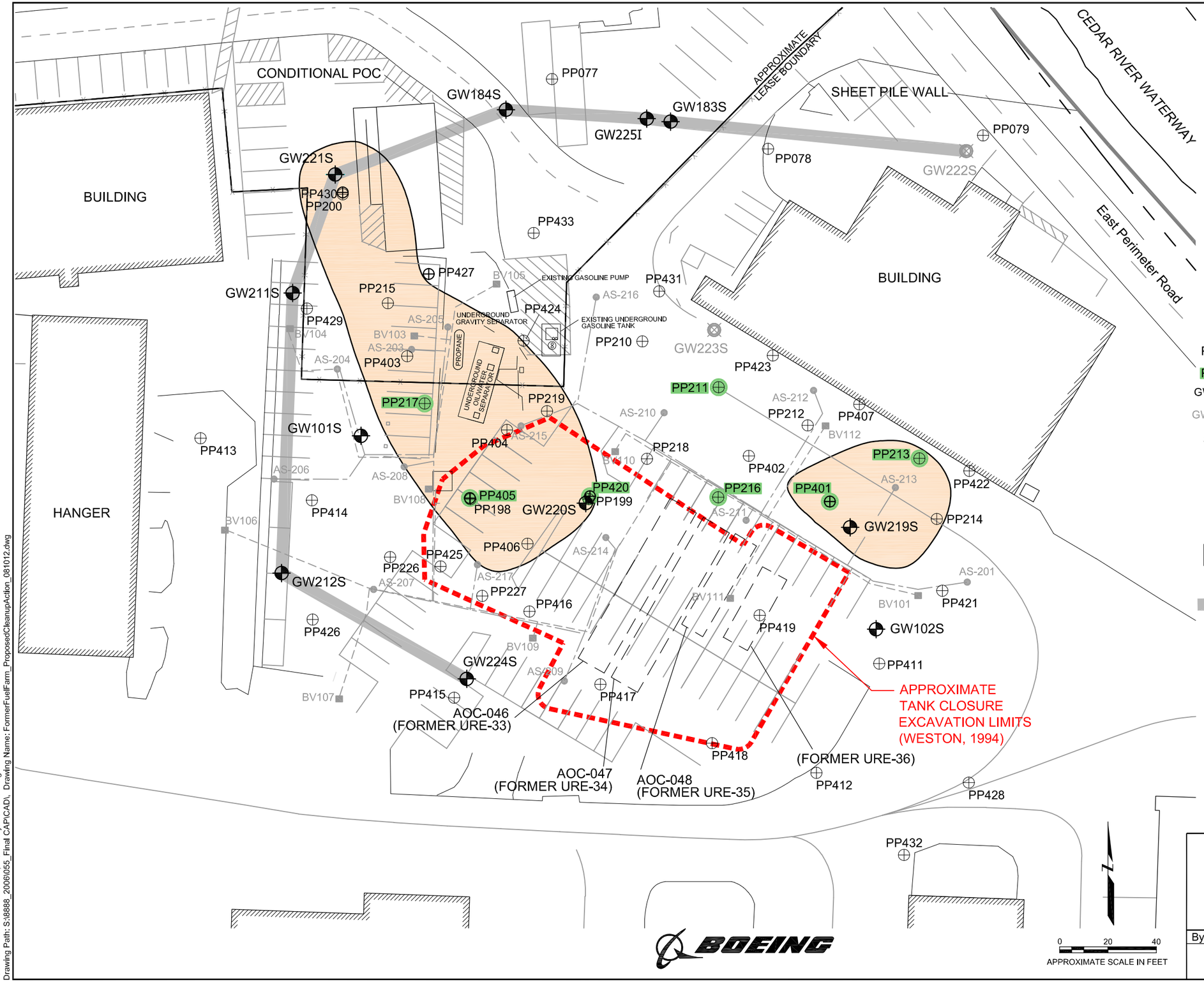
TABLE 3

HISTORICAL SOIL ANALYTICAL RESULTS [1, 2]
Former Fuel Farm
Boeing Renton Facility
Renton, Washington

Location	PP219		PP226		PP227		MTCA	MTCA	Cleanup
Sample ID	RI-SB-PP219-0030	RI-SB-PP219-0100	RI-SB-PP226-0030	RI-SB-PP226-0090	RI-SB-PP227-0030	RI-SB-PP227-0090	Method A	Method A	Level [3]
Sample Date	5/27/2011	5/27/2011	5/27/2011	5/27/2011	5/27/2011	5/27/2011	Industrial	Residential	
Constituent Depth (ft bgs)	3	10	3	9	3	9			
TPH (mg/kg)									
Diesel range	14	24	5.6 U	110	5.2 U	5.4 U	2,000	2,000	2,000
Motor oil							2,000	2,000	2,000
Jet A	5.4 U	5.6	5.6 U	56	5.2 U	5.4 U	2,000	2,000	2,000
BTEX (µg/kg)									
Benzene	1.2 U	0.9	0.9 U	2.1 U	1.1 U	0.9 U	30	30	12
Ethylbenzene	1.2 U	0.9 U	0.9 U	2.1 U	1.1 U	0.9 U	6,000	6,000	--
m,p-Xylene	1.2 U	1.8	0.9 U	2.1 U	1.1 U	0.9 U	--	--	9,000 [4]
o-Xylene	1.2 U	0.9 U	0.9 U	2.1 U	1.1 U	0.9 U	--	--	--
Toluene	1.2 U	0.9 U	0.9 U	2.1 U	1.1 U	0.9 U	7,000	7,000	--
EPH (µg/kg)									
C8-C10 Aliphatics	2,200 U	2,200 U	2,200 U	3,400 U	2,100 U	2,200 U	--	--	--
C8-C10 Aromatics	2,200 U	2,200 U	2,200 U	3,400 U	2,100 U	2,200 U	--	--	--
C10-C12 Aliphatics	2,200 U	2,200 U	2,200 U	3,400 U	2,100 U	2,200 U	--	--	--
C10-C12 Aromatics	2,200 U	2,200 U	2,200 U	3,400 U	2,100 U	2,200 U	--	--	--
C12-C16 Aliphatics	2,200 U	2,200 U	2,200 U	3,400 U	2,100 U	2,200 U	--	--	--
C12-C16 Aromatics	2,200 U	2,200 U	2,200 U	3,400 U	2,100 U	2,200 U	--	--	--
C16-C21 Aliphatics	2,200 U	2,400	2,200 U	3,400 U	2,100 U	2,200 U	--	--	--
C16-C21 Aromatics	2,200 U	2,200 U	2,200 U	3,400 U	2,100 U	2,200 U	--	--	--
C21-C34 Aliphatics	3,900	5,200	7,400	4,200	2,100 U	2,200 U	--	--	--
C21-C34 Aromatics	2,200 U	2,500	2,200 U	3,400 U	2,100 U	2,200 U	--	--	--
VPH (µg/kg)									
C5-C6 Aliphatics	11,000 U	9,000 U	9,400 U	20,000 U	9,000 U	11,000 U	--	--	--
C6-C8 Aliphatics	11,000 U	9,000 U	9,400 U	20,000 U	9,000 U	11,000 U	--	--	--
C8-C10 Aliphatics	11,000 U	9,000 U	9,400 U	20,000 U	9,000 U	11,000 U	--	--	--
C8-C10 Aromatics	11,000 U	9,000 U	9,400 U	20,000 U	9,000 U	11,000 U	--	--	--
C10-C12 Aliphatics	11,000 U	9,000 U	9,400 U	20,000 U	9,000 U	11,000 U	--	--	--
C10-C12 Aromatics	11,000 U	9,000 U	9,400 U	20,000 U	9,000 U	11,000 U	--	--	--
C12-C13 Aromatics	11,000 U	9,000 U	9,400 U	20,000 U	9,000 U	11,000 U	--	--	--
Benzene	1,100 U	900 U	940 U	2,000 U	900 U	1,100 U	30	30	12
Ethylbenzene	1,100 U	900 U	940 U	2,000 U	900 U	1,100 U	6,000	6,000	--
m,p-Xylene	2,200 U	1,800 U	1,900 U	4,100 U	1,800 U	2,200 U	--	--	9,000 [4]
Methyl tert-Butyl Ether	1,100 U	900 U	940 U	2,000 U	900 U	1,100 U	--	--	--
n-Decane	1,100 U	900 U	940 U	2,000 U	900 U	1,100 U	--	--	--
n-Dodecane	1,100 U	900 U	940 U	2,000 U	900 U	1,100 U	--	--	--
n-Hexane	1,100 U	900 U	940 U	2,000 U	900 U	1,100 U	--	--	--
n-Octane	1,100 U	900 U	940 U	2,000 U	900 U	1,100 U	--	--	--
n-Pentane	1,100 U	900 U	940 U	2,000 U	900 U	1,100 U	--	--	--
o-Xylene	1,100 U	900 U	940 U	2,000 U	900 U	1,100 U	--	--	--
Toluene	1,100 U	900 U	940 U	2,000 U	900 U	1,100 U	7,000	7,000	--
SVOCs (µg/kg)									
2-Methylnaphthalene	60 UJ	61 UJ	61 UJ	99 J	63 UJ	60 UJ	--	--	45,800

Notes
1. Data qualifiers are as follows:
U = the analyte was not detected at value to the left, which is the reporting limit.
J = Analyte was detected; value is estimated.
UJ = Analyte not detected. Value shown is estimatd laboratory reporting limit.
-- = not established.
2. Results presented in **bold** exceed cleanup levels from the DCAP (AMEC Geomatrix, 2010).
3. Cleanup level is the cleanup level agreed upon with Ecology and presented in the DCAP.
4. Value presented is for total xylenes

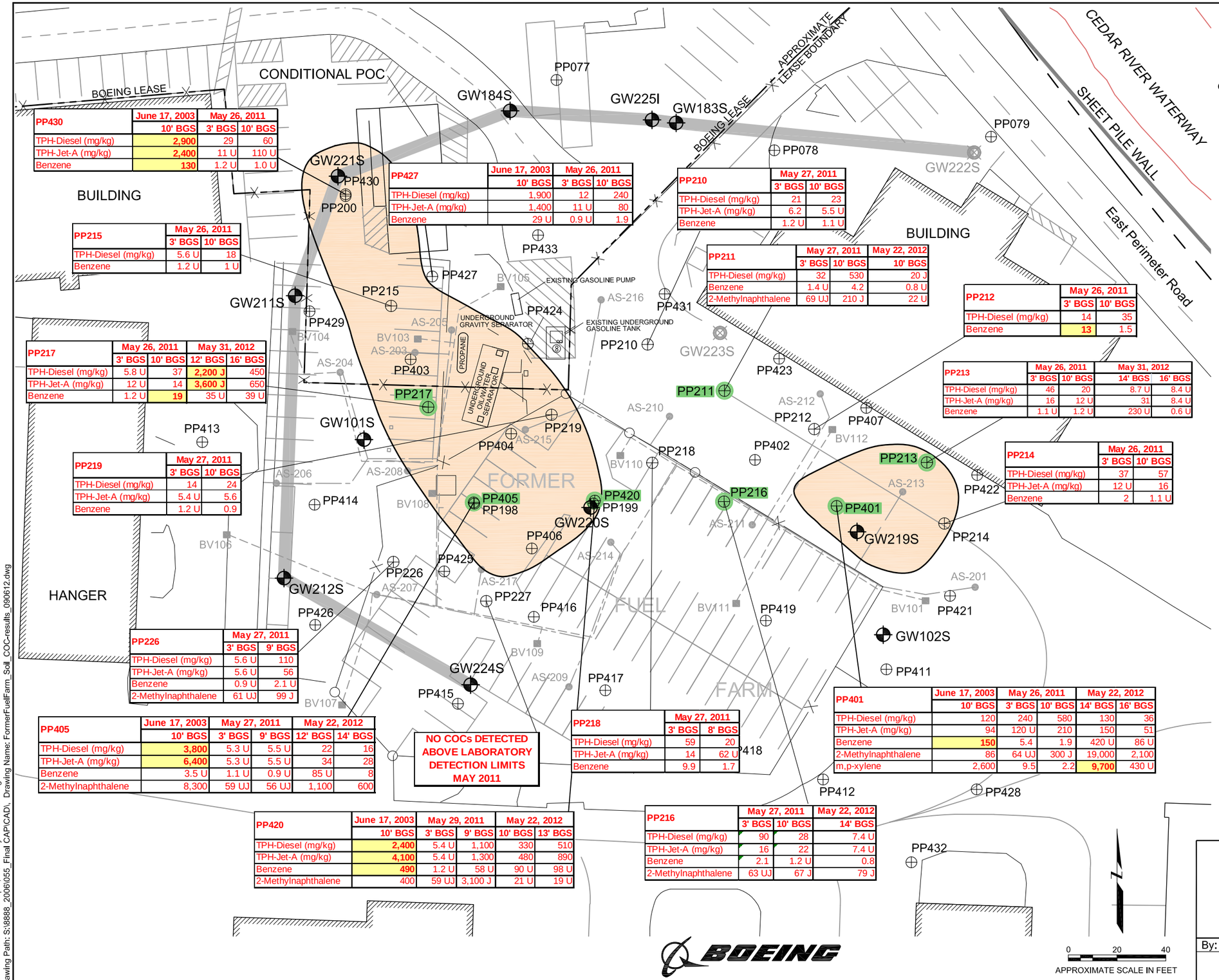
Abbreviations
µg/kg = micrograms per kilogram
BTEX = benzene, toluene, ethylbenzene, xylenes
DCAP = Draft Final Cleanup Action Plan
EPH = extractable petroleum hydrocarbons
ft bgs= feet below ground surface
mg/kg = milligrams per kilogram
MTCA = Model Toxics Control Act
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons
VPH = volatile petroluem hydrocarbons



FORMER FUEL FARM SITE MAP
Boeing Renton Facility
Renton, Washington

By: APS	Date: 08/10/12	Project No. 8888
		Figure 1

Plot Date: 08/10/12 - 11:42am, Plotted by: mike.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\, Drawing Name: FormerFuelFarm_ProposedCleanupAction_081012.dwg



PP430	June 17, 2003	May 26, 2011	
	10' BGS	3' BGS	10' BGS
TPH-Diesel (mg/kg)	2,900	29	60
TPH-Jet-A (mg/kg)	2,400	11 U	110 U
Benzene	130	1.2 U	1.0 U

PP427	June 17, 2003	May 26, 2011	
	10' BGS	3' BGS	10' BGS
TPH-Diesel (mg/kg)	1,900	12	240
TPH-Jet-A (mg/kg)	1,400	11 U	80
Benzene	29 U	0.9 U	1.9

PP210	May 27, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	21	23
TPH-Jet-A (mg/kg)	6.2	5.5 U
Benzene	1.2 U	1.1 U

PP215	May 26, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	5.6 U	18
Benzene	1.2 U	1 U

PP211	May 27, 2011		May 22, 2012
	3' BGS	10' BGS	10' BGS
TPH-Diesel (mg/kg)	32	530	20 J
Benzene	1.4 U	4.2	0.8 U
2-Methylnaphthalene	69 UJ	210 J	22 U

PP212	May 26, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	14	35
Benzene	13	1.5

PP217	May 26, 2011		May 31, 2012	
	3' BGS	10' BGS	12' BGS	16' BGS
TPH-Diesel (mg/kg)	5.8 U	37	2,200 J	450
TPH-Jet-A (mg/kg)	12 U	14	3,600 J	650
Benzene	1.2 U	19	35 U	39 U

PP213	May 26, 2011		May 31, 2012	
	3' BGS	10' BGS	14' BGS	16' BGS
TPH-Diesel (mg/kg)	46	20	8.7 U	8.4 U
TPH-Jet-A (mg/kg)	16	12 U	31	8.4 U
Benzene	1.1 U	1.2 U	230 U	0.6 U

PP214	May 26, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	37	57
TPH-Jet-A (mg/kg)	12 U	16
Benzene	2	1.1 U

PP219	May 27, 2011	
	3' BGS	10' BGS
TPH-Diesel (mg/kg)	14	24
TPH-Jet-A (mg/kg)	5.4 U	5.6
Benzene	1.2 U	0.9

PP226	May 27, 2011	
	3' BGS	9' BGS
TPH-Diesel (mg/kg)	5.6 U	110
TPH-Jet-A (mg/kg)	5.6 U	56
Benzene	0.9 U	2.1 U
2-Methylnaphthalene	61 UJ	99 J

PP405	June 17, 2003	May 27, 2011		May 22, 2012	
	10' BGS	3' BGS	9' BGS	12' BGS	14' BGS
TPH-Diesel (mg/kg)	3,800	5.3 U	5.5 U	22	16
TPH-Jet-A (mg/kg)	6,400	5.3 U	5.5 U	34	28
Benzene	3.5 U	1.1 U	0.9 U	85 U	8
2-Methylnaphthalene	8,300	59 UJ	56 UJ	1,100	600

NO COCs DETECTED ABOVE LABORATORY DETECTION LIMITS MAY 2011

PP218	May 27, 2011	
	3' BGS	8' BGS
TPH-Diesel (mg/kg)	59	20
TPH-Jet-A (mg/kg)	14	62 U
Benzene	9.9	1.7

PP401	June 17, 2003	May 26, 2011		May 22, 2012	
	10' BGS	3' BGS	10' BGS	14' BGS	16' BGS
TPH-Diesel (mg/kg)	120	240	580	130	36
TPH-Jet-A (mg/kg)	94	120 U	210	150	51
Benzene	150	5.4	1.9	420 U	86 U
2-Methylnaphthalene	86	64 UJ	300 J	19,000	2,100
m,p-xylene	2,600	9.5	2.2	9,700	430 U

PP420	June 17, 2003	May 29, 2011		May 22, 2012	
	10' BGS	3' BGS	9' BGS	10' BGS	13' BGS
TPH-Diesel (mg/kg)	2,400	5.4 U	1,100	330	510
TPH-Jet-A (mg/kg)	4,100	5.4 U	1,300	480	890
Benzene	490	1.2 U	58 U	90 U	98 U
2-Methylnaphthalene	400	59 UJ	3,100 J	21 U	19 U

PP216	May 27, 2011		May 22, 2012
	3' BGS	10' BGS	14' BGS
TPH-Diesel (mg/kg)	90	28	7.4 U
TPH-Jet-A (mg/kg)	16	22	7.4 U
Benzene	2.1	1.2 U	0.8
2-Methylnaphthalene	63 UJ	67 J	79 J

LEGEND

- PP212 — PUSH PROBE LOCATION
- PP211 — PUSH PROBE LOCATION RE-SAMPLED IN MAY 2012
- GW101S — MONITORING WELL LOCATION
- GW223S — ABANDONED MONITORING WELL LOCATION
- AS-204 — FORMER UNDERGROUND AIR SPARGING WELL
- BV112 — FORMER UNDERGROUND BIOVENTING WELL
- UNDERGROUND BIOVENTING LINE
- UNDERGROUND AIR SPARGING LINE
- 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.
- CONDITIONAL POINT OF COMPLIANCE

CLEANUP LEVELS FROM DCAP

Analyte	Cleanup Level	Units
TPH-Diesel range	2,000	mg/kg
TPH-Jet A	2,000	mg/kg
Benzene	12	µg/kg
2-Methylnaphthalene	45,800	µg/kg
m,p-Xylene	9,000	µg/kg

13 = RESULT EXCEEDS CLEANUP LEVEL.

BGS	Below Ground Surface
COC	Constituent of Concern
DCAP	Draft Cleanup Action Plan, AMEC 2011
J	Reported result is estimated
TPH	Total Petroleum Hydrocarbons
U	Not detected at laboratory reporting limit
UJ	Not detected at estimated laboratory reporting limit

NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
2. PIPING LOCATIONS APPROXIMATE
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 18 FEET IN DEPTH. 'I' DESIGNATION INDICATES WELL SCREENED GREATER THAN 18 FEET IN DEPTH.
4. ALL UNITS IN µg/kg UNLESS OTHERWISE SPECIFIED.
5. FIELD DUPLICATE COLLECTED AT PP420 IN JUNE 2003 AND AT PP216 IN JUNE 2012. HIGHEST DETECTED CONCENTRATION BETWEEN PRIMARY AND FIELD DUPLICATE IS REPORTED ON THE FIGURE.

0 20 40
APPROXIMATE SCALE IN FEET

SUMMARY OF 2011 AND 2012 SOIL ANALYTICAL RESULTS FORMER FUEL FARM
Boeing Renton Facility
Renton, Washington

By: APS	Date: 09/24/12	Project No. 8888
amec		Figure 2

Plot Date: 09/24/12 - 4:58pm Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\ Drawing Name: FormerFuelFarm_Soil_COC-results_090612.dwg

PROJECT: Boeing Renton Former Fuel Farm Boeing Renton Facility	**Log of Boring No. PP211**
BORING LOCATION: Boeing Renton Former Fuel Farm	ELEVATION AND DATUM:
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 5/22/12 / DATE FINISHED: 5/22/12
DRILLING METHOD: Direct push	TOTAL DEPTH (ft.): 20.0 / MEASURING POINT: Ground
DRILLING EQUIPMENT: Power Probe 9630	DEPTH TO WATER (ft.) — FIRST: 9 / COMPL.: NA
SAMPLING METHOD: Geoprobe macro-core sampler [4' x 2.25"]	LOGGED BY: C. Jefferson
HAMMER WEIGHT: / DROP:	RESPONSIBLE PROFESSIONAL: J.D. Long / REG. NO.: LHg 1354

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	REMARKS
1				0.4	SILTY SAND (SM): brown (7.5YR 5/2), moist, 60% fine sand, 5% medium sand, 25% non-plastic fines, 10% fine gravel dark gray (7.5YR 4/1),	
2				0.4	40% fine sand, 20% medium sand, 30% non-plastic fines, 10% fine gravel	OVM readings taken from headspace in Ziploc bags using a Photovac 2020 calibrated with 100 ppm isobutylene.
3						
4				0.2		
5						
6				0.3	rock broken due to drilling	
7				0.3		
8				0.4		
9	RI-SB01-PP211-10				wet	Soil sample RI-SB01-PP211-10 (3x125 mL, 8x40 mL with NaHSO4 and 8x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH. Extra volume collected for MS/MSD.
10				5.8	SILT with SAND (ML): dark gray (7.5YR 4/1), wet, 60% medium plastic fines, 40% fine sand	
11						
12						No recovery from 12 to 16 feet due to a rock stuck in the shoe of sampler.
13						
14						
15						

PROJECT: Boeing Renton Former Fuel Farm
Boeing Renton Facility

Log of Boring No. PP211 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	REMARKS
16				0.7	SILT with SAND (ML): Continued	
17					POORLY-GRADED SAND with SILT (SP-SM): dark gray (7.5YR 4/1), wet, 35% fine sand, 40% medium sand, 15% coarse sand, 10% non-plastic fines	
18				0.9	SILT with SAND (ML): dark grayish brown (10YR 4/2), wet, 80% medium plastic fines, 20% fine sand	
19					dark gray (7.5YR 4/1)	
20					SILTY SAND (SM): dark gray (7.5YR 4/2), wet, 40% fine sand, 20% medium sand, 20% coarse sand, 20% non-plastic fines	
21					Bottom of boring at 20 feet BGS. Abandoned with hydrated bentonite chips.	
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						

OAKBOREV (REV. 8/2011)

PROJECT: Boeing Renton Former Fuel Farm Boeing Renton Facility	**Log of Boring No. PP213**
BORING LOCATION: Boeing Renton Former Fuel Farm	ELEVATION AND DATUM:
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 5/31/12 / DATE FINISHED: 5/31/12
DRILLING METHOD: Direct push	TOTAL DEPTH (ft.): 20.0 / MEASURING POINT: Ground
DRILLING EQUIPMENT: Power Probe 9600	DEPTH TO WATER (ft.) FIRST: NA / COMPL.: NA
SAMPLING METHOD: Geoprobe macro-core sampler [5' x 2.25"]	LOGGED BY: C. Jefferson
HAMMER WEIGHT: / DROP:	RESPONSIBLE PROFESSIONAL: J.D. Long / REG. NO.: LHg 1354

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	REMARKS
1				0.6	POORLY-GRADED SAND (SP-SM): dark grayish brown (10YR 4/2), moist, 80% fine sand, 10% medium sand, 10% non-plastic fines	
2				0.3		
3					SILTY SAND (SM): dark gray (10YR 4/1), moist, 65% fine sand, 15% medium sand, 20% non-plastic fines Woody debris observed from 2 to 2.25 feet	OVM readings taken from headspace in Ziploc bags using a Photovac 2020 calibrated with 100 ppm isobutylene.
4						
5				0.3		
6				0.1	POORLY-GRADED SAND with SILT and GRAVEL (SP-SM): dark grayish brown (10YR 4/2), moist, 40% fine sand, 10% medium sand, 20% coarse sand, 20% fine gravel, 10% non-plastic fines	
7				0.2	POORLY-GRADED SAND (SP): gray (10YR 5/1), moist, 100% fine sand	
8				0.4		
9						
10				0.3		
11				1.5	SILTY SAND (SM): dark grayish brown (10YR 4/2), moist, 75% fine sand, 10% medium sand, 15% non-plastic fines	
12				2.0	very dark gray (10YR 3/1) silt lens with organics dark grayish brown (10YR 4/2) silt lens with organics POORLY-GRADED SAND (SP): very dark gray (10YR 3/1), moist, 85% fine sand, 10% medium sand, 5% non-plastic fines	
13	RI-SB01-PP213-14			1674		Soil sample RI-SB01-PP213-14 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
14				1542	SILT (ML): very dark gray (10YR 3/1), moist, 100% medium plastic fines gravel lens	
15						

PROJECT: Boeing Renton Former Fuel Farm
Boeing Renton Facility

Log of Boring No. PP213 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		REMARKS
16	RI-SB01-PP213-16			1713	POORLY-GRADED SAND with SILT (SP-SM): 40% medium sand, 30% coarse sand, 20% fine sand, 10% non-plastic fines		Soil sample RI-SB01-PP213-16 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
				1655			
17					SILT (ML): very dark gray (10YR 3/1), moist, 100% medium plastic fines		
				273			
18				7.3			
19				3.8			
					organics		
20					Bottom of boring at 20 feet BGS. Abandoned with hydrated bentonite chips.		
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							

OAKBOREV (REV. 8/2011)

PROJECT: Boeing Renton Former Fuel Farm Boeing Renton Facility	**Log of Boring No. PP216**
BORING LOCATION: Boeing Renton Former Fuel Farm	ELEVATION AND DATUM:
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 5/22/12 / DATE FINISHED: 5/22/12
DRILLING METHOD: Direct push	TOTAL DEPTH (ft.): 20.0 / MEASURING POINT: Ground
DRILLING EQUIPMENT: Power Probe 9630	DEPTH TO WATER (ft.) — FIRST: 9 / COMPL.: NA
SAMPLING METHOD: Geoprobe macro-core sampler [4' x 2.25"]	LOGGED BY: C. Jefferson
HAMMER WEIGHT: / DROP:	RESPONSIBLE PROFESSIONAL: J.D. Long / REG. NO.: LHg 1354

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	REMARKS
1				3.4	SILTY SAND (SM): dark gray (7.5YR 4/1), moist, 40% fine sand, 30% medium sand, 20% non-plastic fines, 10% fine gravel	
2					SILTY SAND with GRAVEL (SM): dark gray (7.5YR 4/1), moist, 25% fine sand, 25% medium sand, 10% coarse sand, 25% non-plastic fines, 15% fine gravel	OVM readings taken from headspace in Ziploc bags using a Photovac 2020 calibrated with 100 ppm isobutylene.
3						
4				2.3	brown (7.5YR 4/2)	
5				0.9		
6				0.9		
7						
8				0.5		
9					POORLY-GRADED SAND with SILT (SP-SM): dark brown (7.5YR 3/3), wet, 90% fine sand, 10% non-plastic fines	
10				0.2	dark gray (7.5YR 4/1)	Soil sample RI-SB01-PP216-14 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
11					silt lens	
12				0.7	SILTY SAND (SM): 60% coarse sand, 10% medium sand, 10% fine sand, 20% non-plastic fines	
13	RI-SB01-216-14 RI-SB01-216-9-14			0.0		Duplicate soil sample RI-SB01-PP216-9-14 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
14				9.7	POORLY-GRADED SAND with SILT and GRAVEL (SP-SM): dark gray (7.5YR 3/1), wet, 10% coarse sand, 30% medium sand, 20% fine sand, 20% fine gravel, 10% non-plastic fines	
15						

PROJECT: Boeing Renton Former Fuel Farm
Boeing Renton Facility

Log of Boring No. PP216 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		REMARKS
16				0.6	POORLY-GRADED SAND with SILT and GRAVEL (SP-SM): Continued very coarse sand		
17					SILTY SAND (SM): brown (10YR 4/3), wet, 10% coarse sand, 60% medium sand, 20% fine sand, 10% non-plastic fines		
18				0.3 0.3			
19							
20					Boring completed at 20 feet BGS. Abandoned with hydrated bentonite chips.		
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OAKBOREV (REV. 8/2011)

PROJECT: Boeing Renton Former Fuel Farm Boeing Renton Facility	**Log of Boring No. PP217**
BORING LOCATION: Boeing Renton Former Fuel Farm	ELEVATION AND DATUM:
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 5/31/12 / DATE FINISHED: 5/31/12
DRILLING METHOD: Direct push	TOTAL DEPTH (ft.): 20.0 / MEASURING POINT: Ground
DRILLING EQUIPMENT: Power Probe 9600	DEPTH TO WATER (ft.) — FIRST: NA / COMPL.: NA
SAMPLING METHOD: Geoprobe macro-core sampler [4' x 2.25"]	LOGGED BY: C. Jefferson
HAMMER WEIGHT: / DROP:	RESPONSIBLE PROFESSIONAL: J.D. Long / REG. NO.: LHg 1354

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	REMARKS
					Surface Elevation:	
0				0.2	SILTY SAND (SM): dark gray (10YR 4/1), moist, 60% fine sand, 10% medium sand, 10% coarse sand, 15% non-plastic fines, 5% fine gravel	
1				0.7	POORLY-GRADED SAND with SILT (SP-SM): dark gray (10YR 4/1), moist, 90% fine sand, 10% non-plastic fines	
2				0.5		OVM readings taken from headspace in Ziploc bags using a Photovac 2020 calibrated with 100 ppm isobutylene.
3				0.5	SILTY SAND (SM): dark gray (10YR 4/1), moist, 70% fine sand, 30% non-plastic fines	
4						
5				0.9	70% fine sand, 10% medium sand, 20% non-plastic fines	
6				0.5	wood debris	
7				0.4	SILT (ML): dark grayish brown (10YR 4/2), moist, 80% medium plastic fines, 20% fine sand organics, 90% medium plastic fines, 10% fine sand	
8				11.3	red brick	
9						
10				0.4		Soil sample RI-SB01-PP217-12 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
11	RI-SB01-PP217-12			266	fines content decreases, woody debris observed SILTY SAND (SM): 80% fine sand, 5% medium sand, 15% non-plastic fines Wood debris observed at 11.5 feet bgs	
12				663	SILTY SAND with GRAVEL (SM): very dark gray (10YR 3/1), moist, 35% fine sand, 10% medium sand, 20% coarse sand, 20% fine gravel, 15% non-plastic fines	
13						
14						
15						

PROJECT: Boeing Renton Former Fuel Farm
Boeing Renton Facility

Log of Boring No. PP217 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	REMARKS
16	RI-SB01-PP217-16			609	POORLY-GRADED SAND with SILT (SP-SM): very dark gray (10YR 3/1), moist, 80% fine sand, 10% medium sand, 10% non-plastic fines	Soil sample RI-SB01-PP217-16 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
				342	POORLY-GRADED SAND with SILT and GRAVEL (SP-SM): very dark gray (10YR 3/1), moist, 30% fine sand, 20% medium sand, 20% coarse sand, 20% fine gravel, 10% non-plastic fines	
17				173	SILTY SAND (SM): very dark gray (10YR 3/1), moist, 60% fine sand, 10% medium sand, 30% non-plastic fines	
					POORLY-GRADED SAND with SILT and GRAVEL (SP-SM): very dark gray (10YR 3/1), moist, 45% fine sand, 20% medium sand, 10% coarse sand, 15% fine gravel, 10% non-plastic fines	
18				155		
19						
20					Bottom of boring at 20 feet BGS. Abandoned with hydrated bentonite chips.	
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OAKBOREV (REV. 8/2011)

PROJECT: Boeing Renton Former Fuel Farm Boeing Renton Facility		**Log of Boring No. PP401**	
BORING LOCATION: Boeing Renton Former Fuel Farm		ELEVATION AND DATUM:	
DRILLING CONTRACTOR: Cascade Drilling, Inc.		DATE STARTED: 5/22/12	DATE FINISHED: 5/22/12
DRILLING METHOD: Direct push		TOTAL DEPTH (ft.): 20.0	MEASURING POINT: Ground
DRILLING EQUIPMENT: Power Probe 9630		DEPTH TO WATER (ft.)	FIRST 9.5 / COMPL. NA
SAMPLING METHOD: Geoprobe macro-core sampler [4' x 2.25"]		LOGGED BY: C. Jefferson	
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL: J.D. Long	REG. NO. LHg 1354

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	REMARKS
1					SILTY SAND with GRAVEL (SM): dark gray (7.5YR 4/1), moist, 30% fine sand, 10% medium sand, 10% coarse sand, 35% non-plastic fines, 15% fine gravel	
2				0.3		OVM readings taken from headspace in Ziploc bags using a Photovac 2020 calibrated with 100 ppm isobutylene.
3						
4				0.4	brown (7.5YR 4/2)	
5						
6				0.3		
7						
8				0.7	SILTY SAND (SM): brown (7.5YR 4/2), moist, 30% fine sand, 20% medium sand, 10% coarse sand, 40% non-plastic fines	
9						
10				19.4 6.8	wet	
11					POORLY-GRADED SAND (SP): dark gray (7.5YR 4/1), wet, 80% fine sand, 15% medium sand, 5% non-plastic fines	
12				212		
13	RI-SB23-PP401-14			344		Soil sample RI-SB23-PP401-14 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
14				1670	ML lenses	
15						

PROJECT: Boeing Renton Former Fuel Farm
Boeing Renton Facility

Log of Boring No. PP401 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		REMARKS
16	RI-SB23-PP401-16			73.9 783	SILT (ML): dark gray (7.5YR 4/1), wet, 100% medium plastic fines POORLY-GRADED SAND (SP):		Soil sample RI-SB23-PP401-16 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
17							
18				485			
19							
20					Bottom of boring at 20 feet BGS. Abandoned with hydrated bentonite chips.		
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22							
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OAKBOREV (REV. 8/2011)

PROJECT: Boeing Renton Former Fuel Farm Boeing Renton Facility	**Log of Boring No. PP405**
BORING LOCATION: Boeing Renton Former Fuel Farm	ELEVATION AND DATUM:
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 5/22/12 / DATE FINISHED: 5/22/12
DRILLING METHOD: Direct push	TOTAL DEPTH (ft.): 20.0 / MEASURING POINT: Ground
DRILLING EQUIPMENT: Power Probe 9630	DEPTH TO WATER (ft.) FIRST: 9.5 / COMPL.: NA
SAMPLING METHOD: Geoprobe macro-core sampler [4' x 2.25"]	LOGGED BY: C. Jefferson
HAMMER WEIGHT: / DROP:	RESPONSIBLE PROFESSIONAL: J.D. Long / REG. NO.: LHg 1354

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	REMARKS
1					SILTY SAND with GRAVEL (SM): dark brown (7.5YR 3/2), moist, 20% coarse sand, 30% medium sand, 15% fine sand, 20% non-plastic fines, 15% fine gravel	
2				0.0	10% coarse sand, 40% medium sand, 15% fine sand, 20% non-plastic fines, 15% fine gravel	OVM readings taken from headspace in Ziploc bags using a Photovac 2020 calibrated with 100 ppm isobutylene.
3						
4				0.0		
5				0.1	SILTY SAND (SM): dark grayish brown (10YR 10/2), moist, 15% coarse sand, 40% medium sand, 20% fine sand, 15% non-plastic fines, 10% fine gravel	
6				0.0		
7				0.2		
8						
9				0.2	wet	
10				0.0	POORLY-GRADED SAND with SILT (SP-SM): very dark gray (7.5YR 3/1), wet, 90% coarse sand, 10% non-plastic fines	
11	RI-SB23-PP405-12			54.8	SILTY SAND with GRAVEL (SM): dark gray (7.5YR 4/1), wet, 30% fine sand, 30% medium sand, 5% coarse sand, 20% non-plastic fines, 15% fine gravel ML lens	Soil sample RI-SB23-PP405-12 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
12				117	SILTY SAND (SM): very dark gray (7.5YR 3/1), moist, 60% fine sand, 40% non-plastic fines	
13	RI-SB23-PP405-14			0.3		Soil sample RI-SB23-PP405-14 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
14				60.1		
15						

PROJECT: Boeing Renton Former Fuel Farm
Boeing Renton Facility

Log of Boring No. PP405 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		REMARKS
16				2.4	SILTY SAND (SM): Continued wet, 70% fine sand, 15% medium sand, 15% non-plastic fines		
17							
18				2.0			
19							
20				0.8	Bottom of boring at 20 feet BGS. Abandoned with hydrated bentonite chips.		
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OAKBOREV (REV. 8/2011)

PROJECT: Boeing Renton Former Fuel Farm Boeing Renton Facility	**Log of Boring No. PP420**	
BORING LOCATION: Boeing Renton Former Fuel Farm	ELEVATION AND DATUM:	
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 5/22/12	DATE FINISHED: 5/22/12
DRILLING METHOD: Direct push	TOTAL DEPTH (ft.): 20.0	MEASURING POINT: Ground
DRILLING EQUIPMENT: Power Probe 9630	DEPTH TO WATER (ft.) FIRST: 9	COMPL.: NA
SAMPLING METHOD: Geoprobe macro-core sampler [4' x 2.25"]	LOGGED BY: C. Jefferson	
HAMMER WEIGHT: / DROP:	RESPONSIBLE PROFESSIONAL: J.D. Long	REG. NO.: LHg 1354

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	REMARKS
1					SILTY SAND with GRAVEL (SM): black (7.5YR 2.5/1), moist, 10% fine sand, 30% medium sand, 15% fine sand, 30% fines non-plastic fines, 15% fine gravel	
2				0.1	SILTY SAND (SM): brown (7.5YR 4/2), moist, 40% fine sand, 15% medium sand, 15% coarse sand, 20% non-plastic fines, 10% fine gravel	OVM readings taken from headspace in Ziploc bags using a Photovac 2020 calibrated with 100 ppm isobutylene.
3						
4				0.3		
5						
6				0.4		
7						
8				0.4	SILTY SAND (SM): dark gray (7.5YR 4/1), moist, 40% fine sand, 10% medium sand, 10% coarse sand, 30% non-plastic fines, 10% fine gravel	Soil sample RI-SB23-PP420-10 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
9	RI-SB23-PP420-10			365	wet	
10						
11						Soil sample RI-SB23-PP420-13 (3x125 mL, 2x40 mL with NaHSO4 and 2x40 mL with MeOH) collected for TPH-Dx, TPH-Jet, BTEX, 2-methylnapthalene, VPH and EPH.
12	RI-SB23-PP420-13			325		
13				754	woody debris, visible sheen	
14				737		
15						

PROJECT: Boeing Renton Former Fuel Farm
Boeing Renton Facility

Log of Boring No. PP420 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	REMARKS
				4.8	SILTY SAND (SM): Continued	
				14.2		
16				163	SANDY SILT (ML): dark gray (7.5YR 4/1), wet, 75% medium plastic fines, 25% fine sand, visible sheen	
17						
18				8.0		
					woody debris and organics	
19						
				1.6		
20					Bottom of boring at 20 feet BGS. Abandoned with hydrated bentonite chips.	
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OAKBOREV (REV. 8/2011)

Memo

To:	Dave Haddock	Project:	0088880080.0040
From:	Crystal Neirby	cc:	Project File
Tel:	(206) 342-1760		
Fax:	(206) 342-1761		
Date:	September 10, 2012		

Subject: Boeing Renton Former Fuel Farm Investigation – May 2012
Summary Data Quality Review – SDGs BNX71 and BNX77

This memorandum presents a summary data quality review for analyses of 12 primary soil samples, one soil field duplicate, four trip blanks, and one field blank collected on May 22 and 31, 2012. The samples were submitted to Lancaster Laboratories, Inc. (LLI), located in Lancaster, Pennsylvania, a laboratory accredited by the Washington State Department of Ecology (Ecology). The samples were analyzed for one or more of the following analytes:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX) by U.S. Environmental Protection Agency (EPA) Method 8260C;
- Total petroleum hydrocarbons (TPH) as diesel (TPH-Dx) plus Jet-A (TPH-Jet A) ranges by Ecology method NWTPH-Dx;
- Volatile petroleum hydrocarbons (VPH) by Ecology Method NWTPH-VPH;
- Extractable petroleum hydrocarbons (EPH) by Ecology Method NWTPH-EPH; and
- 2-Methylnaphthalene by EPA Method 8270D.

The samples and the analyses conducted on the samples are listed below.

Sample ID	Date Collected	SDG	Laboratory Sample ID	Analyses
RI-SB23-PP405-12	5/22/2012	BNX71	6665551	all
RI-SB23-PP405-14	5/22/2012	BNX71	6665552	all
RI-SB23-PP420-13	5/22/2012	BNX71	6665553	all
RI-SB23-PP420-10	5/22/2012	BNX71	6665554	all
RI-SB01-PP216-14	5/22/2012	BNX71	6665555	all
RI-SB01-PP216-9-14 (soil field duplicate)	5/22/2012	BNX71	6665556	all
RI-SB01-PP211-10	5/22/2012	BNX71	6665557	all
RI-SB23-PP401-14	5/22/2012	BNX71	6665558	all
RI-SB23-PP401-16	5/22/2012	BNX71	6665559	all
Trip Blank	5/22/2012	BNX71	6665561	BTEX
Trip Blank	5/22/2012	BNX71	6665562	VPH

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 Collected	SDG	Laboratory Sample ID	Analyses
RI-SB01-PP213-14	5/31/2012	BNX77	6674330	all
RI-SB01-PP213-16	5/31/2012	BNX77	6674331	all
RI-SB01-PP217-12	5/31/2012	BNX77	6674332	all
RI-SB01-PP217-16	5/31/2012	BNX77	6674333	all
Field Blank	5/31/2012	BNX77	6674334	all
Trip Blank	5/31/2012	BNX77	6674335	BTEX
Trip Blank	5/31/2012	BNX77	6674336	VPH

Data were reviewed in accordance with the appropriate method procedures and criteria documented in the Draft 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), laboratory duplicates (LCSD), blank spike samples, 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 guidance documents (EPA, 2008).

Samples were submitted to the laboratory each day upon completion of sampling. Upon receipt by LLI, the sample jar information was compared to the chain-of-custody (COC) form. The temperatures of the coolers were recorded as part of the check-in procedure, and all were below the maximum acceptable temperature of 6 degrees Celsius (°C).

The following observations were noted by laboratory personnel upon sample receipt.

- SDG BNX71: A field blank was indicated on the chain-of-custody though bottles were not submitted in the associated cooler. In addition, a trip blank was submitted but not indicated on the chain-of-custody. The chain-of-custody was revised to reflect samples submitted and the laboratory proceeded with analysis.
- SDG BNX77: Though all of the analyses were requested for the trip blanks included with this SDG, trip blanks are only analyzed for BTEX and VPH. The trip blanks were logged in for analysis of BTEX and VPH, and the laboratory proceeded with analysis.

ORGANIC ANALYSES

Samples were analyzed for the analytes listed in the introduction of this report. Laboratory data were evaluated for the parameters shown below:

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

One field blank was collected and submitted with SDG BNX77. The field blank was submitted for all analyses and was free of contamination except for C21 through C34 aliphatics in the VPH analysis. C21 through C34 aliphatics were not detected in any of the associated samples; therefore, sample results were not affected and were not qualified.

3. Surrogates – Acceptable except as noted:

VPH by Ecology NWTPH-VPH
SDG BNX71: The surrogate trifluorotoluene-P was recovered at 143 percent, greater than the control limits of 60 to 140 percent in the LCS associated with batch 12153A08A. The associated LCS recoveries were within the control limits; therefore, sample results are not affected and are not qualified.

Both surrogates (trifluorotoluene-P and trifluorotoluene-F) were outside of the control limits in the initial and diluted analyses of sample RI-SB23-PP420-13. The surrogate trifluorotoluene-P was below the lower control limit and trifluorotoluene-F was above the upper control limit. Additionally, both surrogates were above the upper control limit in the diluted analysis of sample RI-SB23-PP401-14 The results reported from both the initial and diluted analysis of sample RI-SB23-PP420-13 are qualified as estimated, with detected compounds flagged with a "J" and non-detected compounds flagged with a "UJ." The results reported from the diluted analysis of sample RI-SB23-PP401-14 are qualified as estimated, with detected compounds flagged with a "J" and non-detected compounds flagged with a "UJ."

Both surrogates (trifluorotoluene-P and trifluorotoluene-F) were below the control limits in the analysis of the trip blank. The sample results are not qualified by the possible low bias exhibited in the trip blank.

The surrogate trifluorotoluene-P was also above the upper control limit in the LCS sample associated with batch number 12153A08A. The LCS recoveries were within the control limits; therefore, the results are unaffected by the possible high bias and are not qualified.

SDG BNX77: Both surrogates (trifluorotoluene-P and trifluorotoluene-F) were above the upper control limit in the initial analysis of sample RI-SB01-PP213-14. The sample required high dilutions to quantitate high concentrations of target analytes; therefore, sample results are not qualified.

TPH by NWTPH-Dx
SDGs BNX71 and BNX77: The surrogate chlorobenzene was not recovered in the analysis of samples RI-SB23-PP420-13 and RI-SB01-PP217-12. The low recoveries equate to a possible low bias in the sample; therefore, results are qualified as estimated with detections flagged with a "J" and non-detections flagged with a "UJ."

BTEX by EPA 8260C
SDG BNX77: The recovery of surrogate toluene-d8 was 35 percent in the initial analysis of sample RI-SB01-PP213-16, less than the control limits of 52 to 141 percent. The sample was reanalyzed with similar surrogate recoveries. The results are reported from the initial analysis and qualified as estimated with detections flagged with a "J" and non-detections flagged with a "UJ."

4. LCS/LCSD – Acceptable

5. MS/MSD – Acceptable except as noted:

   BTEX by EPA 8260C
   SDG BNX71: The MS/MSD relative percent differences (RPDs) for ethylbenzene, m,p-xylene, and o-xylene ranged from 35 to 38 percent, greater than the control limit of 30 percent, in the MS/MSD performed using sample RI-SB01-PP211-10. The individual recoveries were acceptable; therefore, sample results were not affected and were not qualified.

   EPH by Ecology NWTPH-EPH
   SDG BNX71: The MS/MSD RPDs for C21 through C34 aliphatics and C21 through C34 aromatics were 50 and 48 percent, respectively, greater than the control limit of 25 percent, in the MS/MSD performed using sample RI-SB01-PP211-10. The individual recoveries were acceptable; therefore, sample results were not affected and were not qualified.

   VPH by Ecology NWTPH-VPH
   SDG BNX71: The MS/MSD recoveries in the analysis performed with sample RI-SB01-PP211-10 were outside of the control limits of 70 to 130 percent as follows: C5 through C6 aliphatics at 68 percent in the MS; C6 through C8 aliphatics at 60 percent in the MS; C8 through C10 aliphatics at 141 and 150 percent in the MS and MSD, respectively; and C8 through C10 aromatics at 490 and 523 percent in the MS and MSD, respectively. The affected compounds were not detected in sample RI-SB01-PP211-10 and therefore are affected only by low recoveries. The results for C5 through C6 aliphatics and C6 through C8 aliphatics in sample RI-SB01-PP211-10 are qualified as estimated and flagged with a "UJ."

6. Laboratory Duplicates – Acceptable except as noted:

   TPH by NWTPH-Dx
   SDG BNX71: The laboratory duplicate RPDs were not calculated for the duplicate performed with sample RI-SB01-PP211-10, since the concentrations of the analytes were less than five times the reporting limit. An alternate criterion is to compare the difference between the primary and duplicate concentrations to the value of the reporting limit. The laboratory duplicate results for diesel and motor oil failed the alternate criteria. Therefore, the results for diesel and motor oil in sample RI-SB01-PP211-10 are qualified as estimated and flagged with a "J."

7. Field Duplicates – Acceptable

   One field duplicate was submitted during this sampling event, meeting the project frequency requirement of 5 percent or 1 for every 20 samples. Sample RI-SB01-PP216-9-14 was collected as a field duplicate of sample RI-SB01-PP216-14. The field duplicate RPDs could not be calculated because all results for the primary samples and duplicates were either below laboratory detection limits or the concentrations were less than five times the value of the reporting limit. An alternate criterion for results that are less than five times the value of the reporting limit is to compare the difference between the primary and duplicate concentrations to the value of the reporting limit. The field duplicate results for 2-methylnaphthalene failed the alternate criteria. Therefore, the 2-methylnaphthalene results in samples RI-SB01-PP216-9-14 and RI-SB01-PP216-14 are qualified as estimated and flagged with a "J."

8. Reporting Limits – Acceptable except as noted:

   VPH by Ecology NWTPH-VPH
   SDG BNX71: The laboratory applied an "E" flag to the following results to indicate that the results were greater than the calibration range of the instrument: C6-C8 aliphatics, C8-C10 aliphatics, and C8-C10 aromatics in sample RI-SB23-PP420-13; C8-C10 aliphatics in sample RI-SB23-PP420-10; C6-C8 aliphatics in sample RI-SB23-PP401-14; and C6-C8 aliphatics in sample RI-SB01-PP213-14. The samples were diluted and reanalyzed. The affected analytes are reported from the reanalysis, and all other compounds are reported from the initial analysis.

OVERALL ASSESSMENT OF DATA

The completeness of SDGs BNX71 and BNX77 is 100 percent. Evaluation of the usefulness of this data is based on EPA guidance documents listed in the introduction to this report. Few problems were identified and analytical performance was generally within specified limits. The data, as qualified, meet the project's data quality objectives.

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
RI-SB23-PP405-12		none		
RI-SB23-PP405-14		none		
RI-SB23-PP420-13	VPH	benzene C5-C6 aliphatics C6-C8 aliphatics C8-C10 aliphatics C8-C10 aromatics ethylbenzene methyl t-butyl ether toluene o-xylene m,p-xylenes	0.776 UJ 7.76 UJ 299 J 1,290 J 887 J 8.63 J 0.776 UJ 5.26 J 3.68 J 1.55 UJ	Surrogate recoveries

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
	TPH-Dx	DRO C12-C24 HRO C24-C40 TPH-Jet A C8-C18	510 J 170 UJ 890 J	
RI-SB23-PP420-10		none		
RI-SB01-PP216-14	SVOCs	2-methylnaphthalene	35 J	field duplicate RPD
RI-SB01-PP216-9-14	SVOCs	2-methylnaphthalene	79 J	field duplicate RPD
RI-SB01-PP211-10	VPH TPH-Dx	C5-C6 aliphatics C6-C8 aliphatics DRO C12-C24 HRO C24-C40	12.4 UJ 12.4 UJ 20 J 82 J	MS/MSD recoveries Laboratory duplicate RPD
RI-SB23-PP401-14	VPH	C6-C8 aliphatics	847 J	Surrogate recoveries
RI-SB23-PP401-16	VPH	C6-C8 aliphatics C8-C10 aliphatics	176 J 17.9 J	surrogate recoveries
Trip Blank		none		
Trip Blank		none		
RI-SB01-PP213-14		none		
RI-SB01-PP213-16	BTEX	benzene ethylbenzene toluene m,p-xylene o-xylene	0.6 UJ 3 UJ 3 UJ 3 UJ 3 UJ	surrogate recoveries
RI-SB01-PP217-12	TPH-Dx	DRO C12-C24 HRO C24-C40 TPH-Jet A C8-C18	2,200 J 370 UJ 3,600 J	surrogate recoveries
RI-SB01-PP217-16		none		
Field Blank		none		
Trip Blank		none		
Trip Blank		none		

Notes
DRO = diesel-range organics
HRO = heavy range organics
J = Compound is positively identified, result is an estimate.
MS/MSD = matrix spike/matrix spike duplicates
RPD = relative percent difference
SVOCs = semivolatile organic compounds
TPH-Dx = total petroleum hydrocarbons as diesel
UJ = Compound was not detected, associated reporting limit is an estimate.
VPH = volatile petroleum hydrocarbons

REFERENCES

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

US Environmental Protection Agency (EPA), 2008, US EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review: EPA 540-R-08-01, June.

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Analysis Report

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ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

August 31, 2012

Project: Boeing_RTN: FFF

Submittal Date: 05/24/2012
Group Number: 1311382
SDG: BNX71
PO Number: 1101494065
State of Sample Origin: WA

Client Sample Description	Lancaster Labs (LLI) #
RI-SB23-PP405-12	6665551
RI-SB23-PP405-14	6665552
RI-SB23-PP420-13	6665553
RI-SB23-PP420-10	6665554
RI-SB01-PP216-14	6665555
RI-SB01-PP216-9-14	6665556
RI-SB01-PP211-10	6665557
RI-SB23-PP401-14	6665558
RI-SB23-PP401-16	6665559
Trip Blank	6665561
Trip Blank	6665562

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	The Boeing Company	Attn: Carl Bach
ELECTRONIC COPY TO	AMEC	Attn: Crystal Neirby
1 COPY TO	Data Package Group	

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Respectfully Submitted,

Rachel L. Kreamer

Rachel L. Kreamer
Group Leader

(717) 556-7221

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Analysis Report

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Sample Description: RI-SB23-PP405-12
Boeing_RTN: FFF

LLI Sample # SW 6665551
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 10:00 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

40512 SDG#: BNX71-01

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		ug/kg		ug/kg	
11995	Benzene	71-43-2	85	U	85	64.88
11995	Ethylbenzene	100-41-4	420	U	420	64.88
11995	Toluene	108-88-3	420	U	420	64.88
11995	m+p-Xylene	179601-23-1	420	U	420	64.88
11995	o-Xylene	95-47-6	420	U	420	64.88
	Reporting limits were raised due to interference from the sample matrix.					
GC/MS Semivolatiles	**SW-846 8270D**		ug/kg		ug/kg	
10726	**2-Methylnaphthalene**	91-57-6	**1,100**		22	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		mg/kg		mg/kg	
05970	**>C10-C12 Aliphatic**	n.a.	**650**		33	5
05970	**>C10-C12 Aromatic**	n.a.	**70**		6.5	1
05970	**>C12-C16 Aliphatic**	n.a.	**620**		33	5
05970	**>C12-C16 Aromatic**	n.a.	**210**		6.5	1
05970	>C16-C21 Aliphatic	n.a.	33	U	33	5
05970	**>C16-C21 Aromatic**	n.a.	**31**		6.5	1
05970	>C21-C34 Aliphatic	n.a.	65	U	65	5
05970	**>C21-C34 Aromatic**	n.a.	**11**		6.5	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		mg/kg		mg/kg	
05666	Benzene	71-43-2	0.549	U	0.549	42
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	5.49	U	5.49	42
05666	C6-C8 Aliphatic Hydrocarbons	n.a.	5.49	U	5.49	42
05666	C8-C10 Aliphatic Hydrocarbons	n.a.	5.49	U	5.49	42
05666	C8-C10 Aromatic Hydrocarbons	n.a.	5.49	U	5.49	42
05666	Ethylbenzene	100-41-4	0.549	U	0.549	42
05666	Methyl t-butyl ether	1634-04-4	0.549	U	0.549	42
05666	Toluene	108-88-3	0.549	U	0.549	42
05666	o-Xylene	95-47-6	0.549	U	0.549	42
05666	m,p-Xylenes	179601-23-1	1.10	U	1.10	42
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		mg/kg		mg/kg	
12093	**DRO C12-C24 w/Si Gel**	n.a.	**22**		9.0	1
12093	HRO C24-C40 w/Si Gel	n.a.	39	U	39	1
12093	**TPH JetA C8-C18 w/Si Gel**	n.a.	**34**		9.0	1
	TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.					
Wet Chemistry	**EPA 160.3 modified**		%		%	
00111	**Moisture**	n.a.	**23.5**		0.50	1

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Analysis Report

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Sample Description: RI-SB23-PP405-12
Boeing_RTN: FFF

LLI Sample # SW 6665551
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 10:00 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

40512 SDG#: BNX71-01

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation	Dilution Factor
Wet Chemistry	**EPA 160.3 modified**		%	%	

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	R121562AA	06/04/2012 22:56	Andrea E Lando	64.88
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	1	201214627757	05/22/2012 10:00	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	2	201214627757	05/22/2012 10:00	Client Supplied	1
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035	1	201214627757	05/22/2012 10:00	Client Supplied	1
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12146SLB026	05/27/2012 12:16	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12146SLB026	05/26/2012 11:30	Sally L Appleyard	1
06647	GC-5g Field Preserved MeOH	SW-846 5035	1	201214627757	05/22/2012 10:00	Client Supplied	n.a.
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/02/2012 16:37	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/03/2012 18:54	Heather E Williams	5
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12153A08A	06/01/2012 12:49	Nicholas R Rossi	42
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121500031A	05/30/2012 23:57	Heather E Williams	1
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121500031A	05/30/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121520027A	05/31/2012 18:10	Sally L Appleyard	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121520027A	06/01/2012 14:45	Edwin Ortiz	1
00111	Moisture	EPA 160.3 modified	1	12150820004A	05/29/2012 11:48	William C Schwebel	1

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Analysis Report

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Sample Description: RI-SB23-PP405-14
Boeing_RTN: FFF

LLI Sample # SW 6665552
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 10:18 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

40514 SDG#: BNX71-02

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		**ug/kg**		**ug/kg**	
11995	**Benzene**	71-43-2	**8**		0.7	0.48
11995	Ethylbenzene	100-41-4	4	U	4	0.48
11995	Toluene	108-88-3	4	U	4	0.48
11995	m+p-Xylene	179601-23-1	4	U	4	0.48
11995	o-Xylene	95-47-6	4	U	4	0.48
GC/MS Semivolatiles	**SW-846 8270D**		**ug/kg**		**ug/kg**	
10726	**2-Methylnaphthalene**	91-57-6	**600**		26	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		**mg/kg**		**mg/kg**	
05970	**>C10-C12 Aliphatic**	n.a.	**450**		7.7	1
05970	**>C10-C12 Aromatic**	n.a.	**34**		7.7	1
05970	**>C12-C16 Aliphatic**	n.a.	**470**		7.7	1
05970	**>C12-C16 Aromatic**	n.a.	**110**		7.7	1
05970	**>C16-C21 Aliphatic**	n.a.	**36**		7.7	1
05970	**>C16-C21 Aromatic**	n.a.	**19**		7.7	1
05970	**>C21-C34 Aliphatic**	n.a.	**23**		15	1
05970	**>C21-C34 Aromatic**	n.a.	**9.8**		7.7	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Benzene	71-43-2	1.52	U	1.52	98.98
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	15.2	U	15.2	98.98
05666	C6-C8 Aliphatic Hydrocarbons	n.a.	15.2	U	15.2	98.98
05666	C8-C10 Aliphatic Hydrocarbons	n.a.	15.2	U	15.2	98.98
05666	C8-C10 Aromatic Hydrocarbons	n.a.	15.2	U	15.2	98.98
05666	Ethylbenzene	100-41-4	1.52	U	1.52	98.98
05666	Methyl t-butyl ether	1634-04-4	1.52	U	1.52	98.98
05666	Toluene	108-88-3	1.52	U	1.52	98.98
05666	o-Xylene	95-47-6	1.52	U	1.52	98.98
05666	m,p-Xylenes	179601-23-1	3.03	U	3.03	98.98
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	**DRO C12-C24 w/Si Gel**	n.a.	**16**		11	1
12093	HRO C24-C40 w/Si Gel	n.a.	46	U	46	1
12093	**TPH JetA C8-C18 w/Si Gel**	n.a.	**28**		11	1

TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.

Wet Chemistry	**EPA 160.3 modified**		**%**		**%**	
00111	**Moisture**	n.a.	**34.7**		0.50	1

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Analysis Report

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Sample Description: RI-SB23-PP405-14
Boeing_RTN: FFF

LLI Sample # SW 6665552
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 10:18 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

40514 SDG#: BNX71-02

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation	Dilution Factor
Wet Chemistry	**EPA 160.3 modified**		%	%	

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	X121531AA	06/01/2012 18:34	Chelsea B Eastep	0.48
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	1	201214627757	05/22/2012 10:18	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	2	201214627757	05/22/2012 10:18	Client Supplied	1
06645	GC/MS-15g Field Preserv. MeOH	SW-846 5035	1	201214627757	05/22/2012 10:18	Client Supplied	n.a.
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12146SLB026	05/27/2012 13:30	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12146SLB026	05/26/2012 11:30	Sally L Appleyard	1
00388	GC - Field Preserved (MA-VPH)	SW-846 5035	1	201215027774	05/22/2012 10:18	Client Supplied	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/02/2012 19:36	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/02/2012 20:20	Heather E Williams	1
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12153A08A	06/01/2012 13:30	Nicholas R Rossi	98.98
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121500031A	05/31/2012 00:42	Heather E Williams	1
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121500031A	05/30/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121520027A	05/31/2012 18:10	Sally L Appleyard	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121520027A	06/01/2012 14:45	Edwin Ortiz	1
00111	Moisture	EPA 160.3 modified	1	12150820004A	05/29/2012 11:48	William C Schwebel	1

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Analysis Report

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Sample Description: RI-SB23-PP420-13
Boeing_RTN: FFF

LLI Sample # SW 6665553
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 11:40 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

42013 SDG#: BNX71-03

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		ug/kg		ug/kg	
11995	Benzene	71-43-2	98	U	98	86.21
11995	Ethylbenzene	100-41-4	490	U	490	86.21
11995	Toluene	108-88-3	490	U	490	86.21
11995	m+p-Xylene	179601-23-1	490	U	490	86.21
11995	o-Xylene	95-47-6	490	U	490	86.21
	Reporting limits were raised due to interference from the sample matrix.					
GC/MS Semivolatiles	**SW-846 8270D**		ug/kg		ug/kg	
10726	2-Methylnaphthalene	91-57-6	19	U	19	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		mg/kg		mg/kg	
05970	**>C10-C12 Aliphatic**	n.a.	**1,500**		140	25
05970	**>C10-C12 Aromatic**	n.a.	**85**		5.7	1
05970	**>C12-C16 Aliphatic**	n.a.	**1,500**		140	25
05970	**>C12-C16 Aromatic**	n.a.	**330**		5.7	1
05970	>C16-C21 Aliphatic	n.a.	140	U	140	25
05970	**>C16-C21 Aromatic**	n.a.	**58**		5.7	1
05970	>C21-C34 Aliphatic	n.a.	290	U	290	25
05970	**>C21-C34 Aromatic**	n.a.	**27**		5.7	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		mg/kg		mg/kg	
05666	Benzene	71-43-2	0.776	U J	0.776	68.03
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	7.76	UE J	7.76	68.03
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**250**	E DNR	7.76	68.03
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**764**	E DNR	7.76	68.03
05666	**C8-C10 Aromatic Hydrocarbons**	n.a.	**482**	E DNR	7.76	68.03
05666	**Ethylbenzene**	100-41-4	**8.63**	J	0.776	68.03
05666	Methyl t-butyl ether	1634-04-4	0.776	U J	0.776	68.03
05666	**Toluene**	108-88-3	**5.26**	J	0.776	68.03
05666	**o-Xylene**	95-47-6	**3.68**	J	0.776	68.03
05666	m,p-Xylenes	179601-23-1	1.55	U J	1.55	68.03
	Trial ID: REDL					
05666	Benzene	71-43-2	3.88	U DNR	3.88	340.17
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	38.8	U DNR	38.8	340.17
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**299**	J	38.8	340.17
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**1,290**	J	38.8	340.17
05666	**C8-C10 Aromatic Hydrocarbons**	n.a.	**887**	J	38.8	340.17

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Analysis Report

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Sample Description: RI-SB23-PP420-13
Boeing_RTN: FFF

LLI Sample # SW 6665553
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 11:40 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

42013 SDG#: BNX71-03

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	**Ethylbenzene**	100-41-4	**11.7**	DNR	3.88	340.17
05666	Methyl t-butyl ether	1634-04-4	3.88	U	3.88	340.17
05666	**Toluene**	108-88-3	**6.60**		3.88	340.17
05666	**o-Xylene**	95-47-6	**7.77**		3.88	340.17
05666	m,p-Xylenes	179601-23-1	7.76	U	7.76	340.17
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	**DRO C12-C24 w/Si Gel**	n.a.	**510**	J	40	5
12093	HRO C24-C40 w/Si Gel	n.a.	170	U J	170	5
12093	**TPH JetA C8-C18 w/Si Gel**	n.a.	**890**	J	40	5

TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.
The surrogate data is outside the QC limits due to unresolvable matrix problems evident in the sample chromatogram.

Wet Chemistry	**EPA 160.3 modified**		%		%	
00111	**Moisture**	n.a.	**12.3**		0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	R121562AA	06/04/2012 23:41	Andrea E Lando	86.21
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	1	201214627757	05/22/2012 11:40	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	2	201214627757	05/22/2012 11:40	Client Supplied	1
06645	GC/MS-15g Field Preserv. MeOH	SW-846 5035	1	201214627757	05/22/2012 11:40	Client Supplied	n.a.
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12146SLB026	05/27/2012 13:55	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12146SLB026	05/26/2012 11:30	Sally L Appleyard	1
00388	GC - Field Preserved (MA-VPH)	SW-846 5035	1	201215027774	05/22/2012 11:40	Client Supplied	1

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Analysis Report

REVISED

Sample Description: RI-SB23-PP420-13
Boeing_RTN: FFF

LLI Sample # SW 6665553
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 11:40 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

42013 SDG#: BNX71-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/02/2012 22:34	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/03/2012 19:39	Heather E Williams	25
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12153A08B	06/04/2012 13:15	Nicholas R Rossi	68.03
05666	WA- VPH soils	ECY 97-602 WA VPH	2-REDL	12153A08B	06/04/2012 18:45	Nicholas R Rossi	340.17
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121500031A	06/01/2012 15:32	Heather E Williams	5
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121500031A	05/30/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121520027A	05/31/2012 18:10	Sally L Appleyard	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121520027A	06/01/2012 14:45	Edwin Ortiz	1
00111	Moisture	EPA 160.3 modified	1	12150820004A	05/29/2012 11:48	William C Schwebel	1

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Analysis Report

REVISED

Sample Description: RI-SB23-PP420-10
Boeing_RTN: FFF

LLI Sample # SW 6665554
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 12:00 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

42010 SDG#: BNX71-04

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		**ug/kg**		**ug/kg**	
11995	Benzene	71-43-2	90	U	90	74.85
11995	Ethylbenzene	100-41-4	450	U	450	74.85
11995	Toluene	108-88-3	450	U	450	74.85
11995	m+p-Xylene	179601-23-1	450	U	450	74.85
11995	o-Xylene	95-47-6	450	U	450	74.85
	Reporting limits were raised due to interference from the sample matrix.					
GC/MS Semivolatiles	**SW-846 8270D**		**ug/kg**		**ug/kg**	
10726	2-Methylnaphthalene	91-57-6	21	U	21	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		**mg/kg**		**mg/kg**	
05970	>C10-C12 Aliphatic	n.a.	6.0	U	6.0	1
05970	>C10-C12 Aromatic	n.a.	6.0	U	6.0	1
05970	**>C12-C16 Aliphatic**	n.a.	**16**		6.0	1
05970	>C12-C16 Aromatic	n.a.	6.0	U	6.0	1
05970	**>C16-C21 Aliphatic**	n.a.	**11**		6.0	1
05970	>C16-C21 Aromatic	n.a.	6.0	U	6.0	1
05970	**>C21-C34 Aliphatic**	n.a.	**100**		12	1
05970	**>C21-C34 Aromatic**	n.a.	**48**		6.0	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Benzene	71-43-2	0.825	U	0.825	68.4
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	8.25	U	8.25	68.4
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**24.7**		8.25	68.4
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**393**	E DNR	8.25	68.4
05666	**C8-C10 Aromatic Hydrocarbons**	n.a.	**309**		8.25	68.4
05666	**Ethylbenzene**	100-41-4	**4.48**		0.825	68.4
05666	Methyl t-butyl ether	1634-04-4	0.825	U	0.825	68.4
05666	Toluene	108-88-3	0.825	U	0.825	68.4
05666	**o-Xylene**	95-47-6	**1.68**		0.825	68.4
05666	m,p-Xylenes	179601-23-1	1.65	U	1.65	68.4
	Trial ID: REDL					
05666	Benzene	71-43-2	4.13	U DNR	4.13	342.01
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	41.3	U	41.3	342.01
05666	C6-C8 Aliphatic Hydrocarbons	n.a.	41.3	U	41.3	342.01
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**643**		41.3	342.01
05666	**C8-C10 Aromatic Hydrocarbons**	n.a.	**463**	DNR	41.3	342.01
05666	**Ethylbenzene**	100-41-4	**5.30**	DNR	4.13	342.01

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Analysis Report

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Sample Description: RI-SB23-PP420-10
Boeing_RTN: FFF

LLI Sample # SW 6665554
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 12:00 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

42010 SDG#: BNX71-04

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Methyl t-butyl ether	1634-04-4	4.13	U DNR	4.13	342.01
05666	Toluene	108-88-3	4.13	U	4.13	342.01
05666	**o-Xylene**	95-47-6	**7.85**		4.13	342.01
05666	m,p-Xylenes	179601-23-1	8.25	U	8.25	342.01
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	**DRO C12-C24 w/Si Gel**	n.a.	**330**		8.4	1
12093	**HRO C24-C40 w/Si Gel**	n.a.	**240**		36	1
12093	**TPH JetA C8-C18 w/Si Gel**	n.a.	**480**		8.4	1

TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.

Wet Chemistry	**EPA 160.3 modified**		%		%	
00111	**Moisture**	n.a.	**17.1**		0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	R121562AA	06/05/2012 00:49	Andrea E Lando	74.85
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	1	201214627757	05/22/2012 12:00	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	2	201214627757	05/22/2012 12:00	Client Supplied	1
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035	1	201214627757	05/22/2012 12:00	Client Supplied	1
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12146SLB026	05/27/2012 14:20	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12146SLB026	05/26/2012 11:30	Sally L Appleyard	1
00388	GC - Field Preserved (MA-VPH)	SW-846 5035	1	201214627757	05/22/2012 12:00	Client Supplied	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/03/2012 07:29	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/03/2012 08:57	Heather E Williams	1

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Analysis Report

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Sample Description: RI-SB23-PP420-10
Boeing_RTN: FFF

LLI Sample # SW 6665554
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 12:00 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

42010 SDG#: BNX71-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12153A08B	06/04/2012 13:56	Nicholas R Rossi	68.4
05666	WA- VPH soils	ECY 97-602 WA VPH	2-REDL	12153A08B	06/04/2012 19:27	Nicholas R Rossi	342.01
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121500031A	05/31/2012 06:40	Heather E Williams	1
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121500031A	05/30/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121520027A	05/31/2012 18:10	Sally L Appleyard	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121520027A	06/01/2012 14:45	Edwin Ortiz	1
00111	Moisture	EPA 160.3 modified	1	12150820004A	05/29/2012 11:48	William C Schwebel	1

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Analysis Report

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Sample Description: RI-SB01-PP216-14
Boeing_RTN: FFF

LLI Sample # SW 6665555
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 13:10 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

21614 SDG#: BNX71-05

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		ug/kg		ug/kg	
11995	Benzene	71-43-2	0.5	U	0.5	0.41
11995	Ethylbenzene	100-41-4	2	U	2	0.41
11995	Toluene	108-88-3	2	U	2	0.41
11995	m+p-Xylene	179601-23-1	2	U	2	0.41
11995	o-Xylene	95-47-6	2	U	2	0.41
GC/MS Semivolatiles	**SW-846 8270D**		ug/kg		ug/kg	
10726	**2-Methylnaphthalene**	91-57-6	**35** J		19	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		mg/kg		mg/kg	
05970	>C10-C12 Aliphatic	n.a.	5.7	U	5.7	1
05970	>C10-C12 Aromatic	n.a.	5.7	U	5.7	1
05970	>C12-C16 Aliphatic	n.a.	5.7	U	5.7	1
05970	>C12-C16 Aromatic	n.a.	5.7	U	5.7	1
05970	>C16-C21 Aliphatic	n.a.	5.7	U	5.7	1
05970	>C16-C21 Aromatic	n.a.	5.7	U	5.7	1
05970	>C21-C34 Aliphatic	n.a.	11	U	11	1
05970	>C21-C34 Aromatic	n.a.	5.7	U	5.7	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		mg/kg		mg/kg	
05666	Benzene	71-43-2	0.802	U	0.802	70.15
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	8.02	U	8.02	70.15
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**22.6**		8.02	70.15
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**8.51**		8.02	70.15
05666	C8-C10 Aromatic Hydrocarbons	n.a.	8.02	U	8.02	70.15
05666	Ethylbenzene	100-41-4	0.802	U	0.802	70.15
05666	Methyl t-butyl ether	1634-04-4	0.802	U	0.802	70.15
05666	Toluene	108-88-3	0.802	U	0.802	70.15
05666	o-Xylene	95-47-6	0.802	U	0.802	70.15
05666	m,p-Xylenes	179601-23-1	1.60	U	1.60	70.15
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		mg/kg		mg/kg	
12093	DRO C12-C24 w/Si Gel	n.a.	8.0	U	8.0	1
12093	HRO C24-C40 w/Si Gel	n.a.	34	U	34	1
12093	TPH JetA C8-C18 w/Si Gel	n.a.	8.0	U	8.0	1

TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.

Wet Chemistry	**EPA 160.3 modified**		%		%	
00111	**Moisture**	n.a.	**12.5**		0.50	1

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Analysis Report

REVISED

Sample Description: RI-SB01-PP216-14
Boeing_RTN: FFF

LLI Sample # SW 6665555
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 13:10 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

21614 SDG#: BNX71-05

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation	Dilution Factor
Wet Chemistry	**EPA 160.3 modified**		%	%	

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	X121531AA	06/01/2012 19:19	Chelsea B Eastep	0.41
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	1	201214627757	05/22/2012 13:10	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	2	201214627757	05/22/2012 13:10	Client Supplied	1
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035	1	201214627757	05/22/2012 13:10	Client Supplied	1
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12146SLB026	05/27/2012 14:45	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12146SLB026	05/26/2012 11:30	Sally L Appleyard	1
00388	GC - Field Preserved (MA-VPH)	SW-846 5035	1	201214627757	05/22/2012 13:10	Client Supplied	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/02/2012 13:39	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/02/2012 14:24	Heather E Williams	1
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12153A08A	06/01/2012 14:23	Nicholas R Rossi	70.15
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121500031A	05/31/2012 02:12	Heather E Williams	1
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121500031A	05/30/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121520027A	05/31/2012 18:10	Sally L Appleyard	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121520027A	06/01/2012 14:45	Edwin Ortiz	1
00111	Moisture	EPA 160.3 modified	1	12150820004A	05/29/2012 11:48	William C Schwebel	1

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Analysis Report

REVISED

Sample Description: RI-SB01-PP216-9-14
Boeing_RTN: FFF

LLI Sample # SW 6665556
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 13:20 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

16914 SDG#: BNX71-06

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		**ug/kg**		**ug/kg**	
11995	**Benzene**	71-43-2	**0.8**		0.4	0.4
11995	Ethylbenzene	100-41-4	2	U	2	0.4
11995	Toluene	108-88-3	2	U	2	0.4
11995	m+p-Xylene	179601-23-1	2	U	2	0.4
11995	o-Xylene	95-47-6	2	U	2	0.4
GC/MS Semivolatiles	**SW-846 8270D**		**ug/kg**		**ug/kg**	
10726	**2-Methylnaphthalene**	91-57-6	**79** J		18	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		**mg/kg**		**mg/kg**	
05970	>C10-C12 Aliphatic	n.a.	5.3	U	5.3	1
05970	>C10-C12 Aromatic	n.a.	5.3	U	5.3	1
05970	>C12-C16 Aliphatic	n.a.	5.3	U	5.3	1
05970	>C12-C16 Aromatic	n.a.	5.3	U	5.3	1
05970	>C16-C21 Aliphatic	n.a.	5.3	U	5.3	1
05970	>C16-C21 Aromatic	n.a.	5.3	U	5.3	1
05970	>C21-C34 Aliphatic	n.a.	11	U	11	1
05970	>C21-C34 Aromatic	n.a.	5.3	U	5.3	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Benzene	71-43-2	0.826	U	0.826	78.48
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	8.26	U	8.26	78.48
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**20.5**		8.26	78.48
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**8.85**		8.26	78.48
05666	C8-C10 Aromatic Hydrocarbons	n.a.	8.26	U	8.26	78.48
05666	Ethylbenzene	100-41-4	0.826	U	0.826	78.48
05666	Methyl t-butyl ether	1634-04-4	0.826	U	0.826	78.48
05666	Toluene	108-88-3	0.826	U	0.826	78.48
05666	o-Xylene	95-47-6	0.826	U	0.826	78.48
05666	m,p-Xylenes	179601-23-1	1.65	U	1.65	78.48
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	DRO C12-C24 w/Si Gel	n.a.	7.4	U	7.4	1
12093	HRO C24-C40 w/Si Gel	n.a.	32	U	32	1
12093	TPH JetA C8-C18 w/Si Gel	n.a.	7.4	U	7.4	1
	TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.					
Wet Chemistry	**EPA 160.3 modified**		**%**		**%**	
00111	**Moisture**	n.a.	**5.0**		0.50	1

CJ 9/6/12

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Analysis Report

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REVISED

Sample Description: RI-SB01-PP216-9-14
Boeing_RTN: FFF

LLI Sample # SW 6665556
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 13:20 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

16914 SDG#: BNX71-06

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation	Dilution Factor
Wet Chemistry	**EPA 160.3 modified**		%	%	

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	X121531AA	06/01/2012 18:56	Chelsea B Eastep	0.4
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	1	201214627757	05/22/2012 13:20	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	2	201214627757	05/22/2012 13:20	Client Supplied	1
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035	1	201214627757	05/22/2012 13:20	Client Supplied	1
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12146SLB026	05/27/2012 15:10	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12146SLB026	05/26/2012 11:30	Sally L Appleyard	1
00388	GC - Field Preserved (MA-VPH)	SW-846 5035	1	201214627757	05/22/2012 13:20	Client Supplied	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/03/2012 00:03	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/03/2012 00:48	Heather E Williams	1
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12153A08A	06/01/2012 15:04	Nicholas R Rossi	78.48
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121500031A	05/31/2012 02:56	Heather E Williams	1
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121500031A	05/30/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121520027A	05/31/2012 18:10	Sally L Appleyard	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121520027A	06/01/2012 14:45	Edwin Ortiz	1
00111	Moisture	EPA 160.3 modified	1	12150820004A	05/29/2012 11:48	William C Schwebel	1

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Analysis Report

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Sample Description: RI-SB01-PP211-10
Boeing_RTN: FFF

LLI Sample # SW 6665557
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 15:20 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

21110 SDG#: BNX71-07BKG

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		ug/kg		ug/kg	
11995	Benzene	71-43-2	0.8	U	0.8	0.58
11995	Ethylbenzene	100-41-4	4	U	4	0.58
11995	Toluene	108-88-3	4	U	4	0.58
11995	m+p-Xylene	179601-23-1	4	U	4	0.58
11995	o-Xylene	95-47-6	4	U	4	0.58
GC/MS Semivolatiles	**SW-846 8270D**		ug/kg		ug/kg	
10726	2-Methylnaphthalene	91-57-6	22	U	22	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		mg/kg		mg/kg	
05970	>C10-C12 Aliphatic	n.a.	6.6	U	6.6	1
05970	>C10-C12 Aromatic	n.a.	6.6	U	6.6	1
05970	>C12-C16 Aliphatic	n.a.	6.6	U	6.6	1
05970	>C12-C16 Aromatic	n.a.	6.6	U	6.6	1
05970	**>C16-C21 Aliphatic**	n.a.	**16**		6.6	1
05970	**>C16-C21 Aromatic**	n.a.	**11**		6.6	1
05970	**>C21-C34 Aliphatic**	n.a.	**62**		13	1
05970	**>C21-C34 Aromatic**	n.a.	**49**		6.6	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		mg/kg		mg/kg	
05666	Benzene	71-43-2	1.24	U	1.24	94.26
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	12.4	U	12.4	94.26
05666	C6-C8 Aliphatic Hydrocarbons	n.a.	12.4	U	12.4	94.26
05666	C8-C10 Aliphatic Hydrocarbons	n.a.	12.4	U	12.4	94.26
05666	C8-C10 Aromatic Hydrocarbons	n.a.	12.4	U	12.4	94.26
05666	Ethylbenzene	100-41-4	1.24	U	1.24	94.26
05666	Methyl t-butyl ether	1634-04-4	1.24	U	1.24	94.26
05666	Toluene	108-88-3	1.24	U	1.24	94.26
05666	o-Xylene	95-47-6	1.24	U	1.24	94.26
05666	m,p-Xylenes	179601-23-1	2.47	U	2.47	94.26
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		mg/kg		mg/kg	
12093	**DRO C12-C24 w/Si Gel**	n.a.	**20**		9.1	1
12093	**HRO C24-C40 w/Si Gel**	n.a.	**82**		39	1
12093	TPH JetA C8-C18 w/Si Gel	n.a.	9.1	U	9.1	1

TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.

Wet Chemistry	**EPA 160.3 modified**		%		%	
00111	**Moisture**	n.a.	**23.7**		0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

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Analysis Report

REVISED

Sample Description: RI-SB01-PP211-10
Boeing_RTN: FFF

LLI Sample # SW 6665557
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 15:20 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

21110 SDG#: BNX71-07BKG

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	X121531AA	06/01/2012 17:25	Chelsea B Eastep	0.58
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	1	201214627757	05/22/2012 15:20	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	2	201214627757	05/22/2012 15:20	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	3	201214627757	05/22/2012 15:20	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	4	201214627757	05/22/2012 15:20	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	5	201214627757	05/22/2012 15:20	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	6	201214627757	05/22/2012 15:20	Client Supplied	1
06645	GC/MS-15g Field Preserv. MeOH	SW-846 5035	1	201214627757	05/22/2012 15:20	Client Supplied	n.a.
06645	GC/MS-15g Field Preserv. MeOH	SW-846 5035	2	201214627757	05/22/2012 15:20	Client Supplied	n.a.
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035	2	201215027774	05/22/2012 15:20	Client Supplied	1
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12146SLB026	05/27/2012 15:35	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12146SLB026	05/26/2012 11:30	Sally L Appleyard	1
00388	GC - Field Preserved (MA-VPH)	SW-846 5035	1	201215027774	05/22/2012 15:20	Client Supplied	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/03/2012 01:32	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/03/2012 02:17	Heather E Williams	1
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12153A08B	06/04/2012 11:52	Nicholas R Rossi	94.26
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121500031A	05/31/2012 05:10	Heather E Williams	1
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121500031A	05/30/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121520027A	05/31/2012 18:10	Sally L Appleyard	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121520027A	06/01/2012 14:45	Edwin Ortiz	1
00111	Moisture	EPA 160.3 modified	1	12150820004A	05/29/2012 11:48	William C Schwebel	1

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Analysis Report

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Sample Description: RI-SB23-PP401-14
Boeing_RTN: FFF

LLI Sample # SW 6665558
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 16:20 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

40114 SDG#: BNX71-08

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		ug/kg		ug/kg	
11995	Benzene	71-43-2	420	U	420	375
11995	Ethylbenzene	100-41-4	2,100	U	2,100	375
11995	Toluene	108-88-3	2,100	U	2,100	375
11995	**m+p-Xylene**	179601-23-1	**9,700**		2,100	375
11995	o-Xylene	95-47-6	2,100	U	2,100	375
GC/MS Semivolatiles	**SW-846 8270D**		ug/kg		ug/kg	
10726	**2-Methylnaphthalene**	91-57-6	**19,000**		190	10
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		mg/kg		mg/kg	
05970	**>C10-C12 Aliphatic**	n.a.	**89**		5.6	1
05970	**>C10-C12 Aromatic**	n.a.	**6.5**		5.6	1
05970	**>C12-C16 Aliphatic**	n.a.	**270**		5.6	1
05970	**>C12-C16 Aromatic**	n.a.	**50**		5.6	1
05970	**>C16-C21 Aliphatic**	n.a.	**40**		5.6	1
05970	**>C16-C21 Aromatic**	n.a.	**17**		5.6	1
05970	**>C21-C34 Aliphatic**	n.a.	**13**		11	1
05970	**>C21-C34 Aromatic**	n.a.	**8.2**		5.6	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		mg/kg		mg/kg	
05666	Benzene	71-43-2	1.08	U	1.08	95.42
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	10.8	U	10.8	95.42
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**702**	E DNR	10.8	95.42
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**377**		10.8	95.42
05666	**C8-C10 Aromatic Hydrocarbons**	n.a.	**192**		10.8	95.42
05666	Ethylbenzene	100-41-4	1.08	U	1.08	95.42
05666	Methyl t-butyl ether	1634-04-4	1.08	U	1.08	95.42
05666	Toluene	108-88-3	1.08	U	1.08	95.42
05666	**o-Xylene**	95-47-6	**1.53**		1.08	95.42
05666	**m,p-Xylenes**	179601-23-1	**3.76**		2.15	95.42
	Trial ID: REDL					
05666	Benzene	71-43-2	5.38	U DNR	5.38	477.08
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	53.8	U DNR	53.8	477.08
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**847**	J	53.8	477.08
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**381**	DNR	53.8	477.08
05666	**C8-C10 Aromatic Hydrocarbons**	n.a.	**200**	DNR	53.8	477.08

CN 9/6/12

Sample Description: RI-SB23-PP401-14
Boeing_RTN: FFF

LLI Sample # SW 6665558
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 16:20 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

40114 SDG#: BNX71-08

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Ethylbenzene	100-41-4	5.38	U DMB	5.38	477.08
05666	Methyl t-butyl ether	1634-04-4	5.38	U	5.38	477.08
05666	Toluene	108-88-3	5.38	U	5.38	477.08
05666	o-Xylene	95-47-6	5.38	U	5.38	477.08
05666	m,p-Xylenes	179601-23-1	10.8	U	10.8	477.08
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	**DRO C12-C24 w/Si Gel**	n.a.	**130**		7.8	1
12093	HRO C24-C40 w/Si Gel	n.a.	34	U	34	1
12093	**TPH JetA C8-C18 w/Si Gel**	n.a.	**150**		7.8	1

TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.

Wet Chemistry	**EPA 160.3 modified**		%		%	
00111	**Moisture**	n.a.	**11.4**		0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	R121562AA	06/05/2012 01:57	Andrea E Lando	375
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	1	201214627757	05/22/2012 16:20	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	2	201214627757	05/22/2012 16:20	Client Supplied	1
06645	GC/MS-15g Field Preserv. MeOH	SW-846 5035	1	201214627757	05/22/2012 16:20	Client Supplied	n.a.
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12146SLB026	05/27/2012 17:04	Jennifer R Riggs	10
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12146SLB026	05/26/2012 11:30	Sally L Appleyard	1
00388	GC - Field Preserved (MA-VPH)	SW-846 5035	1	201215027774	05/22/2012 16:20	Client Supplied	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/02/2012 21:05	Heather E Williams	1

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Analysis Report

REVISED

Sample Description: RI-SB23-PP401-14
Boeing_RTN: FFF

LLI Sample # SW 6665558
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 16:20 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

40114 SDG#: BNX71-08

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/02/2012 21:49	Heather E Williams	1
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12153A08B	06/04/2012 14:37	Nicholas R Rossi	95.42
05666	WA- VPH soils	ECY 97-602 WA VPH	2-REDL	12153A08B	06/04/2012 15:19	Nicholas R Rossi	477.08
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121500031A	05/31/2012 03:41	Heather E Williams	1
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121500031A	05/30/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121520027A	05/31/2012 18:10	Sally L Appleyard	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121520027A	06/01/2012 14:45	Edwin Ortiz	1
00111	Moisture	EPA 160.3 modified	1	12150820004A	05/29/2012 11:48	William C Schwebel	1

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Analysis Report

REVISED

Sample Description: RI-SB23-PP401-16
Boeing_RTN: FFF

LLI Sample # SW 6665559
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 16:30 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

40116 SDG#: BNX71-09

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		**ug/kg**		**ug/kg**	
11995	Benzene	71-43-2	86	U	86	71.5
11995	Ethylbenzene	100-41-4	430	U	430	71.5
11995	Toluene	108-88-3	430	U	430	71.5
11995	m+p-Xylene	179601-23-1	430	U	430	71.5
11995	o-Xylene	95-47-6	430	U	430	71.5
	Reporting limits were raised due to interference from the sample matrix.					
GC/MS Semivolatiles	**SW-846 8270D**		**ug/kg**		**ug/kg**	
10726	**2-Methylnaphthalene**	91-57-6	**2,100**		20	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		**mg/kg**		**mg/kg**	
05970	**>C10-C12 Aliphatic**	n.a.	**20**		6.0	1
05970	>C10-C12 Aromatic	n.a.	6.0	U	6.0	1
05970	**>C12-C16 Aliphatic**	n.a.	**58**		6.0	1
05970	**>C12-C16 Aromatic**	n.a.	**14**		6.0	1
05970	**>C16-C21 Aliphatic**	n.a.	**11**		6.0	1
05970	>C16-C21 Aromatic	n.a.	6.0	U	6.0	1
05970	>C21-C34 Aliphatic	n.a.	12	U	12	1
05970	>C21-C34 Aromatic	n.a.	6.0	U	6.0	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Benzene	71-43-2	1.12	U	1.12	93.34
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	11.2	U	11.2	93.34
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**176**		11.2	93.34
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**17.9**	J	11.2	93.34
05666	C8-C10 Aromatic Hydrocarbons	n.a.	11.2	U	11.2	93.34
05666	Ethylbenzene	100-41-4	1.12	U	1.12	93.34
05666	Methyl t-butyl ether	1634-04-4	1.12	U	1.12	93.34
05666	Toluene	108-88-3	1.12	U	1.12	93.34
05666	o-Xylene	95-47-6	1.12	U	1.12	93.34
05666	m,p-Xylenes	179601-23-1	2.24	U	2.24	93.34
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	**DRO C12-C24 w/Si Gel**	n.a.	**36**		8.4	1
12093	HRO C24-C40 w/Si Gel	n.a.	36	U	36	1
12093	**TPH JetA C8-C18 w/Si Gel**	n.a.	**51**		8.4	1
	TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.					
Wet Chemistry	**EPA 160.3 modified**		%		%	
00111	**Moisture**	n.a.	**16.8**		0.50	1

CN 9/6/12

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Analysis Report

REVISED

Sample Description: RI-SB23-PP401-16
Boeing_RTN: FFF

LLI Sample # SW 6665559
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012 16:30 by CJ

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

40116 SDG#: BNX71-09

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation	Dilution Factor
Wet Chemistry	**EPA 160.3 modified**		%	%	

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	R121562AA	06/05/2012 02:41	Andrea E Lando	71.5
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	1	201214627757	05/22/2012 16:30	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035	2	201214627757	05/22/2012 16:30	Client Supplied	1
06645	GC/MS-15g Field Preserv. MeOH	SW-846 5035	1	201214627757	05/22/2012 16:30	Client Supplied	n.a.
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12146SLB026	05/27/2012 16:26	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12146SLB026	05/26/2012 11:30	Sally L Appleyard	1
00388	GC - Field Preserved (MA-VPH)	SW-846 5035	1	201215027774	05/22/2012 16:30	Client Supplied	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/02/2012 15:08	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121520027A	06/02/2012 15:52	Heather E Williams	1
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12153A08B	06/04/2012 12:33	Nicholas R Rossi	93.34
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121500031A	05/31/2012 04:26	Heather E Williams	1
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121500031A	05/30/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121520027A	05/31/2012 18:10	Sally L Appleyard	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121520027A	06/01/2012 14:45	Edwin Ortiz	1
00111	Moisture	EPA 160.3 modified	1	12150820004A	05/29/2012 11:48	William C Schwebel	1

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Analysis Report

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REVISED

Sample Description: Trip Blank
Boeing_RTN: FFF

LLI Sample # SW 6665561
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

TBSFF SDG#: BNX71-11TB

CAT No.	Analysis Name	CAS Number	As Received Result		As Received Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		ug/kg		ug/kg	
11995	Benzene	71-43-2	1	U	1	1
11995	Ethylbenzene	100-41-4	5	U	5	1
11995	Toluene	108-88-3	5	U	5	1
11995	m+p-Xylene	179601-23-1	5	U	5	1
11995	o-Xylene	95-47-6	5	U	5	1

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	X121531AA	06/01/2012 14:22	Chelsea B Eastep	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035A	1	201214627757	05/22/2012 00:00	Client Supplied	1

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Analysis Report

REVISED

Sample Description: Trip Blank
Boeing_RTN: FFF

LLI Sample # SW 6665562
LLI Group # 1311382
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/22/2012

Submitted: 05/24/2012 09:45
Reported: 08/31/2012 10:57

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

TBMFF SDG#: BNX71-12TB*

CAT No.	Analysis Name	CAS Number	As Received Result		As Received Limit of Quantitation	Dilution Factor
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Benzene	71-43-2	0.500	U	0.500	50
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	5.00	U	5.00	50
05666	C6-C8 Aliphatic Hydrocarbons	n.a.	5.00	U	5.00	50
05666	C8-C10 Aliphatic Hydrocarbons	n.a.	5.00	U	5.00	50
05666	C8-C10 Aromatic Hydrocarbons	n.a.	5.00	U	5.00	50
05666	Ethylbenzene	100-41-4	0.500	U	0.500	50
05666	Methyl t-butyl ether	1634-04-4	0.500	U	0.500	50
05666	Toluene	108-88-3	0.500	U	0.500	50
05666	o-Xylene	95-47-6	0.500	U	0.500	50
05666	m,p-Xylenes	179601-23-1	1.00	U	1.00	50

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06647	GC-5g Field Preserved MeOH	SW-846 5035	1	201214627757	05/22/2012 00:00	Client Supplied	n.a.
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12153A08B	06/04/2012 16:41	Nicholas R Rossi	50

Quality Control Summary

Client Name: The Boeing Company
Reported: 08/31/12 at 10:57 AM

Group Number: 1311382

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Laboratory Compliance Quality Control

Analysis Name	Blank Result		Blank LOQ	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: R121562AA	Sample number(s): 6665551,6665553-6665554,6665558-6665559								
Benzene	50	U	50.	ug/kg	117	118	80-120	1	30
Ethylbenzene	250	U	250.	ug/kg	110	112	80-120	2	30
Toluene	250	U	250.	ug/kg	112	113	80-120	1	30
m+p-Xylene	250	U	250.	ug/kg	113	114	80-120	2	30
o-Xylene	250	U	250.	ug/kg	112	113	80-120	1	30
Batch number: X121531AA	Sample number(s): 6665552,6665555-6665557,6665561								
Benzene	1	U	1.	ug/kg	119		80-120		
Ethylbenzene	5	U	5.	ug/kg	113		80-120		
Toluene	5	U	5.	ug/kg	113		80-120		
m+p-Xylene	5	U	5.	ug/kg	113		80-120		
o-Xylene	5	U	5.	ug/kg	114		80-120		
Batch number: 12146SLB026	Sample number(s): 6665551-6665559								
2-Methylnaphthalene	17	U	17.	ug/kg	110		79-110		
Batch number: 121520027A	Sample number(s): 6665551-6665559								
>C10-C12 Aliphatic	5.0	U	5.0	mg/kg	83		31-137		
>C10-C12 Aromatic	5.0	U	5.0	mg/kg	89		22-119		
>C12-C16 Aliphatic	5.0	U	5.0	mg/kg	83		42-146		
>C12-C16 Aromatic	5.0	U	5.0	mg/kg	90		24-136		
>C16-C21 Aliphatic	5.0	U	5.0	mg/kg	82		57-111		
>C16-C21 Aromatic	5.0	U	5.0	mg/kg	94		34-143		
>C21-C34 Aliphatic	10	U	10.	mg/kg	81		50-124		
>C21-C34 Aromatic	5.0	U	5.0	mg/kg	87		44-134		
Batch number: 12153A08A	Sample number(s): 6665551-6665552,6665555-6665556								
Benzene	0.500	U	0.500	mg/kg	104	106	70-130	2	50
C5-C6 Aliphatic Hydrocarbons	5.00	U	5.00	mg/kg	88	81	70-130	8	50
C6-C8 Aliphatic Hydrocarbons	5.00	U	5.00	mg/kg	90	83	70-130	8	50
C8-C10 Aliphatic Hydrocarbons	5.00	U	5.00	mg/kg	86	83	70-130	3	50
C8-C10 Aromatic Hydrocarbons	5.00	U	5.00	mg/kg	104	102	70-130	2	50
Ethylbenzene	0.500	U	0.500	mg/kg	102	100	70-130	3	50
Methyl t-butyl ether	0.500	U	0.500	mg/kg	110	103	70-130	6	50
Toluene	0.500	U	0.500	mg/kg	99	100	70-130	1	50
o-Xylene	0.500	U	0.500	mg/kg	107	107	70-130	0	50
m,p-Xylenes	1.00	U	1.00	mg/kg	104	103	70-130	1	50
Batch number: 12153A08B	Sample number(s): 6665553-6665554,6665557-6665559,6665562								
Benzene	0.500	U	0.500	mg/kg	104	106	70-130	2	50
C5-C6 Aliphatic Hydrocarbons	5.00	U	5.00	mg/kg	88	81	70-130	8	50
C6-C8 Aliphatic Hydrocarbons	5.00	U	5.00	mg/kg	90	83	70-130	8	50
C8-C10 Aliphatic Hydrocarbons	5.00	U	5.00	mg/kg	86	83	70-130	3	50
C8-C10 Aromatic Hydrocarbons	5.00	U	5.00	mg/kg	104	102	70-130	2	50
Ethylbenzene	0.500	U	0.500	mg/kg	102	100	70-130	3	50

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: The Boeing Company
Reported: 08/31/12 at 10:57 AM

Group Number: 1311382

Analysis Name	Blank Result		Blank LOQ	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Methyl t-butyl ether	0.500	U	0.500	mg/kg	110	103	70-130	6	50
Toluene	0.500	U	0.500	mg/kg	99	100	70-130	1	50
o-Xylene	0.500	U	0.500	mg/kg	107	107	70-130	0	50
m,p-Xylenes	1.00	U	1.00	mg/kg	104	103	70-130	1	50
Batch number: 121500031A	Sample number(s): 6665551-6665559								
DRO C12-C24 w/Si Gel	7.0	U	7.0	mg/kg	74		50-133		
HRO C24-C40 w/Si Gel	30	U	30.	mg/kg					
TPH JetA C8-C18 w/Si Gel	7.0	U	7.0	mg/kg					
Batch number: 12150820004A	Sample number(s): 6665551-6665559								
Moisture					100		99-101		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc		DUP Conc		DUP RPD	Dup RPD Max
Batch number: X121531AA	Sample number(s): 6665552,6665555-6665557,6665561 UNSPK: 6665557										
Benzene	71	96	55-143	27	30						
Ethylbenzene	55	82	44-141	38*	30						
Toluene	61	93	50-146	40*	30						
m+p-Xylene	58	83	44-137	35*	30						
o-Xylene	55	82	42-137	38*	30						
Batch number: 12146SLB026	Sample number(s): 6665551-6665559 UNSPK: 6665551										
2-Methylnaphthalene	118	109	45-134	5	30						
Batch number: 121520027A	Sample number(s): 6665551-6665559 UNSPK: 6665557 BKG: 6665557										
>C10-C12 Aliphatic	89		31-137			5.0	U	5.0	U	0 (1)	25
>C10-C12 Aromatic	86		22-119			5.0	U	5.0	U	0 (1)	25
>C12-C16 Aliphatic	78		42-146			5.0	U	5.0	U	1 (1)	25
>C12-C16 Aromatic	88		42-122			5.0	U	5.0	U	0 (1)	25
>C16-C21 Aliphatic	80		57-111			12		12		3 (1)	25
>C16-C21 Aromatic	78		53-132			8.3		9.4		12 (1)	25
>C21-C34 Aliphatic	104		38-120			47		78		50* (1)	25
>C21-C34 Aromatic	67		55-126			37		60		48*	25
Batch number: 12153A08A	Sample number(s): 6665551-6665552,6665555-6665556 UNSPK: 6665557										
Benzene	86	93	70-130	21	50						
C5-C6 Aliphatic Hydrocarbons	80	92	70-130	28	50						
C6-C8 Aliphatic Hydrocarbons	56*	139*	70-130	31	50						
C8-C10 Aliphatic Hydrocarbons	170*	180*	70-130	20	50						
C8-C10 Aromatic Hydrocarbons	579*	604*	70-130	18	50						
Ethylbenzene	87	93	70-130	21	50						
Methyl t-butyl ether	91	93	70-130	16	50						
Toluene	86	91	70-130	20	50						
o-Xylene	98	94	70-130	9	50						
m,p-Xylenes	87	93	70-130	20	50						
Batch number: 12153A08B	Sample number(s): 6665553-6665554,6665557-6665559,6665562 UNSPK: 6665557										
Benzene	86	93	70-130	21	50						

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: The Boeing Company
Reported: 08/31/12 at 10:57 AM

Group Number: 1311382

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
C5-C6 Aliphatic Hydrocarbons	80	92	70-130	28	50				
C6-C8 Aliphatic Hydrocarbons	56*	139*	70-130	31	50				
C8-C10 Aliphatic Hydrocarbons	170*	180*	70-130	20	50				
C8-C10 Aromatic Hydrocarbons	579*	604*	70-130	18	50				
Ethylbenzene	87	93	70-130	21	50				
Methyl t-butyl ether	91	93	70-130	16	50				
Toluene	86	91	70-130	20	50				
o-Xylene	98	94	70-130	9	50				
m,p-Xylenes	87	93	70-130	20	50				
Batch number: 121500031A	Sample number(s): 6665551-6665559					BKG: 6665557			
DRO C12-C24 w/Si Gel						15	25	50* (1)	20
HRO C24-C40 w/Si Gel						62	96	43* (1)	20
TPH JetA C8-C18 w/Si Gel						7.0 U	7.0 U	200* (1)	20
Batch number: 12150820004A	Sample number(s): 6665551-6665559					BKG: 6665557			
Moisture						23.7	24.3	3	13

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260C Soil Master
Batch number: R121562AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6665551	71	70	65	64
6665553	96	92	86	92
6665554	98	97	89	88
6665558	109	102	112	122
6665559	94	91	90	85
Blank	102	98	93	90
LCS	102	100	94	96
LCSD	102	94	95	94
Limits:	50-141	54-135	52-141	50-131

Analysis Name: 8260C Soil Master
Batch number: X121531AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6665552	102	111	91	122
6665555	101	111	97	96
6665556	99	109	96	94
6665557	102	109	92	92
6665561	104	109	93	97
Blank	103	109	91	93
LCS	101	110	104	100
MS	102	111	104	93

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: The Boeing Company
Reported: 08/31/12 at 10:57 AM

Group Number: 1311382

Surrogate Quality Control

MSD	103	112	104	97
Limits:	50-141	54-135	52-141	50-131

Analysis Name: SVOA 8270D (microwave)
Batch number: 12146SLB026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6665551	78	88	105
6665552	81	92	108
6665553	76	79	95
6665554	106	97	109
6665555	86	92	116
6665556	84	96	112
6665557	74	84	102
6665558	78	88	110
6665559	83	91	113
Blank	92	107	129
LCS	87	98	113
MS	82	91	107
MSD	86	96	109
Limits:	45-123	56-121	36-135

Analysis Name: TPH-Dx SW Fuel ID w/Si Gel
Batch number: 121500031A

	Chlorobenzene	Orthoterphenyl
6665551	65	97
6665552	69	117
6665553	0*	119
6665554	87	107
6665555	68	92
6665556	76	102
6665557	79	96
6665558	80	99
6665559	98	119
Blank	94	105
DUP	67	97
LCS	90	99
Limits:	49-125	50-150

Analysis Name: WA EPH in Soil
Batch number: 121520027A

	Orthoterphenyl	1-chlorooctadecane
6665551	90	76
6665552	90	66
6665553	61	84
6665554	93	71
6665555	93	70
6665556	92	74
6665557	86	52
6665558	91	74
6665559	93	71
Blank	95	67

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: The Boeing Company
Reported: 08/31/12 at 10:57 AM

Group Number: 1311382

Surrogate Quality Control

DUP	87	66
LCS	93	68
MS	88	55
Limits:	30-127	33-122

Analysis Name: WA- VPH soils
Batch number: 12153A08A

	Trifluorotoluene-P	Trifluorotoluene-F
6665551	62	64
6665552	87	88
6665555	84	73
6665556	94	71
Blank	104	94
LCS	108	93
LCSD	99	90
MS	73	66
MSD	82	69
Limits:	60-140	60-140

Analysis Name: WA- VPH soils
Batch number: 12153A08B

	Trifluorotoluene-P	Trifluorotoluene-F
6665553	28*	385*
6665553	25*	447*
REDL		
6665554	66	64
6665554	71	73
REDL		
6665557	82	69
6665558	137	134
6665558	203*	242*
REDL		
6665559	111	107
6665562	46*	46*
Blank	104	93
LCS	108	93
LCSD	99	90
MS	73	66
MSD	82	69
Limits:	60-140	60-140

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Project Name: Boeing_RTN: FFF
LLI Group #: 1311382

General Comments:

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below. Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are included in this data set

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

SW-846 8260C, GC/MS Volatiles

Batch #: X121531AA (Sample number(s): 6665552, 6665555-6665557, 6665561 UNSPK: 6665557)

The relative percent difference(s) for the following analyte(s) in the MS/MSD were outside outside acceptance windows: Toluene, Ethylbenzene, m+p-Xylene, o-Xylene

Sample #s: 6665551, 6665553, 6665554, 6665559

Reporting limits were raised due to interference from the sample matrix.

ECY 97-602 NWTPH-Dx modified, GC Petroleum Hydrocarbons w/Si

Batch #: 121500031A (Sample number(s): 6665551-6665559 BKG: 6665557)

The duplicate RPD for the following analyte(s) exceeded the acceptance window: DRO C12-C24 w/Si Gel, HRO C24-C40 w/Si Gel, TPH JetA C8-C18 w/Si Gel

The recovery(ies) for one or more surrogates were outside of the QC window for sample(s) 6665553

Sample #s: 6665553

The surrogate data is outside the QC limits due to unresolvable matrix problems evident in the sample chromatogram.

ECY 97-602 WA EPH, GC Petroleum Hydrocarbons

Batch #: 121520027A (Sample number(s): 6665551-6665559 UNSPK: 6665557 BKG: 6665557)

The duplicate RPD for the following analyte(s) exceeded the acceptance window: >C21-C34 Aliphatic, >C21-C34 Aromatic

ECY 97-602 WA VPH, GC Petroleum Hydrocarbons

Batch #: 12153A08A (Sample number(s): 6665551-6665552, 6665555-6665556 UNSPK: P665557)

The recovery(ies) for the following analyte(s) in the MS and/or MSD was outside the acceptance window: C6-C8 Aliphatic Hydrocarbons, C8-C10 Aliphatic Hydrocarbons, C8-C10 Aromatic Hydrocarbons

Batch #: 12153A08B (Sample number(s): 6665553-6665554, 6665557-6665559, 6665562 UNSPK: 6665557)

The recovery(ies) for the following analyte(s) in the MS and/or MSD was outside the acceptance window: C6-C8 Aliphatic Hydrocarbons, C8-C10 Aliphatic Hydrocarbons, C8-C10 Aromatic Hydrocarbons

The recovery(ies) for one or more surrogates were outside of the QC window for sample(s) 6665553, 6665553REDL, 6665558REDL, 6665562

Boeing Chain of Custody

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Acct. # 13419 Group # 1311382 Sample # 6665551-62

For Lancaster Laboratories use only

Please print. Instructions on reverse side correspond.

(1) Client Information

Site Location: Boeing Renton Former Fuel Farm
Site Project: Former Fuel Farm Cleanup Action
Site Program/#: 008888800 80
Boeing PM: Fred Wallace
Consultant Contact: John Long, AMEC
Report To: John Long
Invoice To: ☑ Boeing EHS ☐ Other (specify): _____
Sampler: Chelsea Jefferson # of Coolers: 2

(2) Sample Identification	Collected Date	Collected Time	(3) Matrix	No. of Containers	TPH-Dx / TPH-Jet Fuel	BTEX	2-Methylnaphthalene	VPH	EPH	(4) Analyses Requested	(5) Remarks/Comments
RI-SB23-PP405-12	5/22/12	1000	S	7	X	X	X	X	X		
RI-SB23-PP405-14		1018		7	X	X	X	X	X		
RI-SB23-PP420-13		1140		7	X	X	X	X	X		
RI-SB23-PP420-10		1200		7	X	X	X	X	X		
RI-SB01-PP210-14		1310		7	X	X	X	X	X		
RI-SB01-PP210-9-14		1320		7	X	X	X	X	X		
RI-SB01-PP211-10		1520		19	X	X	X	X	X		Xtra volume for MS/MSD
RI-SB23-PP401-14		1620		7	X	X	X	X	X		
RI-SB23-PP401-10		1630		7	X	X	X	X	X		
Field blank		—		1	X	X	X	X	X		Field Blank all analysis

(6) Turnaround Time Requested (please circle)

Standard | 5 day | 4 day
72 hour | 48 hour | 24 hour

Date needed: _____

Relinquished by:	Date/Time	Received by:	Date/Time (7)
[signature]	5/23/12 0900	[signature]	
Relinquished by:	Date/Time	Received by:	Date/Time
Relinquished by:	Date/Time	Received by:	Date/Time
		[signature]	5/24/12 0945

Relinquished by commercial carrier (circle): UPS FedEx Other: _____

Temperature upon Receipt: 3.9-4.0 °C

Custody Seals Intact?: Yes No

Revised COC RLK 5/29/12

Boeing Chain of Custody

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Acct. # 13419 Group # 131382 Sample # 6665551-62

For Lancaster Laboratories use only
Please print. Instructions on reverse side correspond.

(1) Client Information

Site Location: Boeing Renton Former Fuel Farm
Site Project: Former Fuel Farm Cleanup Action
Site Program/#: 00888830080
Boeing PM: Fred Wallace
Consultant Contact: John Long, AMEC
Report To: John Long
Invoice To: ☑ Boeing EHS ☐ Other (specify):
Sampler: Chelsea Jefferson # of Coolers: 2

(2) Sample Identification	Collected Date	Collected Time	(3) Matrix	No. of Containers	TPH-Dx / TPH-Jet Fuel	BTEX	2-Methylnaphthalene	VPH	EPH	(5) Remarks/Comments
RI-SB23-PP405-12	5/22/12	1000	S	7	X	X	X	X	X	
RI-SB23-PP405-14		1018		7	X	X	X	X	X	
RI-SB23-PP420-13		1140		7	X	X	X	X	X	
RI-SB23-PP420-10		1200		7	X	X	X	X	X	
RI-SB01-PP210-14		1310		7	X	X	X	X	X	
RI-SB01-PP210-9-14		1320		7	X	X	X	X	X	
RI-SB01-PP211-10		1520		19	X	X	X	X	X	Xtra volume for MS/MSD
RI-SB23-PP401-14		1620		7	X	X	X	X	X	
RI-SB23-PP401-110		1630		7	X	X	X	X	X	
Field blank (on COC 5/22/12)		—		1	X	X	X	X	X	Field Blank all analyses
Trip blank on 5/22/12	5/22/12	—	TB	2		X		X		

(6) Turnaround Time Requested (please circle)

Standard | 5 day | 4 day
72 hour | 48 hour | 24 hour
Date needed: _____

Relinquished by:	Date/Time	Received by:	Date/Time (7)
[signature]	5/23/12 0900		
Relinquished by:	Date/Time	Received by:	Date/Time
Relinquished by:	Date/Time	Received by:	Date/Time 5/24/12 0945

Relinquished by commercial carrier (circle): UPS FedEx Other: _____
Temperature upon Receipt: 3.5-4.0 °C
Custody Seals Intact?: Yes No

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A# 13414 Gr# 1311382

Environmental Sample Administration Receipt Documentation Log

Client/Project: AMEC

Date of Receipt: 5/24/12

Time of Receipt: 0945

Source Code: 50-1

Shipping Container Sealed: ~~YES~~ NO

Custody Seal Present * : YES ~~NO~~

* Custody seal was intact unless otherwise noted in the discrepancy section

Package: ~~Chilled~~ Not Chilled

Temperature of Shipping Containers							
Cooler #	Thermometer ID	Temperature (°C)	Temp Bottle (TB) or Surface Temp (ST)	Wet Ice (WI) or Dry Ice (DI) or Ice Packs (IP)	Ice Present? Y/N	Loose (L) Bagged Ice (B) or NA	Comments
1	9422	4.0 °C	TB	WI	Y	B	
2	↓	3.9 °C	↓	↓	↓	↓	
3							
4							
5							
6							

Number of Trip Blanks received NOT listed on chain of custody: 2 < 1MeOH 1$NaSO_3$

Paperwork Discrepancy/Unpacking Problems:

Client did not send field blank – Did they mean trip blank on COC?

Unpacker Signature/Emp#: 1454 **Date/Time:** 5/24/12 | 1645

Issued by Dept. 6042 Management

2174.06

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June 11, 2012

Ms. Crystal Neirby
AMEC
Suite 600
600 University Street
Seattle, WA 98101

Dear Ms. Neirby:

I am writing to inform you of revised analytical reports that are being issued for the following:

Project No. Boeing RTN: FFF

Group No. 1311382 **SDG No.: BNX71**

LLI Sample No.	Client Sample Identification	Collection Date
6665557	RI-SB01-PP211-10	05/22/2012

The correction to the data affects the WA-VPH analysis only.

During an additional review of the data, we noticed that the dilution was not identified correctly on the raw data for the above sample and the matrix spike and matrix spike duplicate. The data was reprocessed with the correct dilution. The change only affected the QC summary of the report. The change did not affect the actual sample results.

The revised analytical report reflects this correction and is enclosed.

You are a valued client and we apologize for any inconvenience that this incident may have caused. If you have any questions or require further assistance, please call me at 717-656-2300, Ext. 1343. We appreciate your business and look forward to continuing to serve your laboratory needs.

Sincerely,

Valerie L. Tomayko
Principal Specialist
EPH/Miscellaneous GC

VLT/mcs
Enclosures

cc: Rachel L. Kreamer

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September 7, 2012

Ms. Crystal Neirby
AMEC
Suite 600
600 University St
Seattle, WA 98101

Dear Ms. Neirby:

I am writing to inform you of revised analytical reports that are being issued for the following:

Project No.: Boeing_RTN: FFF

Group No.: 1312959 **SDG.: BNX77**

LLI Sample No.	Client Sample Identification	Collection Date
6674330	R1-SB01-PP213-14	05/31/2012
6674331	R1-SB01-PP213-16	05/31/2012
6674332	R1-SB01-PP217-12	05/31/2012
6674333	R1-SB01-PP217-16	05/31/2012
6674334	Field Blank	05/31/2012
6674336	Trip Blank	05/31/2012

TFT surrogate recoveries

Batch	LLI No.	New FID %Recovery	New PID % Recovery	Old FID % Recovery	Old PID % Recovery
12163A08A	BLANK	97	107	128	141
	LCS	92	104	121	137
	LCSD	97	109	127	144
	6674331	60	63	79	83
	6674332	65	73	86	96
	6674336	90	94	118	124
	6674333	72	76	95	100
	6674330	421	267	554	352
	DF352				
	6674330	49	29	64	39
	DF3518				
12164A08A	BLANK	87	95	114	125
	LCS	89	98	118	129
	LCSD	87	103	114	135
	6674334	88	93	116	122

The correction to the data affects the WAVPH analysis only.

During an additional review of the data, the analyst noticed that the incorrect surrogate concentrations were entered for the calibration. The concentrations were corrected and the calibration was reprocessed. All data associated with this calibration was reprocessed. The surrogate recoveries for the samples listed above changed. The data on the QC Summary of the analytical report and the electronic deliverable were corrected. Please see the attached table for the comparison between the old data and the new data for the surrogates. There was no change to any sample results.

The revised analytical report reflects this correction and is enclosed.

You are a valued client and we apologize for any inconvenience that this incident may have caused. If you have any questions or require further assistance, please call me at 717-656-2300, Ext. 1343. We appreciate your business and look forward to continuing to serve your laboratory needs.

Sincerely,

Valerie Tomayko
Principal Specialist
EPH/Miscellaneous GC

VT/mc
Enclosures

cc: Carl Bach - The Boeing Company
Kay Hower

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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
µg	microgram(s)	**mg**	milligram(s)
mL	milliliter(s)	**L**	liter(s)
m3	cubic meter(s)	**µL**	microliter(s)
		pg/L	picogram/liter

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Data Qualifiers:

C – result confirmed by reanalysis.

J - estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		Inorganic Qualifiers
A	TIC is a possible aldol-condensation product	**B**	Value is <CRDL, but ≥IDL
B	Analyte was also detected in the blank	**E**	Estimated due to interference
C	Pesticide result confirmed by GC/MS	**M**	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	**N**	Spike sample not within control limits
E	Concentration exceeds the calibration range of the instrument	**S**	Method of standard additions (MSA) used for calculation
N	Presumptive evidence of a compound (TICs only)	**U**	Compound was not detected
P	Concentration difference between primary and confirmation columns >25%	**W**	Post digestion spike out of control limits
U	Compound was not detected	*	Duplicate analysis not within control limits
X,Y,Z	Defined in case narrative	+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR part 136 Table II as "analyze immediately" are not performed within 15 minutes.

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Analysis Report

REVISED

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

August 30, 2012

Project: Boeing_RTN: FFF

Submittal Date: 06/01/2012
Group Number: 1312959
SDG: BNX77
PO Number: 1101494065
State of Sample Origin: WA

Client Sample Description	Lancaster Labs (LLI) #
R1-SB01-PP213-14	6674330
R1-SB01-PP213-16	6674331
R1-SB01-PP217-12	6674332
R1-SB01-PP217-16	6674333
Field Blank	6674334
Trip Blank	6674335
Trip Blank	6674336

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	The Boeing Company	Attn: Carl Bach
ELECTRONIC COPY TO	AMEC	Attn: Crystal Neirby
1 COPY TO	Data Package Group	

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REVISED

Respectfully Submitted,

Rachel L. Kreamer

Rachel L. Kreamer
Group Leader

(717) 556-7221

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Analysis Report

REVISED

Sample Description: R1-SB01-PP213-14
Boeing_RTN: FFF

LLI Sample # SW 6674330
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 10:00 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP213 SDG#: BNX77-01

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		**ug/kg**		**ug/kg**	
11995	Benzene	71-43-2	230	U	230	184.91
11995	Ethylbenzene	100-41-4	1,200	U	1,200	184.91
11995	Toluene	108-88-3	1,200	U	1,200	184.91
11995	m+p-Xylene	179601-23-1	1,200	U	1,200	184.91
11995	o-Xylene	95-47-6	1,200	U	1,200	184.91
	Reporting limits were raised due to interference from the sample matrix.					
GC/MS Semivolatiles	**SW-846 8270D**		**ug/kg**		**ug/kg**	
10726	**2-Methylnaphthalene**	91-57-6	**46**		21	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		**mg/kg**		**mg/kg**	
05970	>C10-C12 Aliphatic	n.a.	6.2	U	6.2	1
05970	>C10-C12 Aromatic	n.a.	6.2	U	6.2	1
05970	>C12-C16 Aliphatic	n.a.	6.2	U	6.2	1
05970	>C12-C16 Aromatic	n.a.	6.2	U	6.2	1
05970	>C16-C21 Aliphatic	n.a.	6.2	U	6.2	1
05970	>C16-C21 Aromatic	n.a.	6.2	U	6.2	1
05970	>C21-C34 Aliphatic	n.a.	12	U	12	1
05970	>C21-C34 Aromatic	n.a.	6.2	U	6.2	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Benzene	71-43-2	4.40	U	4.40	351.79
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	44.0	U	44.0	351.79
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**2,300**	E DNR	44.0	351.79
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**406**		44.0	351.79
05666	**C8-C10 Aromatic Hydrocarbons**	n.a.	**161**		44.0	351.79
05666	Ethylbenzene	100-41-4	4.40	U	4.40	351.79
05666	Methyl t-butyl ether	1634-04-4	4.40	U	4.40	351.79
05666	Toluene	108-88-3	4.40	U	4.40	351.79
05666	o-Xylene	95-47-6	4.40	U	4.40	351.79
05666	m,p-Xylenes	179601-23-1	8.81	U	8.81	351.79
	Trial ID: DL					
05666	Benzene	71-43-2	44.0	U DNR	44.0	3517.88
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	440	U DNR	440	3517.88
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**2,200**		440	3517.88
05666	C8-C10 Aliphatic Hydrocarbons	n.a.	440	U DNR	440	3517.88
05666	C8-C10 Aromatic Hydrocarbons	n.a.	440	U	440	3517.88
05666	Ethylbenzene	100-41-4	44.0	U	44.0	3517.88
05666	Methyl t-butyl ether	1634-04-4	44.0	U	44.0	3517.88
05666	Toluene	108-88-3	44.0	U	44.0	3517.88
05666	o-Xylene	95-47-6	44.0	U	44.0	3517.88

on 9/6/12

Sample Description: R1-SB01-PP213-14
Boeing_RTN: FFF

LLI Sample # SW 6674330
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 10:00 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP213 SDG#: BNX77-01

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	m,p-Xylenes	179601-23-1	88.1	U	88.1	3517.88
	The recovery for the method blank surrogate(s) is outside the QC acceptance limits as noted on the QC Summary. Since the recovery is high and no target analytes were detected, the data is reported.					
	The LCS/LCSD surrogate(s) recovery is outside the QC acceptance limits as noted on the QC Summary. Since the recovery for the target analytes is compliant, the data is reported.					
	Reporting limits were raised due to interference from the sample matrix.					
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	DRO C12-C24 w/Si Gel	n.a.	8.7	U	8.7	1
12093	HRO C24-C40 w/Si Gel	n.a.	37	U	37	1
12093	**TPH JetA C8-C18 w/Si Gel**	n.a.	**31**		8.7	1
	TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.					
Wet Chemistry	**EPA 160.3 modified**		**%**		**%**	
00111	**Moisture**	n.a.	**20.1**		0.50	1
	"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.					

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	R121651AA	06/13/2012 05:40	Stephanie A Selis	184.91
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035A	1	201215627810	05/31/2012 10:00	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035A	2	201215627810	05/31/2012 10:00	Client Supplied	1
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	2	201216427877	05/31/2012 10:00	Client Supplied	1
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12156SLA026	06/06/2012 02:20	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12156SLA026	06/05/2012 02:30	Sherry L Morrow	1

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Analysis Report

REVISED

Sample Description: R1-SB01-PP213-14
Boeing_RTN: FFF

LLI Sample # SW 6674330
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 10:00 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP213 SDG#: BNX77-01

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06647	GC-5g Field Preserved MeOH	SW-846 5035A	2	201216427877	05/31/2012 10:00	Client Supplied	n.a.
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121560009A	06/06/2012 01:38	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121560009A	06/06/2012 02:23	Heather E Williams	1
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12163A08A	06/11/2012 15:10	Nicholas R Rossi	351.79
05666	WA- VPH soils	ECY 97-602 WA VPH	2-DL	12163A08A	06/11/2012 15:51	Nicholas R Rossi	3517.88
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121560016A	06/06/2012 10:35	Tracy A Cole	1
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121560016A	06/05/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121560009A	06/05/2012 02:30	Sherry L Morrow	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121560009A	06/05/2012 11:45	Edwin Ortiz	1
00111	Moisture	EPA 160.3 modified	1	12158820002A	06/06/2012 11:38	William C Schwebel	1

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Analysis Report

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REVISED

Sample Description: R1-SB01-PP213-16
Boeing_RTN: FFF

LLI Sample # SW 6674331
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 10:25 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP216 SDG#: BNX77-02

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		ug/kg		ug/kg	
11995	Benzene	71-43-2	0.6	U J	0.6	0.48
11995	Ethylbenzene	100-41-4	3	U	3	0.48
11995	Toluene	108-88-3	3	U	3	0.48
11995	m+p-Xylene	179601-23-1	3	U	3	0.48
11995	o-Xylene	95-47-6	3	U	3	0.48
Trial ID: RE						
11995	Benzene	71-43-2	0.5	U J	0.5	0.42
11995	Ethylbenzene	100-41-4	3	U	3	0.42
11995	Toluene	108-88-3	3	U	3	0.42
11995	m+p-Xylene	179601-23-1	3	U	3	0.42
11995	o-Xylene	95-47-6	3	U	3	0.42
GC/MS Semivolatiles	**SW-846 8270D**		ug/kg		ug/kg	
10726	**2-Methylnaphthalene**	91-57-6	**110**		21	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		mg/kg		mg/kg	
05970	>C10-C12 Aliphatic	n.a.	6.0	U	6.0	1
05970	>C10-C12 Aromatic	n.a.	6.0	U	6.0	1
05970	>C12-C16 Aliphatic	n.a.	6.0	U	6.0	1
05970	>C12-C16 Aromatic	n.a.	6.0	U	6.0	1
05970	>C16-C21 Aliphatic	n.a.	6.0	U	6.0	1
05970	>C16-C21 Aromatic	n.a.	6.0	U	6.0	1
05970	>C21-C34 Aliphatic	n.a.	12	U	12	1
05970	>C21-C34 Aromatic	n.a.	6.0	U	6.0	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		mg/kg		mg/kg	
05666	Benzene	71-43-2	0.413	U	0.413	34.15
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	4.13	U	4.13	34.15
05666	C6-C8 Aliphatic Hydrocarbons	n.a.	4.13	U	4.13	34.15
05666	C8-C10 Aliphatic Hydrocarbons	n.a.	4.13	U	4.13	34.15
05666	C8-C10 Aromatic Hydrocarbons	n.a.	4.13	U	4.13	34.15
05666	Ethylbenzene	100-41-4	0.413	U	0.413	34.15
05666	Methyl t-butyl ether	1634-04-4	0.413	U	0.413	34.15
05666	Toluene	108-88-3	0.413	U	0.413	34.15
05666	o-Xylene	95-47-6	0.413	U	0.413	34.15
05666	m,p-Xylenes	179601-23-1	0.827	U	0.827	34.15

The recovery for the method blank surrogate(s) is outside the QC acceptance limits as noted on the QC Summary. Since the recovery is high and no target analytes were detected, the data is reported.

The LCS/LCSD surrogate(s) recovery is outside the QC acceptance limits as noted on the QC Summary. Since the recovery for the target analytes is compliant, the data is reported.

CN 9/6/12

Sample Description: R1-SB01-PP213-16
Boeing_RTN: FFF

LLI Sample # SW 6674331
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 10:25 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP216 SDG#: BNX77-02

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	DRO C12-C24 w/Si Gel	n.a.	8.4	U	8.4	1
12093	HRO C24-C40 w/Si Gel	n.a.	36	U	36	1
12093	TPH JetA C8-C18 w/Si Gel	n.a.	8.4	U	8.4	1
	TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.					
Wet Chemistry	**EPA 160.3 modified**		%		%	
00111	**Moisture**	n.a.	**17.4**		0.50	1
	"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.					

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	X121651AA	06/13/2012 13:21	Chelsea B Eastep	0.48
11995	8260C Soil Master	SW-846 8260C	2-RE	X121651AA	06/13/2012 14:04	Chelsea B Eastep	0.42
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035A	1	201215627810	05/31/2012 10:25	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035A	2	201215627810	05/31/2012 10:25	Client Supplied	1
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	2	201216427877	05/31/2012 10:25	Client Supplied	1
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12156SLA026	06/06/2012 03:35	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12156SLA026	06/05/2012 02:30	Sherry L Morrow	1
06647	GC-5g Field Preserved MeOH	SW-846 5035A	2	201216427877	05/31/2012 10:25	Client Supplied	n.a.
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121560009A	06/12/2012 02:21	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121560009A	06/12/2012 03:05	Heather E Williams	1
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12163A08A	06/11/2012 12:25	Nicholas R Rossi	34.15
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121560016A	06/06/2012 12:07	Tracy A Cole	1
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121560016A	06/05/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121560009A	06/05/2012 02:30	Sherry L Morrow	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121560009A	06/05/2012 11:45	Edwin Ortiz	1

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Analysis Report

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Sample Description: R1-SB01-PP213-16
Boeing_RTN: FFF

LLI Sample # SW 6674331
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 10:25 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP216 SDG#: BNX77-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00111	Moisture	EPA 160.3 modified	1	12158820002A	06/06/2012 11:38	William C Schwebel	1

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Analysis Report

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Sample Description: R1-SB01-PP217-12
Boeing_RTN: FFF

LLI Sample # SW 6674332
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 11:20 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP217 SDG#: BNX77-03

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		**ug/kg**		**ug/kg**	
11995	Benzene	71-43-2	35	U	35	28.03
11995	Ethylbenzene	100-41-4	170	U	170	28.03
11995	Toluene	108-88-3	170	U	170	28.03
11995	m+p-Xylene	179601-23-1	170	U	170	28.03
11995	o-Xylene	95-47-6	170	U	170	28.03
	Reporting limits were raised due to interference from the sample matrix.					
GC/MS Semivolatiles	**SW-846 8270D**		**ug/kg**		**ug/kg**	
10726	**2-Methylnaphthalene**	91-57-6	**760**		21	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		**mg/kg**		**mg/kg**	
05970	**>C10-C12 Aliphatic**	n.a.	**980**		150	25
05970	**>C10-C12 Aromatic**	n.a.	**32**		6.1	1
05970	**>C12-C16 Aliphatic**	n.a.	**1,900**		150	25
05970	**>C12-C16 Aromatic**	n.a.	**170**		6.1	1
05970	>C16-C21 Aliphatic	n.a.	150	U	150	25
05970	**>C16-C21 Aromatic**	n.a.	**55**		6.1	1
05970	>C21-C34 Aliphatic	n.a.	310	U	310	25
05970	**>C21-C34 Aromatic**	n.a.	**22**		6.1	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Benzene	71-43-2	0.448	U	0.448	36.13
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	4.48	U	4.48	36.13
05666	C6-C8 Aliphatic Hydrocarbons	n.a.	4.48	U	4.48	36.13
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**42.1**		4.48	36.13
05666	**C8-C10 Aromatic Hydrocarbons**	n.a.	**29.1**		4.48	36.13
05666	**Ethylbenzene**	100-41-4	**0.559**		0.448	36.13
05666	Methyl t-butyl ether	1634-04-4	0.448	U	0.448	36.13
05666	Toluene	108-88-3	0.448	U	0.448	36.13
05666	**o-Xylene**	95-47-6	**0.568**		0.448	36.13
05666	m,p-Xylenes	179601-23-1	0.897	U	0.897	36.13
	The recovery for the method blank surrogate(s) is outside the QC acceptance limits as noted on the QC Summary. Since the recovery is high and no target analytes were detected, the data is reported.					
	The LCS/LCSD surrogate(s) recovery is outside the QC acceptance limits as noted on the QC Summary. Since the recovery for the target analytes is compliant, the data is reported.					
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	**DRO C12-C24 w/Si Gel**	n.a.	**2,200** J		87	10

CN 9/6/12

Sample Description: R1-SB01-PP217-12
Boeing_RTN: FFF

LLI Sample # SW 6674332
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 11:20 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP217 SDG#: BNX77-03

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	HRO C24-C40 w/Si Gel	n.a.	370	U J	370	10
12093	**TPH JetA C8-C18 w/Si Gel**	n.a.	**3,600**	J	87	10
	TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.					
Wet Chemistry	**EPA 160.3 modified**		%		%	
00111	**Moisture**	n.a.	**19.4**		0.50	1
	"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.					

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	R121651AA	06/13/2012 04:32	Stephanie A Selis	28.03
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035A	1	201215627810	05/31/2012 11:20	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035A	2	201215627810	05/31/2012 11:20	Client Supplied	1
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	2	201216427877	05/31/2012 11:20	Client Supplied	1
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12156SLA026	06/06/2012 04:00	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12156SLA026	06/05/2012 02:30	Sherry L Morrow	1
06647	GC-5g Field Preserved MeOH	SW-846 5035A	2	201216427877	05/31/2012 11:20	Client Supplied	n.a.
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121560009A	06/12/2012 03:50	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121560009A	06/12/2012 04:34	Heather E Williams	25
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12163A08A	06/11/2012 13:06	Nicholas R Rossi	36.13
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121560016A	06/07/2012 11:19	Tracy A Cole	10
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121560016A	06/05/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121560009A	06/05/2012 02:30	Sherry L Morrow	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121560009A	06/05/2012 11:45	Edwin Ortiz	1

CN 9/6/12

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Analysis Report

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Sample Description: R1-SB01-PP217-12
Boeing_RTN: FFF

LLI Sample # SW 6674332
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 11:20 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

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Seattle WA 98124

PP217 SDG#: BNX77-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00111	Moisture	EPA 160.3 modified	1	12158820002A	06/06/2012 11:38	William C Schwebel	1

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Analysis Report

REVISED

Sample Description: R1-SB01-PP217-16
Boeing_RTN: FFF

LLI Sample # SW 6674333
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 11:45 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP176 SDG#: BNX77-04

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		**ug/kg**		**ug/kg**	
11995	Benzene	71-43-2	39	U	39	32.2
11995	Ethylbenzene	100-41-4	200	U	200	32.2
11995	Toluene	108-88-3	200	U	200	32.2
11995	m+p-Xylene	179601-23-1	200	U	200	32.2
11995	o-Xylene	95-47-6	200	U	200	32.2
	Reporting limits were raised due to interference from the sample matrix.					
GC/MS Semivolatiles	**SW-846 8270D**		**ug/kg**		**ug/kg**	
10726	**2-Methylnaphthalene**	91-57-6	**370**		21	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		**mg/kg**		**mg/kg**	
05970	**>C10-C12 Aliphatic**	n.a.	**22**		6.0	1
05970	>C10-C12 Aromatic	n.a.	6.0	U	6.0	1
05970	**>C12-C16 Aliphatic**	n.a.	**110**		6.0	1
05970	**>C12-C16 Aromatic**	n.a.	**7.0**		6.0	1
05970	**>C16-C21 Aliphatic**	n.a.	**17**		6.0	1
05970	**>C16-C21 Aromatic**	n.a.	**7.2**		6.0	1
05970	>C21-C34 Aliphatic	n.a.	12	U	12	1
05970	>C21-C34 Aromatic	n.a.	6.0	U	6.0	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Benzene	71-43-2	0.428	U	0.428	35.21
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	4.28	U	4.28	35.21
05666	**C6-C8 Aliphatic Hydrocarbons**	n.a.	**8.08**		4.28	35.21
05666	**C8-C10 Aliphatic Hydrocarbons**	n.a.	**125**		4.28	35.21
05666	**C8-C10 Aromatic Hydrocarbons**	n.a.	**94.7**		4.28	35.21
05666	**Ethylbenzene**	100-41-4	**1.76**		0.428	35.21
05666	Methyl t-butyl ether	1634-04-4	0.428	U	0.428	35.21
05666	**Toluene**	108-88-3	**0.537**		0.428	35.21
05666	**o-Xylene**	95-47-6	**2.52**		0.428	35.21
05666	m,p-Xylenes	179601-23-1	0.857	U	0.857	35.21

The recovery for the method blank surrogate(s) is outside the QC acceptance limits as noted on the QC Summary. Since the recovery is high and no target analytes were detected, the data is reported.

The LCS/LCSD surrogate(s) recovery is outside the QC acceptance limits as noted on the QC Summary. Since the recovery for the target analytes is compliant, the data is reported.

GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	

Sample Description: R1-SB01-PP217-16
Boeing_RTN: FFF

LLI Sample # SW 6674333
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 11:45 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP176 SDG#: BNX77-04

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation	Dilution Factor
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/kg**		**mg/kg**	
12093	**DRO C12-C24 w/Si Gel**	n.a.	**450**		17	2
12093	HRO C24-C40 w/Si Gel	n.a.	73	U	73	2
12093	**TPH JetA C8-C18 w/Si Gel**	n.a.	**650**		17	2
	TPH quantitation is based on peak area comparison of the sample pattern to that of a hydrocarbon component mix calibration in a range that includes C8 (n-octane) through C40 (n-tetracontane) normal hydrocarbons.					
Wet Chemistry	**EPA 160.3 modified**		**%**		**%**	
00111	**Moisture**	n.a.	**17.8**		0.50	1
	"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.					

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	R121651AA	06/13/2012 04:55	Stephanie A Selis	32.2
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035A	1	201215627810	05/31/2012 11:45	Client Supplied	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035A	2	201215627810	05/31/2012 11:45	Client Supplied	1
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	2	201216427877	05/31/2012 11:45	Client Supplied	1
10726	SVOA 8270D (microwave)	SW-846 8270D	1	12156SLA026	06/06/2012 04:25	Jennifer R Riggs	1
10813	BNA Soil Microwave APP IX	SW-846 3546	1	12156SLA026	06/05/2012 02:30	Sherry L Morrow	1
06647	GC-5g Field Preserved MeOH	SW-846 5035A	2	201216427877	05/31/2012 11:45	Client Supplied	n.a.
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121560009A	06/12/2012 05:19	Heather E Williams	1
05970	WA EPH in Soil	ECY 97-602 WA EPH	1	121560009A	06/12/2012 06:03	Heather E Williams	1
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12163A08A	06/11/2012 14:28	Nicholas R Rossi	35.21
12093	TPH-Dx SW Fuel ID w/Si Gel	ECY 97-602 NWTPH-Dx modified	1	121560016A	06/07/2012 09:47	Tracy A Cole	2
12118	TPH-Dx w/Fuel Soil Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121560016A	06/05/2012 09:00	Kerrie A Freeburn	1
11213	WA EPH Soils Extraction	ECY 97-602 WA EPH	1	121560009A	06/05/2012 02:30	Sherry L Morrow	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121560009A	06/05/2012 11:45	Edwin Ortiz	1

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Analysis Report

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Sample Description: R1-SB01-PP217-16
Boeing_RTN: FFF

LLI Sample # SW 6674333
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 11:45 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PP176 SDG#: BNX77-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00111	Moisture	EPA 160.3 modified	1	12158820002A	06/06/2012 11:38	William C Schwebel	1

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Analysis Report

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Sample Description: Field Blank
Boeing_RTN: FFF

LLI Sample # WW 6674334
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 12:00 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PPFB1 SDG#: BNX77-05FB

CAT No.	Analysis Name	CAS Number	As Received Result		As Received Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		**ug/l**		**ug/l**	
11996	Benzene	71-43-2	0.2	U	0.2	1
11996	Ethylbenzene	100-41-4	0.5	U	0.5	1
11996	Toluene	108-88-3	0.2	U	0.2	1
11996	m+p-Xylene	179601-23-1	0.5	U	0.5	1
11996	o-Xylene	95-47-6	0.5	U	0.5	1
GC/MS Semivolatiles	**SW-846 8270D**		**ug/l**		**ug/l**	
10461	2-Methylnaphthalene	91-57-6	0.5	U	0.5	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA EPH**		**ug/l**		**ug/l**	
05979	>C10-C12 Aliphatic	n.a.	50	U	50	1
05979	>C10-C12 Aromatic	n.a.	50	U	50	1
05979	>C12-C16 Aliphatic	n.a.	50	U	50	1
05979	>C12-C16 Aromatic	n.a.	50	U	50	1
05979	>C16-C21 Aliphatic	n.a.	50	U	50	1
05979	>C16-C21 Aromatic	n.a.	50	U	50	1
05979	**>C21-C34 Aliphatic**	n.a.	**60**		50	1
05979	>C21-C34 Aromatic	n.a.	50	U	50	1
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**ug/l**		**ug/l**	
05665	Benzene	71-43-2	5.0	U	5.0	1
05665	C5-C6 Aliphatic Hydrocarbons	n.a.	50.0	U	50.0	1
05665	C6-C8 Aliphatic Hydrocarbons	n.a.	50.0	U	50.0	1
05665	C8-C10 Aliphatic Hydrocarbons	n.a.	50.0	U	50.0	1
05665	C8-C10 Aromatic Hydrocarbons	n.a.	50.0	U	50.0	1
05665	Ethylbenzene	100-41-4	5.0	U	5.0	1
05665	Methyl t-butyl ether	1634-04-4	5.0	U	5.0	1
05665	Toluene	108-88-3	5.0	U	5.0	1
05665	o-Xylene	95-47-6	5.0	U	5.0	1
05665	m,p-Xylenes	179601-23-1	10.0	U	10.0	1
GC Petroleum Hydrocarbons w/Si	**ECY 97-602 NWTPH-Dx modified**		**mg/l**		**mg/l**	
12094	Diesel/#2 Fuel w/Si Gel	68334-30-5	0.095	U	0.095	1
12094	DRO C12-C24 w/Si Gel	n.a.	0.095	U	0.095	1
12094	Motor Oil w/Si Gel	n.a.	0.24	U	0.24	1
12094	TPH JetA C8-C18 w/Si Gel	n.a.	0.095	U	0.095	1

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

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Analysis Report

REVISED

Sample Description: Field Blank
Boeing_RTN: FFF

LLI Sample # WW 6674334
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012 12:00 by CJ

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PPFB1 SDG#: BNX77-05FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11996	8260C Water(25ml) Master	SW-846 8260C	1	G121631AA	06/11/2012 11:45	Angela D Sneeringer	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	G121631AA	06/11/2012 11:45	Angela D Sneeringer	1
10461	SVOAs by 8270D in Water	SW-846 8270D	1	12156WAX026	06/06/2012 01:55	Jennifer R Riggs	1
11010	8270D BNA Extraction	SW-846 3510C	1	12156WAX026	06/04/2012 22:00	Elaine F Stoltzfus	1
05979	WA EPH in Water	ECY 97-602 WA EPH	1	121580017A	06/12/2012 14:17	Heather E Williams	1
05979	WA EPH in Water	ECY 97-602 WA EPH	1	121580017A	06/12/2012 15:02	Heather E Williams	1
05665	WA - VPH waters	ECY 97-602 WA VPH	1	12164A08A	06/12/2012 15:00	Nicholas R Rossi	1
12094	NWTPH-Dx,MO,Jet A w/ Si Gel	ECY 97-602 NWTPH-Dx modified	1	121580005A	06/12/2012 04:13	Heather E Williams	1
12120	TPH-Dx w/Fuel Water Ext. (SG)	ECY 97-602 NWTPH-Dx 06/97	1	121580005A	06/06/2012 13:30	Kelli M Barto	1
11175	WA EPH Waters Extraction	ECY 97-602 WA EPH	1	121580017A	06/07/2012 02:30	Sherry L Morrow	1
00497	Silica Gel Fractionation	SW-846 3630C modified	1	121580017A	06/08/2012 06:00	David V Hershey Jr	1

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Analysis Report

REVISED

Sample Description: Trip Blank
Boeing_RTN: FFF

LLI Sample # SW 6674335
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PPTB1 SDG#: BNX77-06TB

CAT No.	Analysis Name	CAS Number	As Received Result		As Received Limit of Quantitation	Dilution Factor
GC/MS Volatiles	**SW-846 8260C**		ug/kg		ug/kg	
11995	Benzene	71-43-2	1	U	1	1
11995	Ethylbenzene	100-41-4	5	U	5	1
11995	Toluene	108-88-3	5	U	5	1
11995	m+p-Xylene	179601-23-1	5	U	5	1
11995	o-Xylene	95-47-6	5	U	5	1

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11995	8260C Soil Master	SW-846 8260C	1	X121651AA	06/13/2012 12:58	Chelsea B Eastep	1
02392	GC/MS - Field Preserved NaHSO4	SW-846 5035A	1	201215627810	05/31/2012 00:00	Client Supplied	1

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Analysis Report

REVISED

Sample Description: Trip Blank
Boeing_RTN: FFF

LLI Sample # SW 6674336
LLI Group # 1312959
Account # 13419

Project Name: Boeing_RTN: FFF

Collected: 05/31/2012

Submitted: 06/01/2012 09:25
Reported: 08/30/2012 16:34

The Boeing Company
PO Box 3707 MC 1W-12
Seattle WA 98124

PPTB2 SDG#: BNX77-07TB*

CAT No.	Analysis Name	CAS Number	As Received Result		As Received Limit of Quantitation	Dilution Factor
GC Petroleum Hydrocarbons	**ECY 97-602 WA VPH**		**mg/kg**		**mg/kg**	
05666	Benzene	71-43-2	0.500	U	0.500	50
05666	C5-C6 Aliphatic Hydrocarbons	n.a.	5.00	U	5.00	50
05666	C6-C8 Aliphatic Hydrocarbons	n.a.	5.00	U	5.00	50
05666	C8-C10 Aliphatic Hydrocarbons	n.a.	5.00	U	5.00	50
05666	C8-C10 Aromatic Hydrocarbons	n.a.	5.00	U	5.00	50
05666	Ethylbenzene	100-41-4	0.500	U	0.500	50
05666	Methyl t-butyl ether	1634-04-4	0.500	U	0.500	50
05666	Toluene	108-88-3	0.500	U	0.500	50
05666	o-Xylene	95-47-6	0.500	U	0.500	50
05666	m,p-Xylenes	179601-23-1	1.00	U	1.00	50

The recovery for the method blank surrogate(s) is outside the QC acceptance limits as noted on the QC Summary. Since the recovery is high and no target analytes were detected, the data is reported.

The LCS/LCSD surrogate(s) recovery is outside the QC acceptance limits as noted on the QC Summary. Since the recovery for the target analytes is compliant, the data is reported.

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00388	GC - Field Preserved (MA-VPH)	SW-846 5035	1	201215627810	05/31/2012 00:00	Client Supplied	1
05666	WA- VPH soils	ECY 97-602 WA VPH	1	12163A08A	06/11/2012 13:47	Nicholas R Rossi	50

Quality Control Summary

Client Name: The Boeing Company
Reported: 08/30/12 at 04:34 PM

Group Number: 1312959

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Laboratory Compliance Quality Control

Analysis Name	Blank Result		Blank LOQ	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: G121631AA	Sample number(s): 6674334								
Benzene	0.2	U	0.2	ug/l	88		80-120		
Ethylbenzene	0.5	U	0.5	ug/l	93		80-120		
Toluene	0.2	U	0.2	ug/l	91		80-120		
m+p-Xylene	0.5	U	0.5	ug/l	94		80-120		
o-Xylene	0.5	U	0.5	ug/l	97		80-120		
Batch number: R121651AA	Sample number(s): 6674330,6674332-6674333								
Benzene	50	U	50.	ug/kg	103	104	80-120	1	30
Ethylbenzene	250	U	250.	ug/kg	108	110	80-120	2	30
Toluene	250	U	250.	ug/kg	110	109	80-120	1	30
m+p-Xylene	250	U	250.	ug/kg	110	111	80-120	1	30
o-Xylene	250	U	250.	ug/kg	111	109	80-120	2	30
Batch number: X121651AA	Sample number(s): 6674331,6674335								
Benzene	1	U	1.	ug/kg	111	116	80-120	5	30
Ethylbenzene	5	U	5.	ug/kg	102	110	80-120	7	30
Toluene	5	U	5.	ug/kg	105	112	80-120	6	30
m+p-Xylene	5	U	5.	ug/kg	105	112	80-120	6	30
o-Xylene	5	U	5.	ug/kg	106	112	80-120	5	30
Batch number: 12156SLA026	Sample number(s): 6674330-6674333								
2-Methylnaphthalene	17	U	17.	ug/kg	110		79-110		
Batch number: 12156WAX026	Sample number(s): 6674334								
2-Methylnaphthalene	0.5	U	0.5	ug/l	108		69-108		
Batch number: 121560009A	Sample number(s): 6674330-6674333								
>C10-C12 Aliphatic	5.0	U	5.0	mg/kg	72		31-137		
>C10-C12 Aromatic	5.0	U	5.0	mg/kg	71		22-119		
>C12-C16 Aliphatic	5.0	U	5.0	mg/kg	73		42-146		
>C12-C16 Aromatic	5.0	U	5.0	mg/kg	71		24-136		
>C16-C21 Aliphatic	5.0	U	5.0	mg/kg	72		57-111		
>C16-C21 Aromatic	5.0	U	5.0	mg/kg	74		34-143		
>C21-C34 Aliphatic	10	U	10.	mg/kg	75		50-124		
>C21-C34 Aromatic	5.0	U	5.0	mg/kg	75		44-134		
Batch number: 121580017A	Sample number(s): 6674334								
>C10-C12 Aliphatic	50	U	50.	ug/l	80	83	30-137	3	30
>C10-C12 Aromatic	50	U	50.	ug/l	65	78	30-140	18	30
>C12-C16 Aliphatic	50	U	50.	ug/l	90	95	68-116	5	30
>C12-C16 Aromatic	50	U	50.	ug/l	71	83	30-149	16	30
>C16-C21 Aliphatic	50	U	50.	ug/l	83	83	81-116	0	30
>C16-C21 Aromatic	50	U	50.	ug/l	80	95	30-148	17	30
>C21-C34 Aliphatic	50	U	50.	ug/l	110	85	44-133	26	30
>C21-C34 Aromatic	50	U	50.	ug/l	81	94	57-127	14	30

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: The Boeing Company
Reported: 08/30/12 at 04:34 PM

Group Number: 1312959

Analysis Name	Blank Result		Blank LOQ	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 12163A08A	Sample number(s): 6674330-6674333,6674336								
Benzene	0.500	U	0.500	mg/kg	105	118	70-130	11	50
C5-C6 Aliphatic Hydrocarbons	5.00	U	5.00	mg/kg	82	97	70-130	16	50
C6-C8 Aliphatic Hydrocarbons	5.00	U	5.00	mg/kg	84	96	70-130	13	50
C8-C10 Aliphatic Hydrocarbons	5.00	U	5.00	mg/kg	77	92	70-130	17	50
C8-C10 Aromatic Hydrocarbons	5.00	U	5.00	mg/kg	104	110	70-130	6	50
Ethylbenzene	0.500	U	0.500	mg/kg	102	110	70-130	7	50
Methyl t-butyl ether	0.500	U	0.500	mg/kg	108	105	70-130	2	50
Toluene	0.500	U	0.500	mg/kg	101	108	70-130	6	50
o-Xylene	0.500	U	0.500	mg/kg	106	117	70-130	10	50
m,p-Xylenes	1.00	U	1.00	mg/kg	105	112	70-130	6	50
Batch number: 12164A08A	Sample number(s): 6674334								
Benzene	5.0	U	5.0	ug/l	110	112	70-130	2	50
C5-C6 Aliphatic Hydrocarbons	50.0	U	50.0	ug/l	100	100	70-130	0	50
C6-C8 Aliphatic Hydrocarbons	50.0	U	50.0	ug/l	102	96	70-130	6	50
C8-C10 Aliphatic Hydrocarbons	50.0	U	50.0	ug/l	92	90	70-130	2	50
C8-C10 Aromatic Hydrocarbons	50.0	U	50.0	ug/l	110	110	70-130	0	50
Ethylbenzene	5.0	U	5.0	ug/l	112	106	70-130	6	50
Methyl t-butyl ether	5.0	U	5.0	ug/l	114	110	70-130	4	50
Toluene	5.0	U	5.0	ug/l	108	106	70-130	2	50
o-Xylene	5.0	U	5.0	ug/l	120	114	70-130	5	50
m,p-Xylenes	10.0	U	10.0	ug/l	110	110	70-130	0	50
Batch number: 121560016A	Sample number(s): 6674330-6674333								
DRO C12-C24 w/Si Gel	7.0	U	7.0	mg/kg	74		60-120		
HRO C24-C40 w/Si Gel	30	U	30.	mg/kg					
TPH JetA C8-C18 w/Si Gel	7.0	U	7.0	mg/kg					
Batch number: 121580005A	Sample number(s): 6674334								
Diesel/#2 Fuel w/Si Gel	0.10	U	0.10	mg/l					
DRO C12-C24 w/Si Gel	0.10	U	0.10	mg/l	69	69	50-120	0	20
Motor Oil w/Si Gel	0.25	U	0.25	mg/l					
TPH JetA C8-C18 w/Si Gel	0.10	U	0.10	mg/l					
Batch number: 12158820002A	Sample number(s): 6674330-6674333								
Moisture					100		99-101		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: G121631AA	Sample number(s): 6674334 UNSPK: P674434								
Benzene	101	93	87-126	8	30				
Ethylbenzene	107	99	80-140	8	30				
Toluene	101	93	83-127	9	30				
m+p-Xylene	108	100	81-137	8	30				
o-Xylene	110	102	81-137	7	30				
Batch number: 12156SLA026	Sample number(s): 6674330-6674333 UNSPK: 6674330								

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: The Boeing Company
Reported: 08/30/12 at 04:34 PM

Group Number: 1312959

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
2-Methylnaphthalene	112	111	45-134	1	30				
Batch number: 12156WAX026	Sample number(s): 6674334 UNSPK: P56WXUS								
2-Methylnaphthalene	107	109	80-111	2	30				
Batch number: 121560009A	Sample number(s): 6674330-6674333 UNSPK: 6674330								
>C10-C12 Aliphatic	134	101	31-137	27	50				
>C10-C12 Aromatic	53	84	22-119	45	50				
>C12-C16 Aliphatic	131	98	42-146	29	50				
>C12-C16 Aromatic	65	90	42-122	32	50				
>C16-C21 Aliphatic	101	102	57-111	1	50				
>C16-C21 Aromatic	89	97	53-132	10	50				
>C21-C34 Aliphatic	100	107	38-120	7	50				
>C21-C34 Aromatic	84	97	55-126	14	50				
Batch number: 121560016A	Sample number(s): 6674330-6674333 BKG: 6674330								
DRO C12-C24 w/Si Gel						6.9 U	6.9 U	200* (1)	20
HRO C24-C40 w/Si Gel						30 U	30 U	0 (1)	20
TPH JetA C8-C18 w/Si Gel						25	17	35* (1)	20
Batch number: 12158820002A	Sample number(s): 6674330-6674333 BKG: 6674330								
Moisture						20.1	19.3	4	13

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260C Water(25ml) Master
Batch number: G121631AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6674334	104	101	98	102
Blank	106	108	100	105
LCS	105	102	98	101
MS	102	100	96	100
MSD	102	105	97	100
Limits:	77-114	74-113	77-110	78-110

Analysis Name: 8260C Soil Master
Batch number: R121651AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6674330	70	61	75	91
6674332	85	81	83	113
6674333	83	80	81	109
Blank	90	83	90	90
LCS	97	90	98	98
LCSD	98	96	99	98

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: The Boeing Company
Reported: 08/30/12 at 04:34 PM

Group Number: 1312959

Surrogate Quality Control

Limits: 50-141 54-135 52-141 50-131

Analysis Name: 8260C Soil Master
Batch number: X121651AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6674331	117	124	35*	109
6674331 RE	107	115	28*	108
6674335	104	111	91	102
Blank	104	103	91	97
LCS	105	108	102	102
LCSD	102	108	102	101

Limits: 50-141 54-135 52-141 50-131

Analysis Name: SVOA 8270D (microwave)
Batch number: 12156SLA026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6674330	95	92	108
6674331	102	94	112
6674332	110	70	109
6674333	108	87	111
Blank	102	103	128
LCS	101	97	114
MS	99	93	112
MSD	98	93	112

Limits: 45-123 56-121 36-135

Analysis Name: SVOAs by 8270D in Water
Batch number: 12156WAX026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6674334	97	93	112
Blank	92	90	110
LCS	96	92	108
MS	97	94	108
MSD	99	93	110

Limits: 52-120 63-114 34-118

Analysis Name: WA EPH in Soil
Batch number: 121560009A

	Orthoterphenyl	1-chlorooctadecane
6674330	94	74
6674331	94	73
6674332	96	89
6674333	106	76
Blank	94	75
LCS	78	67
MS	94	81
MSD	95	74

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: The Boeing Company
Reported: 08/30/12 at 04:34 PM

Group Number: 1312959

Surrogate Quality Control

Limits: 30-127 33-122

Analysis Name: TPH-Dx SW Fuel ID w/Si Gel
Batch number: 121560016A

	Chlorobenzene	Orthoterphenyl
6674330	109	94
6674331	85	92
6674332	0*	127
6674333	78	89
Blank	80	92
DUP	105	94
LCS	88	97
Limits:	50-150	50-150

Analysis Name: TPH-Dx WW Fuel ID w/Si Gel
Batch number: 121580005A

	Chlorobenzene	Orthoterphenyl
6674334	78	77
Blank	71	77
LCS	79	81
LCSD	79	82
Limits:	50-150	50-150

Analysis Name: WA EPH in Water
Batch number: 121580017A

	Orthoterphenyl	1-chlorooctadecane
6674334	91	110
Blank	91	63
LCS	87	86
LCSD	101	83
Limits:	36-118	32-132

Analysis Name: WA- VPH soils
Batch number: 12163A08A

	Trifluorotoluene-P	Trifluorotoluene-F
6674330	267*	421*
6674330	29*	49*
DL		
6674331	63	60
6674332	73	65
6674333	76	72
6674336	94	90
Blank	107	97
LCS	104	92
LCSD	109	97
Limits:	60-140	60-140

Analysis Name: WA - VPH waters
Batch number: 12164A08A

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

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Quality Control Summary

Client Name: The Boeing Company
Reported: 08/30/12 at 04:34 PM

Group Number: 1312959

Surrogate Quality Control

	Trifluorotoluene-P	Trifluorotoluene-F
6674334	93	88
Blank	95	87
LCS	98	89
LCSD	103	87
Limits:	60-140	60-140

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Project Name: Boeing_RTN: FFF
LLI Group #: 1312959

General Comments:

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below. Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

SW-846 8260C, GC/MS Volatiles

Batch #: X121651AA (Sample number(s): 6674331, 6674335)

The recovery(ies) for one or more surrogates were outside of the QC window for sample(s) 6674331, 6674331RE

Sample #s: 6674330, 6674332, 6674333

Reporting limits were raised due to interference from the sample matrix.

ECY 97-602 NWTPH-Dx modified, GC Petroleum Hydrocarbons w/Si

Batch #: 121560016A (Sample number(s): 6674330-6674333 BKG: 6674330)

The duplicate RPD for the following analyte(s) exceeded the acceptance window: DRO C12-C24 w/Si Gel, TPH JetA C8-C18 w/Si Gel

The recovery(ies) for one or more surrogates were outside of the QC window for sample(s) 6674332

ECY 97-602 WA VPH, GC Petroleum Hydrocarbons

Batch #: 12163A08A (Sample number(s): 6674330-6674333, 6674336)

The recovery(ies) for one or more surrogates were outside of the QC window for sample(s) 6674330, 6674330DL

Sample #s: 6674331, 6674332, 6674333, 6674336

The recovery for the method blank surrogate(s) is outside the QC acceptance limits as noted on the QC Summary. Since the recovery is high and no target analytes were detected, the data is reported.
The LCS/LCSD surrogate(s) recovery is outside the QC acceptance limits as noted on the QC Summary. Since the recovery for the target analytes is compliant, the data is reported.

Sample #s: 6674330

The recovery for the method blank surrogate(s) is outside the QC acceptance limits as noted on the QC Summary. Since the recovery is high and no target analytes were detected, the data is reported.
The LCS/LCSD surrogate(s) recovery is outside the QC acceptance limits as noted on the QC Summary. Since the recovery for the target analytes is compliant, the data is reported.
Reporting limits were raised due to interference from the sample matrix.

Boeing Chain of Custody

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Acct. # 13419 Group # 1312959 Sample # 6674330-36

For Lancaster Laboratories use only

Please print. Instructions on reverse side correspond.

(1) Client Information

Site Location: Boeing Renton Former Fuel Farm
Site Project: Former Fuel Farm Cleanup Action
Site Program/#: 0088880080
Boeing PM: Fred Wallace
Consultant Contact: John Long, AMEC
Report To: John Long
Invoice To: ☑ Boeing EHS ☐ Other (specify): _____
Sampler: Chelsea Jefferson # of Coolers: _____

(2) Sample Identification	Collected Date	Collected Time	(3) Matrix	No. of Containers	(4) Analyses Requested: TPH-Dx/TPH-Jet Fuel	BTEX	2-Methylnaphthalene	VPH	EPH	(5) Remarks/Comments
RI-SB01-PP213-14	5/31/12	1000	S	7	X	X	X	X	X	
RI-SB01-PP213-16	5/31/12	1025	S	7	X	X	X	X	X	
RI-SB01-PP217-12	5/31/12	1120	S	7	X	X	X	X	X	
RI-SB01-PP217-16	5/31/12	1145	S	7	X	X	X	X	X	
Field Blank	5/31/12	1200	AQ	10	X	X	X	X	X	
Trip Blank	—	—	AQ	2	X	X	X	X	X	

(6) Turnaround Time Requested (please circle)

Standard | 5 day | 4 day | 72 hour | 48 hour | 24 hour

Date needed: _____

Relinquished by:	Date/Time	Received by:	Date/Time (7)
[signature]	5/16/12 1745		
Chelsea Jefferson	5/31/12 1240		
		[signature]	5/1/12 0925

Relinquished by commercial carrier (circle): UPS FedEx Other: _____

Temperature upon Receipt: 9.4 °C

Custody Seals Intact?: Yes No

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A# 13419 Gr# 1312955

Environmental Sample Administration Receipt Documentation Log

Client/Project: Boeing

Date of Receipt: 6/1/12

Time of Receipt: 0925

Source Code: SO-1

Shipping Container Sealed: (YES) NO

Custody Seal Present * : YES (NO)

* Custody seal was intact unless otherwise noted in the discrepancy section

Package: (Chilled) Not Chilled

Temperature of Shipping Containers							
Cooler #	Thermometer ID	Temperature (°C)	Temp Bottle (TB) or Surface Temp (ST)	Wet Ice (WI) or Dry Ice (DI) or Ice Packs (IP)	Ice Present? Y/N	Loose (L) Bagged Ice (B) or NA	Comments
1	9422	4.4	TB	WI	Y	B	
2							
3							
4							
5							
6							

Number of Trip Blanks received NOT listed on chain of custody: 0*

Paperwork Discrepancy/Unpacking Problems:

* TBs → 1 MeOH, 1 $NaHSO_4$

Unpacker Signature/Emp#: ICAM 2241 **Date/Time:** 6/1/12 1435

Issued by Dept. 6042 Management

2174.06

A# 13419 Gr# 1312959

eurofins | Lancaster Laboratories

September 7, 2012

Ms. Crystal Neirby
AMEC
Suite 600
600 University St
Seattle, WA 98101

Dear Ms. Neirby:

I am writing to inform you of revised analytical reports that are being issued for the following:

Project No.: Boeing_RTN: FFF

Group No.: 1312959 **SDG.: BNX77**

LLI Sample No.	Client Sample Identification	Collection Date
6674330	R1-SB01-PP213-14	05/31/2012
6674331	R1-SB01-PP213-16	05/31/2012
6674332	R1-SB01-PP217-12	05/31/2012
6674333	R1-SB01-PP217-16	05/31/2012
6674334	Field Blank	05/31/2012
6674336	Trip Blank	05/31/2012

TFT surrogate recoveries

Batch	LLI No.	New FID %Recovery	New PID % Recovery	Old FID % Recovery	Old PID % Recovery
12163A08A	BLANK	97	107	128	141
	LCS	92	104	121	137
	LCSD	97	109	127	144
	6674331	60	63	79	83
	6674332	65	73	86	96
	6674336	90	94	118	124
	6674333	72	76	95	100
	6674330	421	267	554	352
	DF352				
	6674330	49	29	64	39
	DF3518				
12164A08A	BLANK	87	95	114	125
	LCS	89	98	118	129
	LCSD	87	103	114	135
	6674334	88	93	116	122

Eurofins Lancaster Laboratories, Inc.
2425 New Holland Pike
PO Box 12425
Lancaster, PA 17605-2425
T | 717-656-2300
F | 717-656-2681
www.LancasterLabs.com

The correction to the data affects the WAVPH analysis only.

During an additional review of the data, the analyst noticed that the incorrect surrogate concentrations were entered for the calibration. The concentrations were corrected and the calibration was reprocessed. All data associated with this calibration was reprocessed. The surrogate recoveries for the samples listed above changed. The data on the QC Summary of the analytical report and the electronic deliverable were corrected. Please see the attached table for the comparison between the old data and the new data for the surrogates. There was no change to any sample results.

The revised analytical report reflects this correction and is enclosed.

You are a valued client and we apologize for any inconvenience that this incident may have caused. If you have any questions or require further assistance, please call me at 717-656-2300, Ext. 1343. We appreciate your business and look forward to continuing to serve your laboratory needs.

Sincerely,

Valerie Tomayko
Principal Specialist
EPH/Miscellaneous GC

VT/mc
Enclosures

cc: Carl Bach - The Boeing Company
Kay Hower

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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
µg	microgram(s)	**mg**	milligram(s)
mL	milliliter(s)	**L**	liter(s)
m3	cubic meter(s)	**µL**	microliter(s)
		pg/L	picogram/liter

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Data Qualifiers:

C – result confirmed by reanalysis.

J - estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR part 136 Table II as "analyze immediately" are not performed within 15 minutes.

APPENDIX E

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT 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) 342-1766

February 2012

Project No. SE11160400.00004

QUALITY ASSURANCE PROJECT PLAN
Boeing Renton Facility
Renton, Washington

APPROVALS

Washington State Department of Ecology Project Manager	Date
Client (Boeing Company)	Date
AMEC Project Manager's Supervisor	Date
AMEC Project Manager	Date
AMEC Quality Assurance Leader	Date
Lancaster Laboratory, Inc., Project Manager	Date
Analytical Resources, Inc., Project Manager	Date

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APPENDICES

DISTRIBUTION LIST

This list identifies all individuals to receive a copy of the approved QAPP, either in hard copy or electronic format, as well as any subsequent revisions.

Washington State Department of Ecology, Project Manager:	Byung Maeng, PE Ecology Northwest Regional Office Hazardous Waste and Toxics Reduction Program 3190 160th Ave. SE Bellevue, WA 98008-5452 (425) 649-7253 bmae461@ecy.wa.gov
Boeing Project Manager:	Carl Bach PO Box 3707, MC 1W-12 Seattle, WA 98124-2207 (206) 898-0438 carl.m.bach@boeing.com
AMEC Project Manager:	David Haddock, LHg, LG, LEG. AMEC Environment & Infrastructure, Inc. 600 University Street, Suite 600 Seattle, WA 98101 (206) 342-1760 dave.haddock@amec.com
AMEC Quality Assurance Leader:	Crystal Neirby AMEC Environment & Infrastructure, Inc. 600 University Street, Suite 600 Seattle, WA 98101 (206) 342-1760 crystal.neirby@amec.com
Analytical Laboratory Project Manager:	Liz Leonhardt Lancaster Laboratory, Inc. 2425 New Holland Pike Lancaster, PA 17601 (510) 232-8894 lleonhardt@lancasterlabs.com
Analytical Laboratory Quality Assurance:	Dorothy Love Lancaster Laboratory, Inc. 2425 New Holland Pike Lancaster, PA 17601 (717) 656-2300 dlove@lancasterlabs.com

DISTRIBUTION LIST
(Continued)

Analytical Laboratory Project Manager:	Kelly Bottem Analytical Resources, Inc. 4611 S. 134th Place Tukwila, WA 98168 (206) 695-6211 kellyb@arilabs.com
Analytical Laboratory Quality Assurance:	Dave Mitchell Analytical Resources, Inc. 4611 S. 134th Place Tukwila, WA 98168 (206) 695-6211 davem@arilabs.com

QUALITY ASSURANCE PROJECT PLAN
Boeing Renton Facility
Renton, Washington

1.0 BACKGROUND

The Boeing Company (Boeing) has been working with the Washington State Department of Ecology (Ecology) to address historical releases of hazardous substances at the Boeing Renton Facility (Facility) located in Renton, Washington. Boeing has entered into Agreed Order No. DE 97HZ-N233 (Agreed Order) with Ecology to address former releases at the Facility. The Agreed Order was issued under the Revised Code of Washington (RCW) 70.105D.050(1) and Washington Administrative Code (WAC) 173 -03-646(3)(a) and became effective on October 10, 1997.

Work that has been completed at this 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 Feasibility Study (FS) report (Geomatrix, 2008) was prepared and conditionally approved by Ecology in a letter to Boeing dated June 30, 2008 (Ecology, 2008). Boeing subsequently prepared a draft Cleanup Action Plan (CAP) identifying the final remedy to be implemented at the Facility. Implementation of the draft CAP will be performed under a new Agreed Order (No. 8191) that will replace Agreed Order No. DE 97HZ-N233

Boeing completed sampling of groundwater and soil as part of the RI, FS, and preparation of the draft CAP. The results identified several solid waste management units (SWMUs) and areas of concern (AOCs) at which hazardous constituents were released at levels requiring corrective action. The SWMUs and AOCs requiring cleanup are described in the draft CAP. Sampling and analysis of soils and groundwater at the Facility have been conducted in accordance with the RI Work Plan, (Weston, 1998). The RI Work Plan included quality assurance (QA) and quality control (QC) procedures, as outlined in the Quality Assurance Project Plan (QAPP) presented in Section 6 of the RI Work Plan. The 1998 QAPP was updated by the 2007 QAPP Addendum (Geomatrix, 2007). The update was necessary because of lower detection limits for analysis of volatile organic compounds and because of changes in analytical protocols, standard operating procedures, and team members since the 1998 QAPP was completed. The 1998 QAPP and 2007 QAPP Addendum were approved by Ecology.

The QAPP presented herein has been prepared to replace both the 1998 QAPP and the 2007 QAPP Addendum. AMEC Environment & Infrastructure, Inc. (AMEC), has prepared this QAPP on behalf of

Boeing. This revised QAPP addresses a change in the project laboratory selected by Boeing and identified in the 2004 QAPP guidance (Ecology, 2004). The new project laboratory will be used for analysis of groundwater, soil, and waste samples collected at the Facility. Due to the change in project laboratory, this QAPP also provides revisions to the project team members and their contact information, changes in detection and reporting limits, updated analytical methods, and changes in standard operating procedures (including laboratory QA/QC procedures).

2.0 PROJECT DESCRIPTION

Boeing Renton Plant (Plant) property has been used for aviation purposes since 1941. The Plant includes property owned by Boeing, located east of the Cedar River Waterway. Boeing leases several properties located within the Renton Municipal Airport from the City of Renton. The Plant borders Lake Washington and is near the Cedar River Waterway (Figure 1). A public park is located along the eastern shore of the Cedar River Waterway, between the Plant and the Cedar River Waterway. Plant property is developed as an industrial facility, with the surface mostly covered by buildings or pavement.

Boeing has been working with Ecology to address releases of hazardous constituents that have occurred during its long history of industrial operations. Cleanup is being addressed under regulations issued by Ecology pursuant to the Model Toxics Control Act (MTCA). The MTCA regulations are codified in WAC 173-340. Under the terms of the Agreed Order, Boeing has completed site characterization, preparation of a FS report, and development of a draft CAP to select the final remedy for the Facility. The FS report identified preferred cleanup approaches for the SWMUs and AOCs that were identified in the RI as requiring cleanup (Figure 2). The draft CAP, which has been submitted for public comment, identifies the comprehensive cleanup remedy for the Facility. Groundwater monitoring is being performed under an ongoing program to track changes in groundwater quality for Facility SWMUs and AOCs.

A new Agreed Order is being prepared to address implementation of the Facility remedy described in the draft CAP. The new Agreed Order will be issued simultaneously with the draft CAP. The Facility remedy includes requirements for future monitoring of groundwater quality at the SWMUs and AOCs addressed in the draft CAP. This QAPP is intended to cover soil and groundwater analyses conducted under the current Agreed Order and under the CAP implementation program to be established under the new Agreed Order.

3.0 ORGANIZATION AND SCHEDULE

The management of the work performed under the current Agreed Order and to be performed under the new Agreed Order is the responsibility of the Boeing Project Coordinator. Boeing may retain the

services of consultants and/or contractors to perform work addressed by this QAPP. The following subsections describe the roles and responsibilities of key organizations.

3.1 THE BOEING COMPANY

Boeing will be responsible for the overall project management of the Facility cleanup. Boeing project management personnel are listed in Table 1. Under the Agreed Order, the Boeing Project Coordinator will be responsible for overall project compliance with state regulations on behalf of Boeing. The Boeing Project Coordinator is named in the Agreed Order. The Project Coordinator will have overall responsibility for final review and approval of all documents prepared under the current Agreed Order and the new Agreed Order, including reports, approvals, and other correspondence.

The Cleanup Action Program Manager will have overall management responsibility for groundwater monitoring, additional soil sampling, and cleanup design and construction for the Facility. The Cleanup Action Program Manager will have responsibility for retaining and managing consultants and contractors that may be retained for work conducted under the current Agreed Order and the new Agreed Order. The Project Coordinator and/or the Cleanup Action Program Manager may be assisted as appropriate by other Boeing staff to complete the work safely and effectively. The Boeing Cleanup Action Program Manager will also be responsible for ensuring that groundwater monitoring is performed in accordance with the approved work plans and schedules.

3.2 ENVIRONMENTAL CONSULTANT

Boeing will likely retain professional environmental consulting services for assistance during the cleanup and monitoring conducted at the Facility. Boeing may also elect to change the environmental consultant. If Boeing changes the environmental consultant for the work covered by this QAPP, Ecology will be notified by letter with a revised Table 1 attached to the letter.

The environmental consultant will designate a Project Manager who will have overall responsibility for the environmental consultant's work activities and will serve as the primary contact with Boeing. The consultant's Project Manager will have responsibility for scheduling and conducting the consultant's work so that the work is conducted and completed in a technically sound manner and that the work meets current standards of practice. The Project Manager is identified in Table 1.

The environmental consultant also will designate a Quality Assurance Leader to independently review analytical data reports for compliance with this QAPP. The Quality Assurance Leader will review and validate analytical data as outlined in Section 11.0. The Quality Assurance Leader is identified in Table 1. Additional environmental consultant staff may contribute to the work as appropriate, based on the expertise required to meet the project goals.

3.3 PROJECT LABORATORY

The project laboratory will provide analytical laboratory services for all work conducted under the current Agreed Order and the new Agreed Order. The project laboratory will contract directly with Boeing. The project laboratory will provide a Project Manager for all work performed for the Facility; the designated Project Manager is listed in Table 1.

The laboratory's Project Manager will be responsible for ensuring that the project requirements are satisfied and performing project QC. Specific responsibilities of this position include the following:

- Verifying implementation of the laboratory QA plan,
- Serving as the laboratory point of contact,
- Activating corrective action for out-of-control events,
- Issuing the final laboratory data reports, both hard copy and electronic data deliverable (EDD),
- Complying with the specifications established in the project plans as related to laboratory services, and
- Participating in QA audits and compliance inspections (as applicable).

The project laboratory also designates a laboratory Quality Assurance Manager for the Facility, as identified in Table 1.

The project laboratories are Lancaster Laboratory, Inc., of Lancaster, Pennsylvania, and Analytical Resources, Inc., of Tukwila, Washington. The laboratory specific Quality Assurance Manuals are provided in Appendix A.

3.4 OTHER CONTRACTORS

Other contractors may be selected and retained by Boeing as needed to complete the work required under the current Agreed Order and the new Agreed Order.

3.5 ECOLOGY PERSONNEL

Byung Maeng, PE, will be Ecology's Project Coordinator for the corrective action program. Ecology will be the lead agency throughout this project.

4.0 QUALITY OBJECTIVES

The sampling design, field procedures, laboratory procedures, and QC procedures have been established to provide high-quality data for use in this project. Specific data quality factors that may

affect data usability include quantitative factors (precision, bias, accuracy, completeness, and reporting limits) and qualitative factors (representativeness and comparability). The measurement quality objectives (MQOs) associated with these data quality factors are provided in Appendix B and discussed in the following subsections. The laboratory periodically updates its control limits; therefore, the limits provided in Appendix B are provided as guidelines. The updated laboratory control limits will be used to evaluate the laboratory data.

4.1 PRECISION

Precision is the agreement among a set of replicate measurements without assumptions of the true value. For this project, precision will be measured by calculating the relative percent difference (RPD) for field duplicate and laboratory duplicate results. Precision is optimized by collecting data at multiple locations and adhering to strict procedural guidelines that minimize possible sample contamination. RPD results that are outside the control limits listed in Appendix B for laboratory split samples will be qualified appropriately during data validation.

Field precision will be assessed collecting and measuring field duplicates at a rate of 1 duplicate per 20 field samples, or a minimum of 1 duplicate per day. Analyses of these field duplicates will measure both field and laboratory precision. The results, therefore, may have more variability than laboratory-generated duplicates. It is expected that results from duplicate soil samples will have a greater variance than duplicates of water samples due to the heterogeneity inherent in contaminated solids.

Laboratory precision will be assessed by analyzing duplicate spiked and/or unspiked samples, as specified by the analytical method. The various types of laboratory duplicate samples are discussed in Section 8.1.

The RPD value will be calculated according to the following equation:

$$RPD(\%) = \frac{|D_1 - D_2|}{(D_1 + D_2)/2} \times 100$$

Where:

D_1 = Concentration of analyte in sample.
D_2 = Concentration of analyte in duplicate sample.

This calculation applies to split samples, replicate analyses, duplicate spiked environmental samples (matrix spike duplicates), and laboratory control duplicates. The RPD will be calculated for samples and compared to the applicable criteria. Precision may also be expressed as the percent difference

(%D) between replicate analyses. During data validation, the data validator will evaluate all RPD values and take action as described in U.S. Environmental Protection Agency (EPA) guidance (EPA, 2008, 2010).

4.2 BIAS

Bias is systematic deviation of a measured value from the true value. Bias can be assessed by comparing a measured value to an accepted reference value in a sample of known concentration or by determining the recovery of a known amount of contaminant in a spiked sample. For this project, bias will be minimized by standardizing methods for field activities, including those for equipment decontamination, sample collection, field observation and documentation, sample transport, and chain-of-custody control.

4.3 ACCURACY

Accuracy is the degree of agreement between an observed value and an accepted reference value. When applied to a set of observed values, accuracy depends on a combination of random error and common systematic error (or bias). For this project, accuracy will be determined by evaluating laboratory spike sample recoveries that represent the difference between an observed value and an accepted reference value. Control limits for spike recoveries have been documented by the project laboratory and are provided in Appendix B. Results showing noncompliant recoveries will be qualified appropriately during data validation. For this project, accuracy will be optimized by using procedures designed to reduce potential error that might affect the accuracy of results. Proper decontamination methods and equipment will be used during field activities to ensure accurate results. The laboratory QC procedures, described in Section 8.1, also will reduce error to improve accuracy.

Accuracy will be assessed by the percent recovery (%R) of a surrogate compound (also known as "system monitoring compound"), a matrix spike result, and/or from a standard reference material, which is calculated as follows:

$$\text{Recovery}(\%) = \frac{\text{sample result}}{\text{spike amount}} \times 100$$

The data validator will evaluate all %R values and take action as described in EPA guidance (EPA 2008, 2010).

4.4 REPRESENTATIVENESS

Representativeness is a measure of how well data reflect the actual environment and the conditions under which the data are collected. For this project, representativeness will be optimized by ensuring that (1) sampling locations are selected properly, (2) sufficient numbers of samples are collected to

accurately reflect conditions at the site, and (3) samples are representative of the sampling locations. The methods used to collect samples and measurements, as detailed in the work plan and the groundwater management plan (GWMP) (Geomatrix, 2007), are also designed to collect representative data with minimal disturbance of the environment from which they are collected.

To be considered representative, a data set should accurately and precisely represent the actual site conditions. The representativeness of the data will be determined by the following actions:

- Comparing actual sampling procedures to those prescribed in the GWMP and this QAPP,
- Comparing analytical results from field duplicates to determine variation in the analytical results, and
- Flagging nonrepresentative data as invalid or identifying data that are out of compliance with the project specifications.

Only representative data will be used in subsequent data reduction, validation, and reporting activities.

4.5 COMPARABILITY

Comparability represents how well multiple data sets can be used for a common interpretation. For this project, comparability will be optimized by using the same standards for data collection at each location and the same analytical procedures and QA procedures that have been used during other sampling events at the site.

Comparability expresses the confidence associated with a comparison of one set of data to another. There are no established numerical goals for comparability; therefore, a statement of comparability on which to base the overall usefulness of data sets will be prepared after the determination of both precision and accuracy.

4.6 COMPLETENESS

Completeness is a measure of the amount of data collected that are found to be valid in relation to the total amount of data intended to be collected according to the sampling design. For this project, completeness will be optimized by subjecting all analytical results to validation by a data validator and by performing field work in a multiphased progression so that sufficient data are collected.

The number of samples and expected results establishes the comparative basis for completeness and is defined as a ratio of acceptable measurements (including estimated data) obtained to the total number of planned measurements for an activity. Completeness (C) can be calculated as follows:

$$\%C = \frac{(\text{number of acceptable data points})}{(\text{total number of data points})} \times 100$$

For this project, the data quality objective for completeness is 100 percent usable data for the planned samples/analyses. If the completeness goal is not achieved, the data will be evaluated to determine whether they are adequate to meet the project objectives. Completeness below 100% will require a review of the sampling objectives to determine whether further sampling and analyses may be required. (Note that in the case of solids, archived (frozen) material may be reanalyzed.)

4.7 REPORTING LIMITS

Analytical methods have quantitative limitations at a given statistical level of confidence that are often expressed as the method detection limit (MDL). Although results reported near the MDL provide insight to site conditions, QA requires that analytical methods achieve a consistently reliable level of quantitation known as the practical quantitation limit (PQL). The laboratory will provide numerical results for all analytes and report them as detected above the PQL or undetected at the PQL.

Ideally, the laboratory's reporting limits (PQLs) should be low enough to compare to the preliminary screening levels for the site. A reasonable level of effort will be exercised to achieve this goal.

Analytical detection limits for the target analytes are helpful in providing statistically useful data. Intended data uses, such as comparison to regulatory criteria or risk assessment, usually dictate specific target reporting levels necessary to fulfill the stated objectives. The selected analytical methods and processes should provide a PQL that is lower than the target reporting level (e.g., lowest regulatory screening level) under ideal conditions. The reporting limits that will be achieved by Lancaster are listed in Table 2. The reporting limits listed in Table 2 are considered "target" reporting limits, because several factors may influence laboratory PQLs and individual sample quantitation limits. First, the physical conditions of soil (e.g., moisture, compaction, and composition) affect detection limits. Second, analytical procedures may require sample dilutions and/or cleanup and reanalysis to accurately quantify a particular analyte at concentrations above the calibration range of the instrument. The effect is that other analytes may be reported as undetected at a PQL that is much higher than a specified regulatory screening level. Data users must be aware that high nondetected values, although correctly reported, can bias statistical summaries, and careful interpretation is required to correctly characterize the site conditions. During data validation, the analytical results will be evaluated, and the most appropriate result for each analyte will be reported.

5.0 SAMPLING PROCESS DESIGN

The sampling design, including figures showing the locations of field work and tables of samples to be collected, are included in the GWMP (Geomatrix, 2007).

6.0 SAMPLING PROCEDURES

Sample collection and other field procedures will be conducted in accordance with the Ecology-approved RI Work Plan (Weston, 1998) as previously amended, which includes field methods for sample collection, sample designation, equipment decontamination, and documentation, and the GWMP (Geomatrix, 2007).

7.0 MEASUREMENT PROCEDURES

The analytical methods that will be used to analyze the soil and water samples are listed in Tables 2 and 3. The methods are derived from SW-846, EPA Test Methods for Evaluating Solid Waste (latest revisions, EPA, 1998), EPA's Methods for Chemical Analysis of Water and Wastes (EPA, 1983), Ecology's Analytical Methods for Petroleum Hydrocarbons (Ecology, 1997), Standard Methods for the Examination of Water and Wastewater (18th and 19th Editions), and methods developed by Lancaster Laboratories.

8.0 QUALITY CONTROL SAMPLES

This section discusses both laboratory and field quality control samples. Collection and analysis of these quality control samples help to support the development of a complete and accurate data set from sample collection though laboratory analysis and data validation. In this section, a sampling event is defined as consecutive days of sampling not separated by more than 2 days of inactivity.

8.1 LABORATORY QUALITY CONTROL SAMPLES

Laboratory QC samples are specified in each method and may include laboratory control samples (LCSs), laboratory duplicate samples, matrix spike/matrix spike duplicate (MS/MSD) samples, surrogate spikes, and method blanks. The control limits for laboratory QC samples are provided in Appendix B. Control limits are periodically updated by the laboratory and provided with the analytical results. The most recent laboratory control limits will always be used to evaluate laboratory QC samples.

8.1.1 Laboratory Control Samples

LCSs are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects. The LCS is prepared by spiking reagent water or silica sand with standard solutions prepared independently of those used in establishing instrument calibration. The

LCS is extracted and analyzed with each batch of samples. The results are compared on a per-batch basis to established control limits and are used to evaluate laboratory performance for precision and accuracy. LCS recoveries will be compared to laboratory-specified control limits and associated sample data qualified in accordance with the guidance in EPA's Functional Guidelines (EPA, 2008, 2010).

8.1.2 Laboratory Duplicate Samples

The precision of the analytical system is evaluated by means of laboratory duplicates. Laboratory duplicates consist of two portions of a single homogenous sample analyzed for the same parameter. Laboratory duplicates will be prepared and analyzed with the project samples as specified in the methods. RPDs will be compared to laboratory-specified control limits, and the associated sample data will be qualified in accordance with the guidance in EPA's Functional Guidelines (EPA, 2008, 2010).

8.1.3 Matrix Spike/Matrix Spike Duplicate Samples

Matrix spikes are used to assess sample matrix interferences and analytical errors, as well as to measure the accuracy of the analysis. Known concentrations of analytes are added to environmental samples; the matrix spike is then processed through the entire analytical procedure and the recovery of the analytes is calculated. Results are expressed as percent recovery of the known spiked amount. The analysis of MS/MSD pairs will be performed on project samples at the frequency specified in the method. Additional volume will be collected for project-specific MS/MSD samples at a rate of 5 percent of the field samples collected during each sampling event. MS/MSD recoveries will be compared to laboratory-specified control limits, and the associated sample data will be qualified in accordance with the guidance in EPA's Functional Guidelines (EPA, 2008, 2010).

8.1.4 Surrogate Spikes

Surrogate compounds are added to the sample at the preparation step and used to measure the effect of the matrix on the accuracy of the analytical result. Samples for analysis of organic compounds will be spiked with surrogate compounds consistent with the method requirement. Surrogate recoveries will be assessed on the basis of laboratory-specified control limits. Data will be qualified on the basis of surrogate recoveries, in accordance with EPA's Functional Guidelines (EPA, 2008, 2010).

8.1.5 Method Blanks

Method blanks are used to check for laboratory contamination and instrument bias. Laboratory method blanks will be analyzed at a minimum frequency of 5 percent or one per analytical batch for all chemical parameter groups.

QC criteria require that no contaminants be detected in the blank(s) above the PQL. If contaminants are detected above the PQL, the data will be qualified, in accordance with EPA's Functional Guidelines (EPA, 2008, 2010).

8.2 FIELD QUALITY CONTROL

Field QC samples will be used to evaluate data quality. Field QC samples are control samples introduced into the analysis stream whose results are used to review data quality and to calculate the accuracy and precision of the chemical analysis program. The types of field QC samples that will be collected include field duplicate samples, equipment blanks, and trip blanks. Field QC samples will be collected and analyzed with the frequencies stated in the following subsections and summarized in Table 4.

8.2.1 Field Duplicate Samples

Field duplicate samples results are used to assess the precision of the sample collection process. Field duplicate samples will be collected in conjunction with the associated primary samples and analyzed by the same methods. Field duplicates will be collected from locations with potentially high concentrations of target analytes.

For sampling events that include six or more samples, field duplicates will be submitted to the laboratory at a frequency of 5 percent of the field samples for each sampling event. For sampling events that include five or fewer samples, a field duplicate will not be collected and the results will be based on laboratory duplicates. Comparability criteria are not specified for each sampling technique or analytical method. Control limits for field duplicate precision are 30 percent for groundwater samples and 50 percent for soil samples.

Field duplicates will be submitted blind to the laboratory, with sample numbers that are indistinguishable from those of the primary samples.

8.2.2 Equipment Blanks

Equipment blanks are collected to determine the potential for cross-contamination of samples during collection by assessing the decontamination process. Equipment blanks will be collected and analyzed at the rate of one blank per sampling event, if nondedicated sampling equipment is used. Equipment blanks will consist of deionized water collected during the final rinse of sampling equipment after the decontamination procedures have been completed. The equipment blank will be subjected to all the analyses requested for the environmental samples associated with the equipment blank.

8.2.3 Trip Blanks

Trip blanks are used to assess the potential introduction of volatile organic contaminants from sample containers or during the transportation and storage procedures. Trip blanks will be analyzed at the rate of one blank per sample storage container (cooler) containing samples to be analyzed for volatile organic compounds (VOCs). The trip blank consists of two VOC sample vials that are filled in the laboratory with reagent-grade water, transported to the sampling site, handled under the same conditions as an environmental sample, and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are prepared only when samples are collected for analysis of VOCs, and they are analyzed for the same suite of VOCs as the samples associated with the trip blank.

9.0 DATA MANAGEMENT PROCEDURES

The laboratory will submit hard copy reports that include information sufficient to review the data in terms of holding times and sample condition, reporting limits, laboratory duplicates and MS/MSDs, precision, accuracy, and completeness.

The laboratory will provide a data package for each analytical batch. The laboratory data packages will include the following:

- Case narrative identifying the laboratory analytical batch number, matrix, and number of samples included; analyses performed and analytical methods used; description of any problems or exceedance of QC criteria and corrective action taken; any changes to the reference method; and an explanation of data qualifiers. The laboratory manager or his or her designee must sign the narrative.
- A copy of the chain-of-custody form for all samples included in the batch.
- Tabulated sample analytical results identified and quantified, with reporting limits for all analytes. All analytes will be reported for each sample as a detected concentration or as not detected above the specific limit of quantitation, which must be stated. Solid samples will be reported on a dry-weight basis with the percentage of moisture also reported. The laboratory will also report units, data qualifiers, dilution factor, laboratory batch, and dates of sampling, receipt, extraction, and analysis.
- Analytical results for QC sample spikes (MS/MSD samples), laboratory duplicates, laboratory blanks (method blanks), LCSs, and surrogates as required by the method.
- Reporting of all raw data in accordance with the Ecology Agreed Order. Under the Agreed Order, raw data to be reported includes “respondent sample raw data, associated laboratory control spike and/or laboratory control spike duplicate raw data, matrix spike and/or matrix spike duplicate raw data, associated method blank raw data, and a full case narrative to address the initial and continuing calibrations as well as any anomalies associated with the prep or analysis of said listed samples.”
- Electronic Data Deliverables (EDDs).

The environmental consultant will use a relational Access database to track and report the following:

- Sample collection information including sample number, station, matrix, type of sample (field, blank, or duplicate), and date of collection, and
- Analytical results including concentration, units, data qualifier, and analytical method.

Laboratory EDDs will be directly loaded into the database, thereby avoiding any errors relating to hand entry of data. After the data quality review has been performed, qualifiers and any changes in values will be added to the database. Tables will be generated and validated against the laboratory data. The original laboratory data and EDDs will be archived in the project files.

10.0 AUDITS AND REPORTS

Since the RI has been completed and approved, no formal assessments or audits are anticipated during the completion of this project. Project staff will monitor the performance of subcontractors and field staff on the project. Reporting will follow the requirements outlined in the Agreed Order.

11.0 DATA REVIEW, VERIFICATION, AND VALIDATION

In order to ensure that data is of a known and acceptable quality, the environmental consultant will perform a data quality review that will include a review of laboratory performance criteria and sample-specific criteria. The reviewer will determine whether the project objectives have been met and will calculate data completeness for the project.

The primary data quality review will consist of verification of the following elements:

- Sample numbers and analyses matched the chain-of-custody request.
- The requirements for sample preservation and holding times were met.
- Field and laboratory blanks were collected/prepared and analyzed at the proper frequency and that no analytes were present in the blanks.
- Field and laboratory duplicates, matrix spikes, and LCSs were collected/prepared and analyzed at the proper frequency and that the control limits were met.
- Analyses of surrogate compounds were performed and results met the criteria.
- The established reporting limits were achieved.

The data quality review will also include a review of the precision, bias, and completeness of analytical data. Precision will be assessed on the basis of the RPD of MS/MSD samples and/or duplicate pairs. Calculated RPDs will be compared to the control limits and if the RPD is within these

limits, the precision of the analysis will be assumed to meet the DQOs of the project. Bias will be reviewed by comparing the percent recoveries of surrogate spikes, matrix spikes, and LCSs to the appropriate control limits.

The control limits for the analytical methods that may be used are indicated in Appendix B. The control limits are periodically updated by the laboratory. The control limits in Appendix B will be verified by the data review. If more current control limits are available, the laboratory QC results will be compared to the current control limits provided by the laboratory.

Data will be reviewed in accordance with the analytical methods, the laboratory's standard operating procedures, this QAPP, the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review (EPA 2008), and USEPA CLP National Functional Guidelines for Inorganic Superfund Data Review (EPA 2010).

The following qualifiers may be added to the data:

- U: The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J: The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ: The analyte was not detected above the reported sample quantitation limit; however, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R: The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Completeness will be expressed as the percentage of the total tests conducted that are valid and meet the DQOs defined in this QAPP.

12.0 DATA QUALITY ASSESSMENT

The analytical methods that may be used are listed in Tables 2 and 3; no departures from these analytical methods are expected. After the field work and the final analyses have been completed and reviewed, a final QC summary report will be prepared by a project engineer or scientist who has been trained in data quality assessment. The data review will be documented in a report that will be distributed to data users along with the analytical data and appended to the appropriate investigation report(s). The report will summarize the QA and audit information, indicating any corrective actions taken and the overall project compliance. The QC summary report will include an evaluation of

sampling documentation/representativeness, holding time, analyses of field and laboratory blanks, results from laboratory and field QC samples, field duplicates, compound identification and quantitation, elevated reporting limits, and a summary of qualified data.

The objectives of this QAPP will be reviewed on an ongoing basis as data are received and used for reporting and other interpretive uses. Data that do not meet the data quality requirements as described in the QAPP will be qualified or rejected during data validation. Rejected data will not be used for any purpose.

Any data qualifiers applied to the data as a result of the data review will be added to the hard copy of the data and any printed or electronic data tables. The final summary report will be included in the central project file and incorporated into the final field exploration report(s).

13.0 REFERENCES

AMEC, 2011, Cleanup Action Plan, Submitted to the Boeing Company, September.

Ecology (Washington State Department of Ecology), 1997, Analytical Methods for Petroleum Hydrocarbons, Publication No. ECY 97-602, June.

Ecology, 2004, Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies, Publication No. 04-03-030.

Ecology, 2008, Letter from Ecology (Byung Maeng) to Boeing (Carl Bach) dated June 30.

EPA (U.S. Environmental Protection Agency), 1983, Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79/020, March.

EPA, 1998, Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846). 3rd Ed., September 1986; Final Update I, July 1992; Final Update IIA, August 1993; Final Update II, September 1994; Final Update IIB, January 1995; Final Update III December 1996; Final Update IIIA, April 1998.

EPA, 2008, USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June.

EPA, 2010, USEPA CLP National Functional Guidelines for Inorganic Superfund Data Review, January.

Geomatrix (Geomatrix Consultants, Inc.), (2007), Remedial Investigation Work Plan Addenda, Quality Assurance Project Plan Addendum, Groundwater Monitoring Plan Addendum, Boeing Renton Facility, Renton, Washington, Prepared for The Boeing Company, Seattle, Washington, January.

Geomatrix, 2008, Draft Final Feasibility Study Report, Prepared for The Boeing Company, Seattle, Washington, June.

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

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

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TABLE 1

PROJECT ORGANIZATION

Boeing Renton Facility
Renton, Washington

Organization/Project Role	Project Job Title	Person
The Boeing Company		
	Project Coordinator	Carl Bach
	Cleanup Program Manager	Carl Bach
Environmental Consultant		
AMEC Environment & Infrastructure, Inc.	Project Manager	Dave Haddock
	Data Quality Specialist	Crystal Neirby
Washington State Certified Analytical Laboratory		
Lancaster Laboratory, Inc.	Project Manager	Liz Leonhardt
	Quality Assurance Manager	Dorothy Love
Analytical Resources, Inc.	Project Manager	Kelly Bottem
	Quality Assurance Manager	Dave Mitchell
Washington State Department of Ecology		
	Project Coordinator	Byung Maeng, P.E.

TABLE 2

SOIL AND WATER ANALYSES, METHOD DETECTION LIMITS, AND REPORTING LIMITS[1,2]
Boeing Renton Facility
Renton, Washington

Parameter	Method	Lancaster Laboratories, Inc.				Analytical Resources, Inc.			
		Soil/Solids		Water		Soil/Solids		Water	
		MDL	RL	MDL	RL	MDL	RL	MDL	RL
Volatile Organic Compounds (VOCs)	**USEPA 8260C**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
Chloromethane	Standard	2.0	5.0	0.2	0.5	0.263	1.0	0.098	0.5
Bromomethane	ARI = 10mL purge	2.0	5.0	0.1	0.5	0.187	1.0	0.043	1.0
Vinyl Chloride	Lancaster = 25mL purge	0.5	1.0	0.1	0.2	0.235	1.0	0.075	0.2
Chloroethane		2.0	5.0	0.1	0.5	0.462	1.0	0.152	0.2
Methylene Chloride		2.0	5.0	0.2	0.5	0.635	2.0	0.391	0.5
Acetone		7.0	20	3.0	5.0	0.482	5.0	0.720	5.0
Carbon Disulfide		1.0	5.0	0.4	0.5	0.559	1.0	0.087	0.2
1,1-Dichloroethene		0.5	1.0	0.1	0.2	0.336	1.0	0.091	0.2
1,1-Dichloroethane		1.0	5.0	0.1	0.5	0.203	1.0	0.053	0.2
trans-1,2-Dichloroethene		1.0	5.0	0.1	0.2	0.266	1.0	0.085	0.2
cis-1,2-Dichloroethene		0.5	1.0	0.1	0.2	0.240	1.0	0.100	0.2
Chloroform		1.0	5.0	0.1	0.2	0.234	1.0	0.081	0.2
1,2-Dichloroethane		1.0	5.0	0.1	0.2	0.203	1.0	0.075	0.2
2-Butanone (Methyl Ethyl Ketone)		4.0	10	1.0	5.0	0.513	5.0	0.808	5.0
1,1,1-Trichloroethane		1.0	5.0	0.1	0.5	0.226	1.0	0.089	0.2
Carbon Tetrachloride		1.0	5.0	0.1	0.2	0.213	1.0	0.075	0.2
Vinyl Acetate		2.0	10	0.2	0.5	0.381	5.0	0.068	1.0
Bromodichloromethane		1.0	5.0	0.1	0.5	0.254	1.0	0.053	0.2
1,2-Dichloropropane		1.0	5.0	0.1	0.5	0.162	1.0	0.093	0.2
cis-1,3-Dichloropropene (mixed isomers)		1.0	5.0	0.1	0.2	0.226	1.0	0.058	0.2
Trichloroethene		1.0	5.0	0.1	0.2	0.212	1.0	0.076	0.2
Dibromochloromethane		1.0	5.0	0.1	0.5	0.266	1.0	0.090	0.2
1,1,2-Trichloroethane		1.0	5.0	0.1	0.2	0.286	1.0	0.035	0.2
Benzene		0.5	5.0	0.1	0.2	0.296	1.0	0.056	0.2
trans-1,3-Dichloropropene (mixed isomers)		1.0	5.0	0.1	0.2	0.216	1.0	0.059	0.2
2-Chloroethylvinylether [3]		--	--	--	--	0.276	5.0	0.086	1.0
Bromoform		1.0	5.0	0.1	0.5	0.297	1.0	0.070	0.2
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)		3.0	10	1.0	5.0	0.420	5.0	0.384	5.0
2-Hexanone		3.0	10	1.0	5.0	0.439	5.0	0.310	5.0
Tetrachloroethene		1.0	5.0	0.1	0.2	0.257	1.0	0.088	0.2
1,1,2,2-Tetrachloroethane		1.0	5.0	0.1	0.2	0.253	1.0	0.067	0.2
Toluene		1.0	5.0	0.1	0.2	0.151	1.0	0.056	0.2
Chlorobenzene		1.0	5.0	0.1	0.5	0.219	1.0	0.042	0.2
Ethylbenzene		1.0	5.0	0.1	0.5	0.202	1.0	0.094	0.2
Styrene		1.0	5.0	0.1	0.5	0.138	1.0	0.066	0.2
Trichlorofluoromethane		2.0	5.0	0.1	0.5	0.266	1.0	0.092	0.2
1,1,2-Trichloro-1,2,2-trifluoroethane		2.0	10	0.2	0.5	0.287	2.0	0.107	0.2
m,p-Xylene		1.0	5.0	0.1	0.5	0.392	1.0	0.144	0.4
o-Xylene		1.0	5.0	0.1	0.5	0.224	1.0	0.057	0.2

TABLE 2

SOIL AND WATER ANALYSES, METHOD DETECTION LIMITS, AND REPORTING LIMITS[1,2]
Boeing Renton Facility
Renton, Washington

Parameter	Method	Lancaster Laboratories, Inc.				Analytical Resources, Inc.			
		Soil/Solids		Water		Soil/Solids		Water	
		MDL	RL	MDL	RL	MDL	RL	MDL	RL
VOCs	**USEPA 8260C**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
Chloromethane	Medium Level (soils only)	--	--	--	--	247	500	--	--
Bromomethane		--	--	--	--	510	1,000	--	--
Vinyl Chloride		--	--	--	--	251	500	--	--
Chloroethane		--	--	--	--	305	500	--	--
Methylene Chloride		--	--	--	--	357	1,000	--	--
Acetone		--	--	--	--	2,340	2,500	--	--
Carbon Disulfide		--	--	--	--	156	500	--	--
1,1-Dichloroethene		--	--	--	--	258	500	--	--
1,1-Dichloroethane		--	--	--	--	228	500	--	--
trans-1,2-Dichloroethene		--	--	--	--	239	500	--	--
cis-1,2-Dichloroethene		--	--	--	--	234	500	--	--
Chloroform		--	--	--	--	192	500	--	--
1,2-Dichloroethane		--	--	--	--	194	500	--	--
2-Butanone (Methyl Ethyl Ketone)		--	--	--	--	1,071	2,500	--	--
1,1,1-Trichloroethane		--	--	--	--	151	500	--	--
Carbon Tetrachloride		--	--	--	--	245	500	--	--
Vinyl Acetate		--	--	--	--	238	2,500	--	--
Bromodichloromethane		--	--	--	--	244	500	--	--
1,2-Dichloropropane		--	--	--	--	257	500	--	--
cis-1,3-Dichloropropene (mixed isomers)		--	--	--	--	268	500	--	--
Trichloroethene		--	--	--	--	168	500	--	--
Dibromochloromethane		--	--	--	--	254	500	--	--
1,1,2-Trichloroethane		--	--	--	--	230	500	--	--
Benzene		--	--	--	--	178	500	--	--
trans-1,3-Dichloropropene (mixed isomers)		--	--	--	--	284	500	--	--
2-Chloroethylvinylether		--	--	--	--	835	2,500	--	--
Bromoform		--	--	--	--	274	500	--	--
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)		--	--	--	--	2,144	2,500	--	--
2-Hexanone		--	--	--	--	265	2,500	--	--
Tetrachloroethene		--	--	--	--	168	500	--	--
1,1,2,2-Tetrachloroethane		--	--	--	--	270	500	--	--
Toluene		--	--	--	--	457	500	--	--
Chlorobenzene		--	--	--	--	236	500	--	--
Ethylbenzene		--	--	--	--	231	500	--	--
Styrene		--	--	--	--	310	500	--	--
Trichlorofluoromethane		--	--	--	--	193	500	--	--
1,1,2-Trichloro-1,2,2-trifluoroethane		--	--	--	--	244	1,000	--	--
m,p-Xylene		--	--	--	--	551	1,000	--	--
o-Xylene		--	--	--	--	284	500	--	--

TABLE 2

SOIL AND WATER ANALYSES, METHOD DETECTION LIMITS, AND REPORTING LIMITS[1,2]
Boeing Renton Facility
Renton, Washington

Parameter	Method	Lancaster Laboratories, Inc.				Analytical Resources, Inc.			
		Soil/Solids		Water		Soil/Solids		Water	
		MDL	RL	MDL	RL	MDL	RL	MDL	RL
Low-Level VOCs	**USEPA 8260C-SIM**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
1,1,2,2-Tetrachloroethane		--	--	--	--	--	--	0.00473	0.020
1,1-Dichloroethene		--	--	0.01	0.02	--	--	0.00459	0.020
cis-1,2-Dichloroethene		--	--	0.01	0.02	--	--	0.00362	0.020
Vinyl Chloride		--	--	0.01	0.02	--	--	0.00501	0.020
Trichloroethene		--	--	0.01	0.02	--	--	0.00649	0.020
Tetrachloroethene		--	--	0.01	0.02	--	--	0.00682	0.020
Semivolatile Organic Compound (SVOCs)	**USEPA 8270D**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
Phenol	(Liquid-Liquid Extraction for Water / Microwave Extraction for Soils/Solids)	17	33	--	--	16.1	67	0.519	1.0
bis(2-Chloroethyl)ether		17	33	--	--	16.9	67	0.583	1.0
2-Chlorophenol		17	33	--	--	14.3	67	0.529	1.0
1,3-Dichlorobenzene		17	33	--	--	11.7	67	0.358	1.0
1,4-Dichlorobenzene		17	33	--	--	15.6	67	0.397	1.0
Benzyl Alcohol		170	500	--	--	86.6	330	2.008	5.0
1,2-Dichlorobenzene		17	33	--	--	18.4	67	0.365	1.0
2-Methylphenol (o-Cresol)		17	33	--	--	23.3	67	0.531	1.0
2,2'-oxybis(1-chloropropane)		17	33	--	--	18.7	67	0.623	1.0
4-Methylphenol (p-Cresol)		17	33	--	--	22.4	67	0.523	1.0
n-Nitroso-di-n-propylamine		17	33	--	--	20.8	67	0.560	1.0
Hexachloroethane		33	170	--	--	18.8	67	0.350	1.0
Nitrobenzene		17	33	--	--	25.6	67	0.575	1.0
Isophorone		17	33	--	--	13.4	67	0.481	1.0
2-Nitrophenol		17	33	--	--	63.4	67	1.968	5.0
2,4-Dimethylphenol		17	33	--	--	16.2	67	0.359	1.0
Benzoic Acid		170	500	--	--	251	670	5.111	10.0
bis(2-Chloroethoxy)methane		17	33	--	--	17.3	67	0.565	1.0
2,4-Dichlorophenol		17	33	--	--	74.7	330	2.597	5.0
1,2,4-Trichlorobenzene		17	33	--	--	15.9	67	0.383	1.0
Naphthalene		3	17	--	--	14.9	67	0.522	1.0
4-Chloroaniline (p-Chloroaniline)		17	33	--	--	99.7	330	2.599	5.0
Hexachlorobutadiene		17	33	--	--	18.8	67	0.306	1.0
4-Chloro-3-methylphenol		17	33	--	--	115	330	2.417	5.0
2-Methylnaphthalene		3	17	--	--	24.4	67	0.475	1.0
Hexachlorocyclopentadiene		170	500	--	--	62.4	330	1.181	5.0
2,4,6-Trichlorophenol		17	33	--	--	142	330	2.408	5.0
2,4,5-Trichlorophenol		17	33	--	--	150	330	2.220	5.0
2-Chloronaphthalene		7	33	--	--	21.3	67	0.477	1.0
2-Nitroaniline		17	33	--	--	120	330	2.627	5.0
Dimethyl phthalate		67	170	--	--	26.5	67	0.528	1.0
Acenaphthylene		3	17	--	--	21.1	67	0.480	1.0
3-Nitroaniline		67	170	--	--	104	330	2.314	5.0
Acenaphthene		3	17	--	--	16.4	67	0.546	1.0
2,4-Dinitrophenol		300	1,000	--	--	77.4	670	3.480	10.0
4-Nitrophenol		170	500	--	--	48.2	330	2.573	5.0
Dibenzofuran		17	33	--	--	18.2	67	0.479	1.0

TABLE 2

SOIL AND WATER ANALYSES, METHOD DETECTION LIMITS, AND REPORTING LIMITS[1,2]
Boeing Renton Facility
Renton, Washington

Parameter	Method	Lancaster Laboratories, Inc.				Analytical Resources, Inc.			
		Soil/Solids		Water		Soil/Solids		Water	
		MDL	RL	MDL	RL	MDL	RL	MDL	RL
Semivolatile Organic Compound (SVOCs)	**USEPA 8270D**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
2,6-Dinitrotoluene		17	33	--	--	95.7	330	2.393	5.0
2,4-Dinitrotoluene		67	170	--	--	96.1	330	2.520	5.0
Diethyl Phthalate		67	170	--	--	20.9	67	0.582	1.0
4-Chlorophenyl-phenylether		17	33	--	--	20.5	67	0.451	1.0
Fluorene		3	17	--	--	15.6	67	0.558	1.0
4-Nitroaniline		67	170	--	--	102	330	2.248	5.0
4,6-Dinitro-2-methylphenol		170	500	--	--	122	670	3.087	10.0
n-Nitrosodiphenylamine		17	33	--	--	NA*	67	0.460	1.0
4-Bromophenyl-phenylether		17	33	--	--	19.3	67	0.423	1.0
Hexachlorobenzene		3	17	--	--	18.9	67	0.470	1.0
Pentachlorophenol		33	170	--	--	96.4	330	2.411	5.0
Phenanthrene		3	17	--	--	20.0	67	0.557	1.0
Carbazole		17	33	--	--	14.7	67	0.306	1.0
Anthracene		3	17	--	--	20.2	67	0.531	1.0
di-n-Butyl Phthalate		67	170	--	--	33.1	67	0.537	1.0
Fluoranthene		3	17	--	--	41.6	67	0.515	1.0
Pyrene		3	17	--	--	46.8	67	0.547	1.0
Butyl Benzyl Phthalate		67	170	--	--	24.6	67	0.557	1.0
3,3'-Dichlorobenzidine		100	330	--	--	89.0	330	1.510	5.0
Benzo[a]anthracene		3	17	--	--	19.4	67	0.520	1.0
bis(2-Ethylhexyl) phthalate		67	170	--	--	23.9	67	1.877*	1.0
Chrysene		3	17	--	--	21.0	67	0.549	1.0
di-n-Octyl Phthalate		67	170	--	--	19.1	67	0.508	1.0
Benzo[a]pyrene		3	17	--	--	20.9	67	0.484	1.0
Indeno[1,2,3-cd]pyrene		3	17	--	--	27.0	67	0.485	1.0
Dibenzo[a,h]anthracene		3	17	--	--	24.6	67	0.520	1.0
Benzo(g,h,i)perylene		3	17	--	--	25.9	67	0.546	1.0
1-Methylnaphthalene		3	17	--	--	28.8	67	0.479	1.0
Total Benzofluoranthenes		--	--	--	--	32.5	67	0.483	1.0
Benzo(b)fluoranthene		3	17	--	--	--	--	--	--
Benzo(k)fluoranthene		3	17	--	--	--	--	--	--
1,4-Dioxane[2]		100	330	--	--	18.3	67	0.506	2.0
Phenol	(Separatory Funnel Extraction)	--	--	0.5	1	--	--	0.163	1.0
bis(2-Chloroethyl)ether		--	--	0.5	1	--	--	0.456	1.0
2-Chlorophenol		--	--	0.5	1	--	--	0.254	1.0
1,3-Dichlorobenzene		--	--	0.5	1	--	--	0.406	1.0
1,4-Dichlorobenzene		--	--	0.5	1	--	--	0.418	1.0
Benzyl Alcohol		--	--	5	15	--	--	0.652	5.0
1,2-Dichlorobenzene		--	--	0.5	1	--	--	0.400	1.0
2-Methylphenol (o-Cresol)		--	--	0.5	1	--	--	0.227	1.0
2,2'-Oxybis(1-chloropropane)		--	--	0.5	1	--	--	0.541	1.0

TABLE 2

SOIL AND WATER ANALYSES, METHOD DETECTION LIMITS, AND REPORTING LIMITS[1,2]
Boeing Renton Facility
Renton, Washington

Parameter	Method	Lancaster Laboratories, Inc.				Analytical Resources, Inc.			
		Soil/Solids		Water		Soil/Solids		Water	
		MDL	RL	MDL	RL	MDL	RL	MDL	RL
SVOCs (continued)	**USEPA 8270D**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
4-Methylphenol (p-Cresol)		--	--	0.5	1	--	--	0.185	1.0
n-Nitroso-di-n-propylamine		--	--	0.5	1	--	--	0.449	1.0
Hexachloroethane		--	--	1	5	--	--	0.392	1.0
Nitrobenzene		--	--	0.5	1	--	--	0.551	1.0
Isophorone		--	--	0.5	1	--	--	0.215	1.0
2-Nitrophenol		--	--	0.5	1	--	--	1.059	5.0
2,4-Dimethylphenol		--	--	0.5	1	--	--	0.176	1.0
Benzoic Acid		--	--	6	15	--	--	0.819	10.0
bis(2-Chloroethoxy)methane		--	--	0.5	1	--	--	0.420	1.0
2,4-Dichlorophenol		--	--	0.5	1	--	--	0.965	5.0
1,2,4-Trichlorobenzene		--	--	0.5	1			0.479	1.0
Naphthalene		--	--	0.1	0.5	--	--	0.553	1.0
4-Chloroaniline (p-Chloroaniline)		--	--	0.5	1	--	--	0.850	5.0
Hexachlorobutadiene		--	--	0.5	1	--	--	0.348	1.0
4-Chloro-3-methylphenol		--	--	0.5	1	--	--	0.962	5.0
2-Methylnaphthalene		--	--	0.1	0.5	--	--	0.185	1.0
Hexachlorocyclopentadiene		--	--	5	15	--	--	0.854	5.0
2,4,6-Trichlorophenol		--	--	0.5	1	--	--	0.845	5.0
2,4,5-Trichlorophenol		--	--	0.5	1	--	--	0.665	5.0
2-Chloronaphthalene		--	--	0.4	1	--	--	0.507	1.0
2-Nitroaniline		--	--	0.5	1	--	--	0.680	5.0
Dimethyl phthalate		--	--	2	5.0	--	--	0.408	1.0
Acenaphthylene		--	--	0.1	0.5	--	--	0.210	1.0
3-Nitroaniline		--	--	0.5	1	--	--	0.851	5.0
Acenaphthene		--	--	0.1	0.5	--	--	0.202	1.0
2,4-Dinitrophenol		--	--	10	30	--	--	1.147	10.0
4-Nitrophenol		--	--	10	30	--	--	0.568	5.0
Dibenzofuran		--	--	0.5	1	--	--	0.157	1.0
2,6-Dinitrotoluene		--	--	0.5	1	--	--	0.922	5.0
2,4-Dinitrotoluene		--	--	1	5	--	--	1.025	5.0
Diethyl Phthalate		--	--	2	5	--	--	0.417	1.0
4-Chlorophenyl-phenylether		--	--	0.5	1	--	--	0.176	1.0
Fluorene		--	--	0.1	0.5	--	--	0.189	1.0
4-Nitroaniline		--	--	0.5	1	--	--	1.041	5.0
4,6-Dinitro-2-methylphenol		--	--	5	15	--	--	1.040	10.0
n-Nitrosodiphenylamine		--	--	0.5	1	--	--	0.497	1.0
4-Bromophenyl-phenylether		--	--	0.5	1	--	--	0.397	1.0
Hexachlorobenzene		--	--	0.1	0.5	--	--	0.194	1.0
Pentachlorophenol		--	--	1	5	--	--	0.647	5.0
Phenanthrene		--	--	0.1	0.5	--	--	0.180	1.0
Carbazole		--	--	0.5	1	--	--	0.103	1.0

TABLE 2

SOIL AND WATER ANALYSES, METHOD DETECTION LIMITS, AND REPORTING LIMITS[1,2]
Boeing Renton Facility
Renton, Washington

Parameter	Method	Lancaster Laboratories, Inc.				Analytical Resources, Inc.			
		Soil/Solids		Water		Soil/Solids		Water	
		MDL	RL	MDL	RL	MDL	RL	MDL	RL
SVOCs (continued)	**USEPA 8270D**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
Anthracene		--	--	0.1	0.5	--	--	0.217	1.0
di-n-Butyl Phthalate		--	--	2	5	--	--	0.189	1.0
Fluoranthene		--	--	0.1	0.5	--	--	0.220	1.0
Pyrene		--	--	0.1	0.5	--	--	0.200	1.0
Butyl Benzyl Phthalate		--	--	2	5	--	--	0.153	1.0
3,3'-Dichlorobenzidine		--	--	2	5	--	--	0.946	5.0
Benzo[a]anthracene		--	--	0.1	0.5	--	--	0.219	1.0
bis(2-Ethylhexyl) phthalate		--	--	2	5.0	--	--	0.152	1.0
Chrysene		--	--	0.1	0.5	--	--	0.181	1.0
di-n-Octyl Phthalate		--	--	2	5	--	--	0.194	1.0
Benzo[a]pyrene		--	--	0.1	0.5	--	--	0.205	1.0
Indeno[1,2,3-cd]pyrene		--	--	0.1	0.5	--	--	0.214	1.0
Dibenzo[a,h]anthracene		--	--	0.1	0.5	--	--	0.163	1.0
Benzo(g,h,i)perylene		--	--	0.1	0.5	--	--	0.150	1.0
1-Methylnaphthalene		--	--	0.1	0.5	--	--	0.541	1.0
Total Benzofluoranthenes		--	--	--	--	--	--	0.577	1.0
Benzo(b)fluoranthene		--	--	0.1	0.5	--	--	--	--
Benzo(k)fluoranthene		--	--	0.1	0.5	--	--	--	--
1,4-Dioxane[4]		--	--	1	5	--	--	0.211	2.0
Low-Level SVOCs	**USEPA 8270D-SIM**								
bis(2-Ethylhexyl) phthalate		--	--	0.05	1	--	--	--	--
Phenanthrene		0.67	1.7	--	--	2.5	5.0	--	--
Polychlorinated Biphenyls (PCBs)	**USEPA 8082**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
Aroclor 1016	**Standard**	3.6	17	0.10	0.5	9.83	33	0.130	1.0
Aroclor 1221	(accumulated solids, soil, and water)	4.6	17	0.10	0.5	NA	33	NA	1.0
Aroclor 1232		8	17	0.20	0.5	NA	33	NA	1.0
Aroclor 1242	(ARI = 500-mL extraction for waters)	3.3	17	0.10	0.5	NA	33	NA	1.0
Aroclor 1248		3.3	17	0.10	0.5	NA	33	NA	1.0
Aroclor 1254		3.3	17	0.10	0.5	NA	33	NA	1.0
Aroclor 1260	(Lancaster = 1 Liter extraction for waters)	4.9	17	0.15	0.5	7.06	33	0.147	1.0
Aroclor 1262		3.3	17	0.20	0.5	NA	33	NA	1.0
Aroclor 1268		3.3	17	0.16	0.5	NA	33	NA	1.0
PCBs	**USEPA 8082-Modified**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
Aroclor 1016	Low-Level	--	--	0.006	0.01	--	--	0.00248	0.01
Aroclor 1221	(ARI = 1-Liter hexane extraction for waters)	--	--	0.006	0.01	--	--	NA	0.01
Aroclor 1232		--	--	0.007	0.01	--	--	NA	0.01
Aroclor 1242		--	--	0.006	0.01	--	--	NA	0.01
Aroclor 1248	(Lancaster = 1-Liter methylene chloride extraction for waters)	--	--	0.005	0.01	--	--	NA	0.01
Aroclor 1254		--	--	0.005	0.01	--	--	NA	0.01
Aroclor 1260		--	--	0.005	0.01	--	--	0.00276	0.01
Aroclor 1262		--	--	0.005	0.01	--	--	NA	0.01
Aroclor 1268		--	--	0.005	0.01	--	--	NA	0.01

TABLE 2

SOIL AND WATER ANALYSES, METHOD DETECTION LIMITS, AND REPORTING LIMITS[1,2]
Boeing Renton Facility
Renton, Washington

Parameter	Method	Lancaster Laboratories, Inc.				Analytical Resources, Inc.			
		Soil/Solids		Water		Soil/Solids		Water	
		MDL	RL	MDL	RL	MDL	RL	MDL	RL
PCBs	**USEPA 8082**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
Aroclor 1016	soil/sediment	3.3	17	--	--	9.33	20	--	--
Aroclor 1221		3.3	17	--	--	NA	20	--	--
Aroclor 1232		3.3	17	--	--	NA	20	--	--
Aroclor 1242		3.3	17	--	--	NA	20	--	--
Aroclor 1248		3.3	17	--	--	NA	20	--	--
Aroclor 1254		3.3	17	--	--	NA	20	--	--
Aroclor 1260		3.9	17	--	--	7.06	20	--	--
Aroclor 1262		3.3	17	--	--	NA	20	--	--
Aroclor 1268		3.3	17	--	--	NA	20	--	--
Aroclor 1016	Medium Level	500	2,500	--	--	63.3	800	--	--
Aroclor 1221	(oil/joint compound	500	2,500	--	--	NA	800	--	--
Aroclor 1232	or caulking)	500	2,500	--	--	NA	800	--	--
Aroclor 1242		500	2,500	--	--	NA	800	--	--
Aroclor 1248		500	2,500	--	--	NA	800	--	--
Aroclor 1254		500	2,500	--	--	NA	800	--	--
Aroclor 1260		500	2,500	--	--	123	800	--	--
Aroclor 1262		500	2,500	--	--	NA	800	--	--
Aroclor 1268		500	2,500	--	--	NA	800	--	--
Total Petroleum Hydrocarbons (TPH)[5]	**Ecology June 1997**	mg/kg	mg/kg	mg/L	mg/L	mg/kg	mg/kg	mg/L	mg/L
Gasoline Range	NWTPH-Gx	1.0	5.0	0.05	0.25	2.39	5.0	0.060	0.25
Diesel Range	NWTPH-Dx	3.0	7.0	0.03	0.10	0.742	5.0	0.016	0.10
Oil Range	NWTPH-Dx, Extended	10	30	0.07	0.25	1.31	10.0	0.049	0.20
Jet A Range	NWTPH-Dx, Extended	3	7	0.03	0.10	NA*	5.0	NA*	0.10
Extractable Petroleum Hydrocarbons (EPH)	**Ecology June 1997**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
C8 - C10 Aliphatics	WDOE-EPH	--	--	--	--	--	2000	--	40
C10 - C12 Aliphatics		1000	5000	10	50	--	2000	--	40
C12 - C16 Aliphatics		1000	5000	10	50	--	2000	--	40
C16 - C21 Aliphatics		3000	5000	11	50	--	2000	--	40
C21 - C34 Aliphatics		6000	10000	20	50	--	2000	--	40
C8 - C10 Aromatics		--	--	--	--	--	2000	--	40
C10 - C12 Aromatics		1000	5000	10	50	--	2000	--	40
C12 - C16 Aromatics		1000	5000	10	50	--	2000	--	40
C16 - C21 Aromatics		2000	5000	13	50	--	2000	--	40
C21 - C34 Aromatics		2000	5000	15	50	--	2000	--	40

TABLE 2

SOIL AND WATER ANALYSES, METHOD DETECTION LIMITS, AND REPORTING LIMITS[1,2]
Boeing Renton Facility
Renton, Washington

Parameter	Method	Lancaster Laboratories, Inc.				Analytical Resources, Inc.			
		Soil/Solids		Water		Soil/Solids		Water	
		MDL	RL	MDL	RL	MDL	RL	MDL	RL
Volatile Petroleum Hydrocarbons (VPH)	**Ecology June 1997**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
C5 - C6 Aliphatics	WDOE-VPH	2500	5000	25	50	--	5	--	50
C6 - C8 Aliphatics		2500	5000	25	50	--	5	--	50
C8 - C10 Aliphatics		2500	5000	25	50	--	5	--	50
C10 - C12 Aliphatics		--	--	--	--	--	5	--	50
C8 - C10 Aromatics		2500	5000	25	50	--	5	--	50
C10 - C12 Aromatics		--	--	--	--	--	5	--	50
C12 - C13 Aromatics		--	--	--	--	--	5	--	50
Benzene		50	50	1	5	--	0.5	--	5
Toluene		50	50	1	5	--	0.5	--	5
Ethylbenzene		50	50	1	5	--	0.5	--	5
m,p-xylene		100	100	2	10	--	0.5	--	5
o-xylene		50	50	1	5	--	0.5	--	5
Methyl tert-Butyl Ether (MTBE)		50	50	1	5	--	0.5	--	5
Purgeable Aromatic Compounds (BTEX)	**USEPA 8021B**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
Benzene		2.0	5.0	0.2	1.0	10.9	25	0.139	1.0
Toluene		2.0	5.0	0.2	1.0	10.6	25	0.077	1.0
Ethylbenzene		2.0	5.0	0.2	1.0	10.0	25	0.149	1.0
m,p-Xylene		5.0	15.0	0.4	2.0	17.2	50	0.109	1.0
o-Xylene		5.0	15.0	0.2	1.0	12.9	25	0.143	1.0
Dissolved Gases	**RSK-175**	µg/kg	µg/kg	µg/L	µg/L	µg/kg	µg/kg	µg/L	µg/L
Methane		--	--	5.0	15	--	--	0.502	0.7
Ethane		--	--	1.0	5.0	--	--	0.610	1.2
Ethene		--	--	1.0	5.0	--	--	0.354	1.1
Metals (Dissolved and Total)	**USEPA 6000/7000 Series**	mg/kg	mg/kg	mg/L	mg/L	mg/kg	mg/kg	mg/L	mg/L
Arsenic	6010B	0.550	2.00	0.0051	0.0200	0.46	5.0	0.00333	0.050
	6020/200.8	0.08	0.4	0.00095	0.0020	0.087	0.2	0.000048	0.0002
Antimony	6010B	0.66	2.00	0.0058	0.0200	--	5.0	0.025	0.05
	6020/200.8	0.074	0.2	0.00042	0.0010	--	0.2	0.0001	0.0002
Cadmium	6010B	0.0200	0.500	0.00027	0.0050	0.11	0.2	0.00018	0.0020
	6020/200.8	0.044	0.1	0.00020	0.00050	0.012	0.1	0.000010	0.0001
Chromium	6010B	0.140	1.50	0.0011	0.0150	0.27	0.5	0.00124	0.0050
	6020/200.8	0.12	0.4	0.00060	0.0020	0.038	0.5	0.000045	0.0005
Copper	6010B	0.0960	1.00	0.00094	0.0100	0.05	0.2	0.00092	0.0020
	6020/200.8	0.08	0.4	0.00038	0.0020	0.036	0.5	0.000158	0.0005
Lead	6010B	0.220	1.50	0.0022	0.0150	0.13	2.0	0.00155	0.020
	6020/200.8	0.0102	0.2	0.000080	0.0010	0.047	0.1	0.000046	0.0001
Mercury	7471A/7470A	0.0070	0.100	0.000026	0.00020	0.0013	0.025	0.0000069	0.00010
Selenium	6010B	0.680	2.00	0.0069	0.0200	0.65	5.0	0.00499	0.050
	6020/200.8	0.058	0.4	0.00027	0.0020	0.099	0.5	0.000127	0.0005
Silver	6010B	0.0830	0.500	0.00091	0.0050	0.03	0.3	0.00043	0.0030
	6020/200.8	0.0142	0.1	0.00098	0.0005	0.008	0.2	0.000008	0.0002
Thallium	6020/200.8	0.03	0.1	0.0015	0.0005	0.45	5	0.00762	0.0500
Zinc	6010B	0.330	2.00	0.0032	0.0200	0.12	1.0	0.00145	0.0100
	6020/200.8	0.56	3	0.0040	0.0150	0.339	4.0	0.000497	0.0040

TABLE 2

SOIL AND WATER ANALYSES, METHOD DETECTION LIMITS, AND REPORTING LIMITS[1,2]
Boeing Renton Facility
Renton, Washington

Parameter	Method	Lancaster Laboratories, Inc.				Analytical Resources, Inc.			
		Soil/Solids		Water		Soil/Solids		Water	
		MDL	RL	MDL	RL	MDL	RL	MDL	RL
Conventional Parameters		mg/kg	mg/kg	mg/L	mg/L	mg/kg	mg/kg	mg/L	mg/L
Alkalinity	SM 2320B	--	--	0.46	2.0	NA	NA	0.37	1.0
Ammonia	USEPA 350.1 or SM20 4500 NH3 C or D (water)/USEPA 350.3 (soil)	3.3	10.0	0.05	0.15	NA	5	NA	0.1
Hexavalent Chromium	218.6 (water)/USEPA 7199 (water and soil)	0.2	1.0	0.005	0.01	NA	0.1	0.003	0.01
Nitrate	USEPA 353.2 (water)/USEPA 9056 and 300.0 (soil)	0.8	1.5	0.05	0.10	NA	1	NA	0.01
Nitrate+Nitrite	USEPA 353.2 (water and soil)/USEPA 300.0 (soil)	0.8	1.5	0.08	0.10	NA	0.1	NA	0.01
Sulfate	USEPA 300.0 (water and soil)/USEPA 9056 (soil)	--	--	1.50	5.0	NA	NA	0.059	0.10
Total Organic Carbon	SM 5310B or C (water)/USEPA 9060 (soil)	100	300	0.50	1.0	0.0029%	0.02%	0.15	1.5

Notes
1. Reporting limits may be elevated in data reports due to dilutions required by matrix interference or high analyte concentrations.
2. Some reporting limits may exceed the site specific cleanup levels specified in the DCAP. When analyses are to be used for assessing regulatory compliance cleanup standards, methods with reporting limits below cleanup levels will be selected.
3. Lancaster will not report 2-Chloroethylvinylether.
4. 1,4-Dioxane will only be reported if specifically requested.
5. Samples were treated with silica-gel acid cleanup at ARI and will be treated with silica gel cleanup at Lancaster. MDLs and RLs reflect the cleanup procedure.

Abbreviations
ARI = Analytical Resources, Inc.
BTEX = benzene, toluene, ethylbenzene, xylenes
DCAP = Draft Cleanup Action Plan
MDL - method detection limit
mg/kg - milligram per kilogram (ppm)
mg/L - milligram per liter (ppm)
mL - milliliter
NA - not applicable or not available
RL - reporting limit
SM - Standard Method
ug/kg - microgram per kilogram
ug/L - microgram per liter
USEPA - United States Environmental Protection Agency

TABLE 3

FIELD QUALITY CONTROL SAMPLE COLLECTION SUMMARY

Boeing Renton Facility
Renton, Washington

Sample Type	Frequency
Equipment Blanks	1 per sampling event, when non-dedicated sampling equipment is used
Trip Blanks	1 in every cooler containing VOC samples
Field Duplicates	5 percent for each sampling event
Matrix Spikes	5 percent for each sampling event

Notes

1. A sampling event is defined as consecutive days of sampling not separated by more than two days of inactivity.
2. Field duplicates will only be collected for events with more than 5 samples.

TABLE 4

SAMPLE CONTAINERS, PRESERVATION METHODS, AND HOLDING TIMES
Boeing Renton Facility
Renton, Washington

Analyte	Analytical Methods (Water/Soil if different)	Water/Soil Container	Water/Soil Preservation	Water/Soil Holding Time
Conventionals				
pH	SM20 4500 H (water)/EPA 9045 (soil)	50 mL HDPE bottle / 1 - 4 oz. wide mouth glass jar	6°C	ASAP
Sulfate	EPA 300.0 (water and soil)/EPA 9056 (soil)	100 mL HDPE bottle / 1 - 4 oz. wide mouth glass jar	6°C	28 days
Ammonia	EPA 350.1 or SM20 4500 NH3 C or D (water)/EPA 350.3 (soil)	500 mL HDPE bottle / 1 - 4 oz. wide mouth glass jar	9N H_2SO_4 (water), 6°C	28 days
Nitrate	EPA 353.2 (water)/EPA 9056 and 300.0 (soil)	2 x 40 mL glass bottle / 1 - 4 oz. wide mouth glass jar	1 - H_2SO_4 to pH <2, 1 - unpreserved (water)/6°C	48 hours (water), 28 days soil
Nitrate + Nitrite	EPA 353.2 (water and soil)/EPA 300.0 (soil)	50 mL HDPE bottle / 1 - 4 oz. wide mouth glass jar	1 - H_2SO_4 to pH <2 (water)/6°C	28 days
Total Organic Carbon	SM 5310B or C (water)/EPA 9060 (soil)	2 - 40 mL VOA vials / 1 - 4 oz. wide mouth glass jar	H_3PO_4, 6°C/6°C	28 days
Alkalinity	SM2320B (water)	250 mL HDPE bottle (no headspace)	6°C	14 days
Volatile Organic Compounds				
Volatile Organics	EPA 8260C	4 - 40 mL VOA vials	3 vials sodium bisulfate, 1 vial meoh (methanol); 6°C	analysis: 14 days (soil)
% solids- for all 5035 methods[1]		1 -2 oz. wide mouth glass jar with septa	-	analysis: 7 days (soil)
Volatile Organics	EPA 8260C	3 - 40 mL VOA vials - water No headspace	HCL to pH < 2, 6°C	analysis: 14 days (water); 7 days if unpreserved (water)

TABLE 4

SAMPLE CONTAINERS, PRESERVATION METHODS, AND HOLDING TIMES
Boeing Renton Facility
Renton, Washington

Analyte	Analytical Methods (Water/Soil if different)	Water/Soil Container	Water/Soil Preservation	Water/Soil Holding Time
Volatile Organic Compounds (Continued)				
Low-level Volatile Organics	EPA 8260C-SIM	2 - 40 mL VOA vials - water No headspace	HCL to pH < 2, 6°C	analysis: 14 days (water); 7 days if unpreserved (water)
VPH	WDOE	2 - 40 mL VOA vials - soil	meoh (methanol); 6°C	analysis: 14 days (soil)
		2 - 40 mL VOA vials - water	HCL to pH < 2, 6°C	analysis: 14 days (water); 7 days if unpreserved (water)
BTEX/Gas	EPA 8021B/NWTPH-Gx	2 - 40 mL VOA vials - soil	meoh (methanol); 6°C	analysis: 14 days (soil)
		2 - 40 mL VOA vials - water	HCL to pH < 2, 6°C	analysis: 14 days (water); 7 days if unpreserved (water)
Semivolatile Organic Compounds				
Semivolatile Organics	EPA 8270D	2 - 1 L amber glass bottle - water 1 - 8 oz. wide-mouth glass jar - soil	6°C	extraction: 7 days water; 14 days soil analysis: 40 days after extraction (soil and water)
Low-level Semivolatile Organics	EPA 8270D SIM	2 - 1 L amber glass bottle - water 1 - 8 oz. wide-mouth glass jar - soil	6°C	extraction: 7 days water; 14 days soil analysis: 40 days after extraction (soil and water)
Polychlorinated Biphenyls	EPA 8082	2 - 1 L amber glass bottle - water 1 - 8 oz. wide-mouth glass jar - soil	6°C	extraction: 7 days water; 14 days soil analysis: 40 days after extraction (soil and water)
NWTPH-Dx, EPH	NWTPH-Dx, EPH	2 - 500 mL amber glass bottle - water 2 - 8 oz. wide-mouth glass jar - soil	6°C	extraction: 7 days water; 14 days soil analysis: 40 days after extraction (soil and water)

TABLE 4

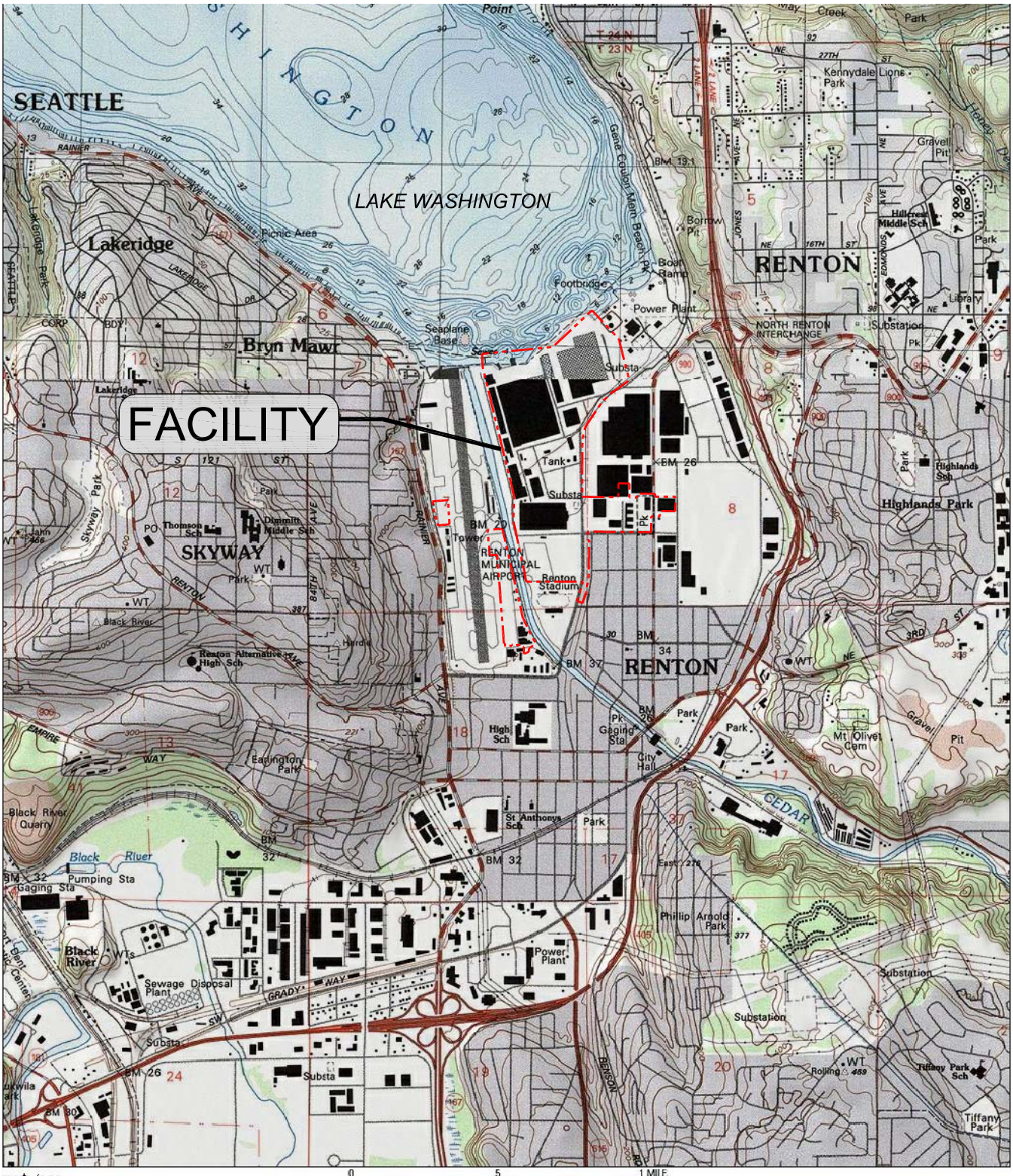
SAMPLE CONTAINERS, PRESERVATION METHODS, AND HOLDING TIMES
Boeing Renton Facility
Renton, Washington

Analyte	Analytical Methods (Water/Soil if different)	Water/Soil Container	Water/Soil Preservation	Water/Soil Holding Time
Metals				
Metals - except chromium (VI)	EPA 6000 and 200.8 series, EPA 7470, 7471	1 -250 mL HDPE bottle - water 1 - 4 oz. wide mouth glass jar - soil	HNO_3 to pH < 2, $6^oC/6^oC$	analysis: 180 days (water and soil) mercury analysis : 28 days (water and soil)
Chromium (VI)	218.6 (water)/ EPA 7199 (water and soil)	200 mL HDPE bottle - water 2 - 4 oz. wide mouth glass jar - soil	6^oC	24 hours (water); 28 days (soil)
RSK 175				
Methane, Ethane, Ethene	RSK 175	2 - 40 mL VOA vials - water	-	analysis: 7 days (water)

Notes
1. All soil samples collected for Volatile analyses will be collected using EPA 5035.

Abbreviations
BTEX = Benzene, Toluene, Ethylbenzene, Xylenes
EPH = Extractable petroleum hydrocarbons
SIM = Select ion monitoring
VPH = Volatile petroleum hydrocarbons
WDOE = Washington State Department of Ecology

FIGURES

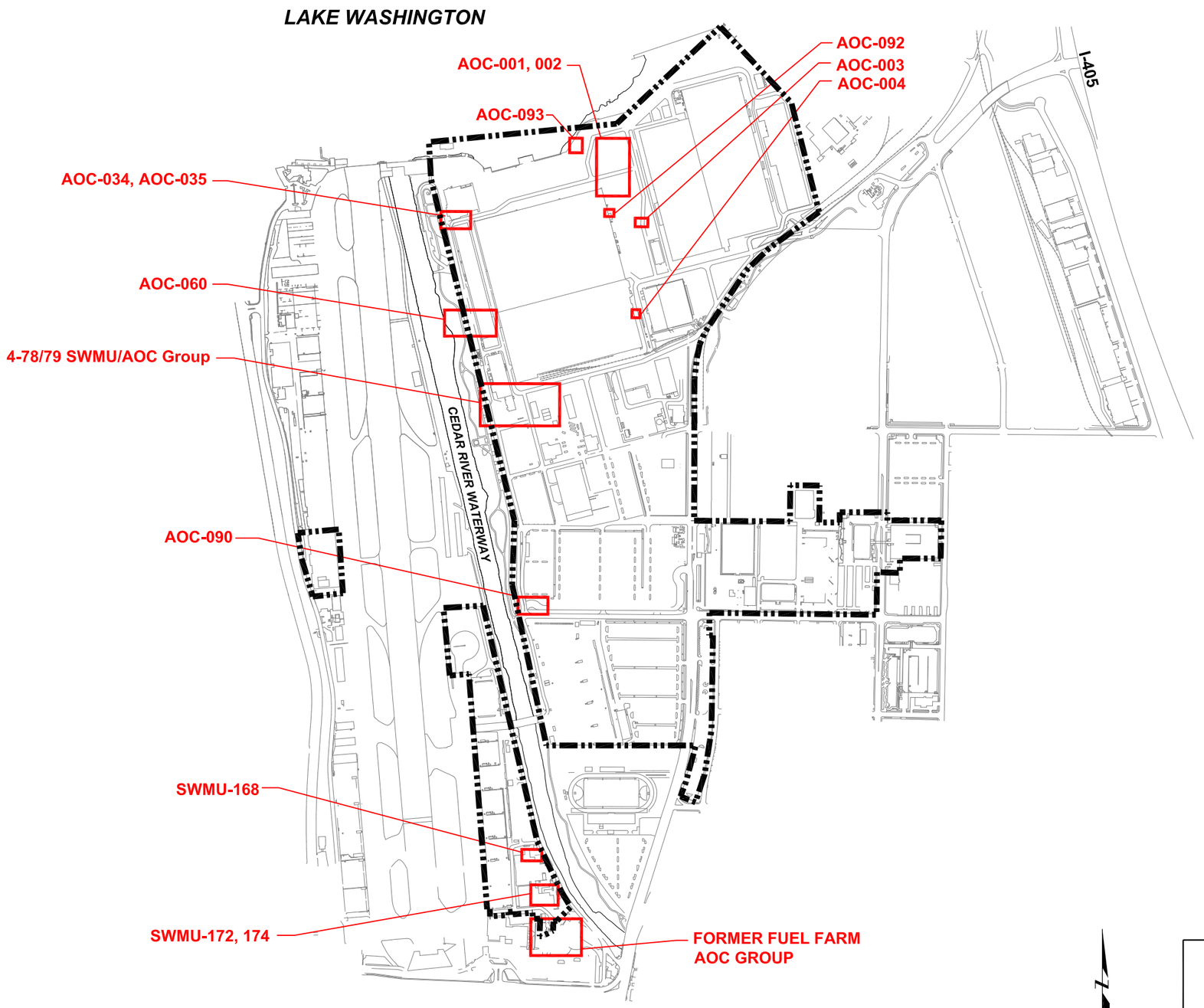


VICINITY MAP
Boeing Renton Facility
Renton, Washington

By: APS	Date: 01/17/12	Project No. 8888
amec		Figure 1

BOEING

Plot Date: 01/17/12 - 11:19am, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\060_QAPP\CAD\, Drawing Name: BoeingRentonSiteMapSWMU-AOC_011712.dwg



LEGEND

GENERAL LOCATION OF SWMUs AND AOCs

FACILITY BOUNDARY

NOTES

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

N

0 400 800

APPROXIMATE SCALE IN FEET

BOEING

SITE PLAN
Boeing Renton Facility
Renton, Washington

By: APS	Date: 01/17/12	Project No. 8888
amec		Figure 2

Plot Date: 01/17/12 - 11:24am Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\060_QAPP\CAD\ Drawing Name: BoeingRentonSiteMapSWMU-AOC_011712.dwg

APPENDIX A

Project Laboratory Quality Assurance Manuals

Environmental Quality Policy Manual

Prepared by

Amy L. Doupé, QA Principal Specialist — Date: 09/06/2011

Approvals

Harolyn Clow, Manager, Environmental Microbiology — Date: 09/09/11

Duane Luckenbill, Director, Environmental Chemistry — Date: 9/13/11

Timothy Oostdyk, President — Date: 9/15/11

J. Wilson Hershey, Chairman of the Board — Date: 9/14/11

Kathleen M. Loewen, Quality Assurance Director — Date: 9/21/11

Table of Contents

Revision Log:

Revision: 10	Effective Date: This version	
Section	**Justification**	**Changes**
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Removed revision logs up to the previous version.
Entire Document	Title changes	Changed President to Chairman of the Board
1.4	Thermo-Fisher language	Removed the reference to the "Four 'I's"
1.5	To reflect current practice	Updated diagram
2.1	Change in ownership	Updated to include sale to Eurofins
2.2	Title Changes	Added Chairman of the Board and Vice Presidents to Vice President
2.3	To reflect current practice	Added responsibility of assigning deputies for key personnel
2.4	Change in ownership	Revised reference from being wholly owned subsidiary of Thermo Fisher to Eurofins Scientific
2.17	To reflect current practice	Added that all employees sign the ethics statement on the first day of employment.
10.1 Sample Flow Table	To reflect current practice	Deleted microfilmed
12.3	To include all client feedback	Changed section title from Client Complaints to Client Feedback
12.3	To reflect current practice	Added that client concerns are tracked in the LIMS
12.3	To reflect current practice	Added description of the client survey

Revision: 09	Effective Date: 06/29/10	
Section	**Justification**	**Changes**
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Removed revision logs up to the previous version.
Entire Document	Indicate imperative steps	Use present tense
1.1	Reflect current language	Replaced Vision Statement with Promise of Value
2.4	Enhancement	Added "manner that is consistent with ISO 17025 and the elements of Chapter 5 of the current NELAC standard."
2.4	Clarification	Clarified that LLI Quality systems are specific to LLI
2.14	To reflect current practice	Added bullet: Confirming certification status
3.1	Reflect new building addition	Changed description of Building C
3.4	Clarification	Clearly stated that not all equipment is monitored by Andover System and changed language to the imperative
4.2	Regulatory requirement	Added note re: OH EPA approval
4.5	To reflect current practice	Clarify that the form system is used to control external documents
5.7	To reflect current practice	Replaced homogenization with mixing
6.5.1.8	Reflect current operations	Deleted reference to Citrix server
8.5	Regulatory requirement	Added note re: OH EPA
9.4	Enhancement	Added text defining how Measurement Uncertainty is obtained for tests that do not have an LCS
12.4	Reflect current operations	Added bullets describing QA reports for management and employee input
13.1	Reflect current language	Updated superlative service statement

1. INTRODUCTION

This *Quality Policy Manual* is based upon Lancaster Laboratories' overall business and management philosophies, mission, and goals. This manual was written to present the policies employed by the Environmental Division of Lancaster Laboratories as well as the support departments that serve the environmental laboratories and to comply with the requirements of the National Environmental Laboratory Accreditation Program and ISO 17025. These policies define the "what" we do with emphasis on management's responsibilities and commitment to quality. Governing SOPs are in place within the organization, to ensure the proper execution of this policy document (refer to Appendix A). The most recent and up-to-date *Quality Policy Manual* and all referenced documents are available to all laboratory personnel who work in or support the Environmental Division. Lancaster Laboratories actively strives for continuous improvement of its quality systems to better serve our clients.

1.1. Our Unique Promise of Value

The global leader in the National Environmental Laboratory Accreditation Program (NELAP) for accredited environmental laboratory services; Lancaster Laboratories provides unmatched regulatory compliance, capacity, and technical expertise for an outstanding service experience to environmental clients worldwide.

1.2. Mission Statement

Lancaster Laboratories offers analytical and consulting services in the chemical and biological sciences with comprehensive expertise in environmental and pharmaceutical laboratory applications. The company mission statement describes the corporate philosophy:

At Lancaster Laboratories, we are people working together to serve the health and environmental needs of society through science and technology. We strive to be the recognized leader in all that we do.

Our mission is to provide independent laboratory services in the chemical and biological sciences with excellent quality and service. As a corporate community, we:

- Deliver quality by fully understanding and always meeting the requirements of those we serve.
- Live our values by relating to our clients, coworkers, shareholders, suppliers, and community in a fair and ethical manner.
- Manage our growth and financial resources so we can serve our clients well, provide a satisfactory return to shareholders, and maintain our meaningful and enriching workplace.

1.3. Quality Policy

The Executive Management Group recognizes quality as a key element of the laboratory's standard of service. The group supports the laboratory's commitment to quality as defined by NELAP and ISO 17025 through the strict adherence to the Quality Policy Statement. The Quality Assurance Officer wrote the Quality Policy Statement, with final approval from the Chairman of the Board. The policy can not be revised without the Chairman of the Board and Quality Assurance Officer's approval.

The Quality Policy Statement gives employees clear requirements for the production of analytical data. Employees are trained on the components of the Quality Policy Statement during their first day of orientation. Each employee signs the statement as agreement to implement the policy in all aspects of their work. The statement is as follows:

We strive to provide the highest quality data achievable by:

- Describing clearly and accurately all activities performed; documenting "real time" as the task is carried out; understanding that it is never acceptable to "back date" entries and should additional information be required at a later date, the actual date and by whom the notation is made must be documented.
- Providing accountability and traceability for each sample analyzed through proper sample handling, labeling, preparation, instrument calibration/qualification, analysis, and reporting; establishing an audit trail that identifies date, time, analyst, instrument used, instrument conditions, quality control samples (where appropriate and/or required by the method), and associated standard material.
- Emphasizing a total quality management process and commitment to continuous improvement which provides accuracy, and strict compliance with agency regulations and client requirements, giving the highest degree of confidence; understanding that meeting the requirements of the next employee in the work flow process is just as important as meeting the needs of the external client.
- Providing thorough documentation and explanation to qualify reported data that may not meet all requirements and specifications, but is still of use to the client; understanding this occurs only after discussion with the client on the data limitations and acceptability of this approach.
- Responding immediately to indications of questionable data, out-of-specification occurrences, equipment malfunctions, and other types of laboratory problems, with investigation and applicable corrective action; documenting these activities completely, including the reasons for the decisions made.
- Providing a work environment that ensures accessibility to all levels of management and encourages questions and expression of concern on quality issues to management.

We each take personal responsibility to provide this quality product while meeting the company's high standards of integrity and ethics, understanding that improprieties, such as failure to conduct the required test, manipulation of test procedures or data, or inaccurate documentation will not be tolerated. Intentional misrepresentation of the activities performed is considered fraud and is grounds for termination.

1.4. Statement of Values

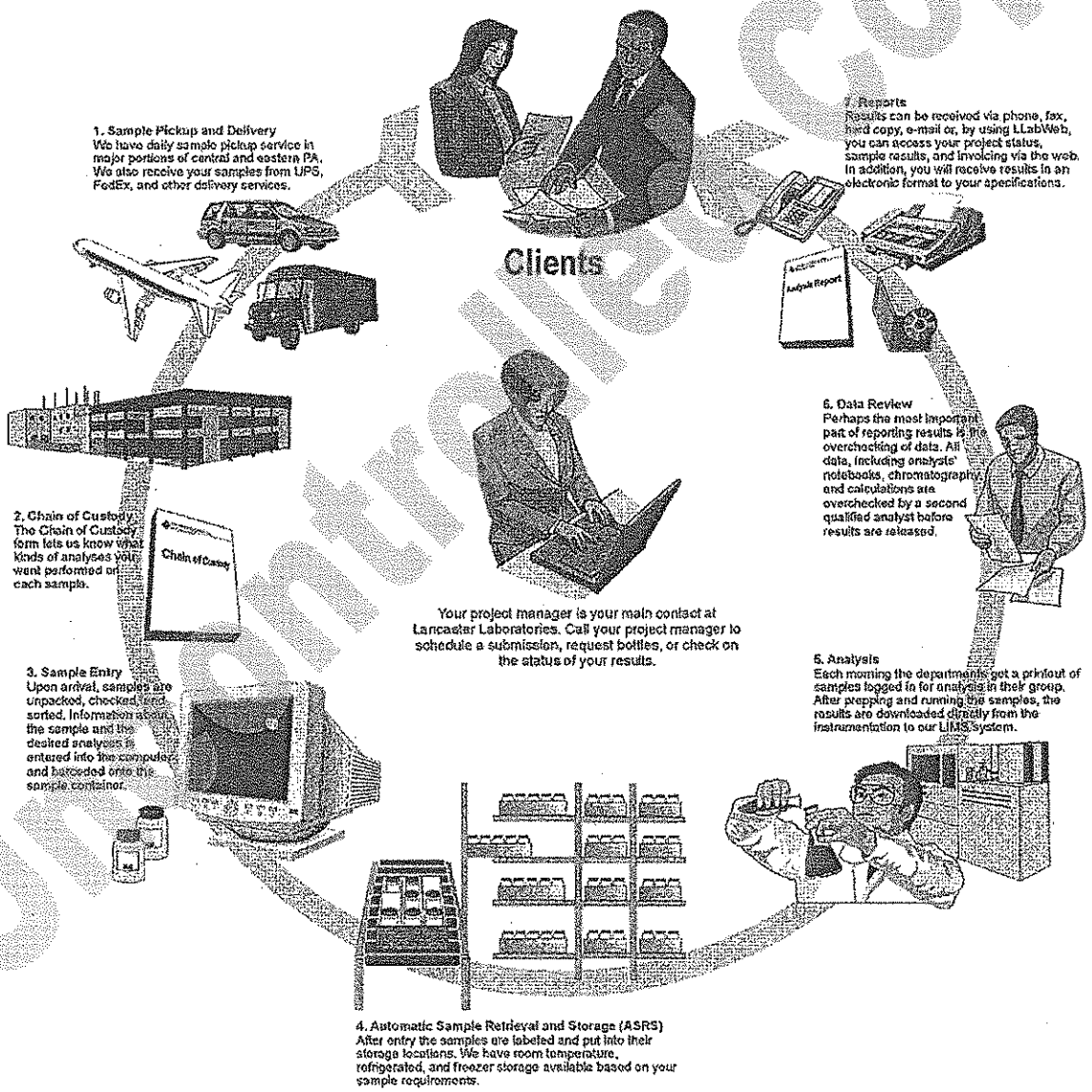
As a corporate community, we embrace our heritage of integrity and strive to live by the following principles:

- Fairness and honesty in all our relationships
- Mutual trust
- A respect for ourselves and others
- A sense of caring that leads us to act responsibly toward each other and society, now and in the future
- Loyalty to our clients and one another

- A spirit of open-mindedness as we deal with all
- Dedication to service
- Good stewardship of our resources
- A commitment to flexibility and continuous improvement

We each take personal responsibility to live these values in all of our dealings, knowing full well our pledge may involve difficult choices, hard work, and courage.

1.5. Sample Flow-Through Diagram



1.6. Certifications, Accreditations, and Registrations

Accreditation/Certification is the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications and/or standards. It is the one generally accepted method by which a laboratory such as ours can demonstrate its capability of generating acceptable, professional, quality test results in those areas in which it claims competence. To this end, we have actively sought accreditation by organizations offering it in those areas relevant to our technical expertise. We strive to ensure that the facilities, equipment, procedures, records, and methods used by Lancaster Laboratories in the testing of environmental samples are in compliance with the requirements of these standards.

Although organizations offering accreditation differ somewhat in the details of their programs, they generally evaluate laboratories in four basic areas: personnel (adequate staffing, education, training, and experience), physical facilities, instrumentation/equipment, and quality assurance program. This evaluation is performed by one or more of the following procedures: periodic on-site inspections of the laboratory by assessors experienced in technical operations and management, periodic testing of proficiency test samples, and periodic updating of the laboratory's file to reflect changes in personnel, equipment, or services offered. Some states offer reciprocity with other state programs.

Appendix B lists accreditations, registrations, and contracts held by Lancaster Laboratories, Inc. in support of environmental work. Current copies of all scopes of accreditation are kept on file in the Quality Assurance Department.

2. ORGANIZATION AND PERSONNEL

2.1. Company Overview and History

Lancaster Laboratories was founded in 1961 by Dr. Earl Hess in response to a need for high quality technical services by the agricultural and industrial communities in southeastern Pennsylvania. Nourished in a culture of quality and caring about all those associated with the business, the corporation became an industry leader known for innovative business practices and people-friendly policies. The company was independently owned until the retirement of Dr. Hess in 1995. At that time, LLI was acquired by a publicly held company, Thermo TerraTech, Inc., a Thermo Electron company. Ownership changed in September 2000, when Lancaster Laboratories was acquired by Goldner, Hawn, Johnson, and Morrison, Inc. (GHJ&M), a private equity investment firm. In August 2005, LLI was acquired by Fisher Scientific under their BioPharma Division. On November 9, 2006, Thermo Electron and Fisher Scientific merged to form Thermo Fisher Scientific. In April 2011, Thermo Fisher Scientific sold Lancaster Laboratories to Eurofins Scientific. Lancaster Laboratories continues to operate as an independent laboratory and is incorporated by the State of Minnesota.

Lancaster Laboratories provides a wide array of laboratory services to clients working in the pharmaceutical and environmental industries. We strive to offer high quality technical services in the chemical and biological sciences with personal attention to client needs. These services include chemical analyses, microbiological testing, biopharmaceutical testing, and analytical method development. We are, therefore, a technical service company and do not manufacturer or distribute goods. Our "product" is accurate and timely technical information and our continued existence depends on the quality of the services we offer and efficiency with which we deliver them.

2.2. Organizational Structure

The Chairman of the Board of Lancaster Laboratories, J. Wilson Hershey, Ph.D., is responsible for the daily operations of the Environmental Division of the laboratory.

The Executive Management Group is defined as Lancaster Laboratories' Chairman of the Board, President and Vice President.

Senior Management is defined as directors and above, including the Quality Assurance Director.

The management staff includes directors, managers and group leaders. Organizational charts are presented in Appendix C of this manual. A list of key personnel is also provided.

2.3. Management Responsibilities

Management/supervisor is defined as group leaders, managers, directors, and above.

Laboratory management duties are outlined for supervisory personnel using a job plan format, which details each individual's responsibilities along with expected results. Typically, management duties include, but are not limited to:

- Personnel hiring and training
- Supervision of personnel
- Ensuring quality of data produced
- Resource allocation
- Directing daily work operations, including scheduling of work
- Maintaining awareness of technical developments and regulatory requirements
- Assessing laboratory capacity and workload
- Contributing to the continuous improvement of the laboratory operation
- Providing resources to ensure a safe work environment
- Providing resources to ensure a work environment free of undue pressures
- Communicating problems and concerns to Senior and Executive Management to enlist a higher level of support for corrections and continuous improvements.
- Ensuring compliance with the requirements of ISO 17025 and NELAP.
- Ensuring that corrective actions are carried out in an appropriate and agreed time-frame.

The Chairman of the Board and Director of Quality Assurance are responsible for appointing deputies for all key personnel.

The Technical Director ensures that the laboratory's policies and objectives for quality of testing services are documented in this quality manual. The Technical Director must assure that the manual is communicated to, understood, and implemented by all personnel concerned.

2.4. Overview of the Quality Assurance Program

Quality Assurance (QA) is responsible for developing planned activities whose purpose is to provide assurance to all levels of management that a quality program is in place within the laboratory, and that it is functioning in an effective manner that is consistent with ISO 17025 and the requirements of NELAP. Although LLI is a wholly owned subsidiary of Eurofins Scientific, the Quality Assurance and Quality Systems operations described in this manual are specific to LLI.

The administration of the QA program is the responsibility of the QA Director in cooperation with all levels of management.

2.4.1. Quality Assurance Director

The Quality Assurance Director ensures that the quality system is followed at all times. The QA Director reports directly to the Chairman of the Board, thus ensuring corrective actions to quality issues are taken promptly and are separate from business decisions. The QA Director has no direct supervisory responsibility for the generation of technical data to avoid any conflict of interest in administrating the QA program. The QA Director has the final authority to stop work that compromises our integrity or data quality. The situation must be investigated and appropriate corrective action must be put in place before the QA Director will authorize the resumption of work. The specific duties of the QA Director are communicated in job plan format.

The QA program, as directed by executive management, was established to:

- Ensure accountability, accuracy, and traceability of all analytical data generated.
- Ensure that current regulatory, agency, and client requirements are being met.
- Ensure that operating procedures are in place to minimize the possible loss, damage, and tampering with data, in addition to ensuring that raw data is stored in a secured area and is maintained by designated archivists and/or system administrators.
- Ensure that curriculum vitae (CVs) and training records are maintained to document that staff members have the necessary education, training, and experience to perform their job responsibilities and functions.
- Ensure that regulatory training is provided to applicable employees on a routine and ongoing basis.
- Ensure that all procedures are available, controlled, and current.
- Ensure that all equipment and instrumentation is qualified, maintained, and calibrated, as appropriate, in accordance with written standard operating procedures.
- Ensure that all significant laboratory problems are investigated and corrective action is put in place as documented
- Ensure that an internal audit program is in place to confirm that laboratory personnel are adhering to standard operating procedures and applicable regulations.
- Ensure that quality issues are brought to the attention of management in a timely manner.
- Communicate (within 30 days) to the relevant state authorities when there are management or facility changes that impact the environmental division.

2.5 Quality Assurance Responsibilities

Responsibilities within the QA Department are divided between divisions and assigned in accordance with the regulations the business unit of interest is required to follow (i.e., Food and Drug Administration [FDA], Environmental Protection Agency [EPA]). The QA Director assigns tasks with input from the company Chairman of the Board. The primary responsibilities of QA in support of the Environmental Division include, but are not limited to the following:

- Oversee the laboratories' internal audit program which consists of various audit types and applies to all laboratory activities (technical and administrative).
- Review and approve standard operating procedures and LLI analytical methods.
- Review and approve validation documentation.
- Review non-conforming quality control data and approve laboratory investigation and corrective action reports.
- Perform tracking and trending of quality measurements and investigation report issues.
- Ensure that appropriate corrective actions are implemented as needed in response to quality issues or audit findings.
- Host client and regulatory agencies during facility audits and follow-up to any cited deficiencies.
- Provide regulatory guidance to the laboratory.
- Monitor GLP regulatory activities.
- Communicate quality issues to management.
- Provide and/or coordinate on-going regulatory training (e.g., Good Laboratory Practice [GLP], Good Manufacturing Practice [GMP]).
- Participate in the vendor and supplier approval process, including subcontractors.
- Review analytical data.
- Prepare and review QA project plans (QAPPs) as required by EPA and client projects.
- Maintain and update this *Quality Policy Manual*.
- Administer proficiency test sample programs, both single and double blinds.

2.6. Communication of Quality Issues to Management

The QA Department is responsible for preparing reports to Senior Management to keep them apprised of outstanding quality issues. Reports to management foster communication, review, and refinement of QA activities to ensure that the QA program is adequate to meet regulatory and Lancaster Laboratories' quality objectives. The following reports are used to communicate quality issues and include, but are not limited to:

- Internal, client, and agency audit reports and corrective action plans
- Proficiency test reports
- Investigation and corrective action reports
- Monthly and quarterly quality status reports
- Plans for corrective action

2.7. Personnel Qualifications and Responsibilities

Full resumes and responsibilities of key personnel are provided in Appendix D.

Due to the number of analysts on staff, entry level chemists, technicians, and support personnel are not included in the resume section. However, all employees have job plans that define their responsibilities. Duties for these personnel typically include:

- Sample storage
- Sample preparations
- Performance of tests
- Calibration, operation, and maintenance of instruments
- Data entry
- Standard and reagent preparation
- Glassware preparation
- Data package preparation

2.8. Relationship of Functional Groups and the Quality Assurance Program

In addition to this *Quality Policy Manual*, aspects of the QA program are documented in a series of standard operating procedures that support the proper execution of this document. Technical operation procedures with required quality components are also in place. A list of the titles of relevant SOPs is provided in Appendix E. There are a variety of mechanisms used to communicate requirements and verify compliance with the QA program, including:

- Management requires that all employees read and be trained in the policies and SOPs that are pertinent to their jobs.
- Employee job plans define individual responsibilities. All job plans include QA aspects, and performance is reviewed annually.
- Laboratory audit findings are circulated to management and require a response and follow-up to items needing corrective action.
- Cross-functional meetings, including representatives from QA, Client Services, Marketing, management, and technical operations are held regularly to review specific projects and quality issues.

2.9. Balancing Laboratory Capacity and Workload

Evaluating laboratory capacity to perform specific projects is the responsibility of the Chairman of the Board, the lead Technical Director and the Director of the Client Services/Project Management Group. These responsibilities are documented in the individual job plans for these positions.

The laboratory facilities and staff size are very large compared to other laboratories serving the environmental industry. Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in case of malfunctions. This minimizes the need to evaluate small and medium size projects against capacity available to complete them. Large projects are reviewed against capacity estimates before bids are submitted to ensure that the client's analysis schedule is met.

Regularly scheduled meetings are held with upper management, laboratory middle management, Client Services and QA personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Laboratory capacity and backlog is tracked on a continuous basis using information from the sample management system, including turnaround time, and work in-house.

2.10. Identification of Approved Signatories

Approved signatories for laboratory reports are defined in the SOP on final review of laboratory generated reports. Directors, managers, group leaders, and other designated employees (such as project managers and senior technical staff) are designated to sign reports. Request for approval of an employee to review/sign reports must be made through the QA Department. Approved signatories are designated with an asterisk in the personnel list provided in Appendix C.

2.11. Personnel Training

The experience and training received by personnel is of great importance to our clients and regulatory agencies. CVs and on-going training documentation are available to demonstrate how personnel have been prepared for the tasks they routinely perform. To ensure the highest quality of services at Lancaster Laboratories, training programs and plans are developed to match skills with job functions. Accurate training documentation is the responsibility of both the employee and their supervisor. On a routine basis, the supervisor reviews and signs training documentation to verify that it is complete and current.

Training requirements can be met through education, prior job experience, internal and external training classes, on-the-job training, TRN training modules, procedure reading, or any combination thereof, to enable the person to perform assigned job functions and meet regulatory compliance.

Each analyst training to perform a new analysis is required to perform an initial demonstration of capability and meet the requirements for accuracy and precision before working independently on the test method. Typically, this is accomplished by the successful analysis of four known samples. However, there are certain tests performed that are not required by the mandated test method or regulation to perform the above procedure (i.e., EPA 1010, 9095). In this case, the analyst's documentation of proficiency is satisfied by the sign-off of having read, understood, and agreed to follow the SOP as written and observation by a senior analyst.

Management personnel are responsible for planning ongoing professional growth and development activities for an employee through on-the-job training and/or internal and external training courses so an employee can maintain a current skill set to match job responsibilities.

An annual performance review based on job accountabilities, objective measures, and pre-defined standards is completed by management personnel for each employee. This assessment is documented and maintained. Input is obtained from other managerial personnel as needed.

2.11.1. New Hire Training

New employees are oriented as part of a year-long process that is designed to make the employee feel welcome and comfortable by defining our culture, traditions, philosophies, and work practices. During the orientation process an employee learns about personnel and safety policies and business strategies in addition to quality, ethics, and customer satisfaction expectations through a formal process administered by our Human Resources Department.

New employees are required to attend a "core" technical orientation as applicable, which can entail the participation in training module exercises, short session attendance, and/or other skill training specific to their assigned department or job function. Additional job-specific training required for an employee is based upon their assigned duties and is identified by their supervisor. Technical orientation occurs during the first few weeks of employment.

The orientation process is designed to enable employees to initiate and take responsibility for their personal and professional career growth at Lancaster Laboratories. The orientation process is conducted without regard to employee race, color, creed, national origin, sex, age, or disability in accordance with LLI's Employee Equal Opportunity (EEO) policy.

2.11.2. Ongoing Training

Refresher and ongoing training occurs through various means, which include but are not limited to, training in or independently review new/updated LLI standard operating procedures and TRN training procedures; on-going regulatory training; in-house or off-site classes or seminars. The goal of this training is to ensure that employees remain current with changes to laboratory systems and practices, as applicable to their job function. Retraining and re-qualification activities occur as directed by procedures or regulations. Employees are retrained if an issue or investigation warrants that retraining is a necessary corrective action. Management directs when employee re-training is required, and the extent of the re-training.

2.12. Regulatory Training

The QA Department is responsible for coordinating and conducting initial and ongoing regulatory training (i.e., GMP, GLP) for all applicable laboratory and support personnel. It is the responsibility of management within each department to ensure that personnel attend the required training sessions.

The choice of training format and topics covered for ongoing regulatory training is left to the discretion of QA and the trainer. All training sessions reinforce the concepts in the regulations as they are relevant to Lancaster Laboratories.

Whenever possible, after training is completed, a demonstration of proficiency of the training topic is given. The demonstration of proficiency is generally in the form of a quiz although other demonstrations of proficiency are acceptable depending on the scope and content of the training. If necessary, training is presented and/or repeated one-on-one with individuals who do not demonstrate proficiency in the training topic. This is performed by QA in conjunction with applicable laboratory management personnel.

2.13. Employee Safety

Lancaster Laboratories, being mindful of its responsibilities as an employer and active corporate citizen, has established the following objectives of its safety program:

- Provide a safe environment for its employees, visitors, and the community surrounding its place of business.
- Provide ongoing safety training for employees.

- Provide all necessary facilities and equipment to ensure the safety of its employees and to minimize all chemical exposure during the normal performance of their required tasks, and to take all necessary precautions to safeguard the surrounding environment.
- Provide periodic health physicals for employees.
- Foster and encourage safe operations and a proper safety attitude on the part of our employees through general operations and systems, training, and the *Chemical Hygiene Plan* (CHP).

The *Lancaster Laboratories Chemical Hygiene Plan* addresses various aspects of our safety program in greater detail.

A Safety Committee works to enhance our overall safety program. The committee meets on a routine and ongoing basis and its specific responsibilities are detailed below.

- Review accident and incident reports. Make recommendations for methods of prevention to eliminate further accidents.
- Promote safety awareness and distribute safety information by various means (e.g., posters, videotapes, pamphlets, and books). Use internal communication channels to promote safety awareness.
- Enhance and recommend safety-training programs for all employees, as necessary.
- Maintain up-to-date information on employee concerns that are safety related. Offer input and information to the Chemical Hygiene Officer and/or Safety Officer, as needed.

2.14. Client Services/Project Management Responsibilities

Members of the Environmental Client Services/Project Management Group are responsible for organizing and managing client projects. Clients are assigned a project manager who serves as their primary contact at LLI. It is the project manager's responsibility to act as the client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements. All client verbal communications are documented by the project manager in a controlled notebook. In addition to information management, Project Management responsibilities include:

- Coordinating and preparing proposals in conjunction with technical staff.
- Confirming certification status.
- Hosting client visits and audits.
- Coordinating and communicating turnaround time (TAT) requirements for high priority samples/projects.
- Answering common technical questions, facilitating problem resolution.
- Providing clients with sample status report or results prior to receipt of hardcopy analytical reports (e.g., fax, e-mail, phone).
- Scheduling sample submissions, sample containers, and sample pick-up via LL courier service.
- Informing the client of deviation from their contract.

2.15. Confidentiality

Strict confidentiality is maintained in all of our dealings with clients. Confidentiality agreements, therefore, are willingly provided. Clients are promptly notified any time their data is subpoenaed or requested by a regulatory or legal body.

All employees are required to protect company technical data, including client names and test results from disclosure to any third party. This policy, as described in the *Lancaster Laboratories Personnel Manual*, is provided and presented to employees during their orientation period.

Intellectual property associated with the testing that we perform under contract for a client is the property of the client.

In an attempt to ensure the confidentiality of our systems and procedures within our laboratory, it is our policy to restrict the distribution of our internal procedures to clients. Clients are permitted to review our procedures while on-site as part of an audit or visit. Based on this policy, we would request that any documents viewed would not be shared or made available to any third parties without the permission of Lancaster Laboratories.

2.16. Business Conduct

Our business conduct policy applies to all operations of the company. All employees must avoid any relationship with other individuals or organizations (including Eurofins Scientific sister companies) that might impair, or even appear to impair, the proper performance of their company-related responsibilities. Employees must avoid any situation that might affect their independence of judgment with respect to any business dealings between the company and any other organization or individual. Any employee who believes that they have such a conflict, whether actual or potential, or who is aware of any conflict involving any other employee must report all pertinent details to the President of the company or Chairman of the Board. The company's management vigorously enforces this policy and takes prompt and appropriate action, including termination, against any employee found to be in violation.

2.17. Operational Integrity

All employees sign an Employee Ethics Statement on their first day of employment. Employees responsible for generating, handling, or reviewing laboratory data understand that Lancaster Laboratories mission is to perform all work with the highest level of integrity. Under no circumstances are shortcuts or generating results to suit a client's purpose rather than good scientific practice considered acceptable. Any violation of the laboratory ethics policy results in a detailed investigation that could lead to termination.

All levels of management consider the following activities unacceptable:

- Knowingly recording inaccurate data.
- Fabrication of data without performing the work needed to generate the information. This includes creating any type of fictitious data or documentation.
- Time travel or adjusting clocks on computerized systems to make it appear that data was acquired at some time other than the actual time.
- Manipulation of data for the express purpose of passing system suitability or quality control criteria.

- Selective use of data generated, or not using data that was legitimately generated and has an impact on the outcome of the test.
- Executing significant deviations from approved test methods and procedures without prior approval from Lancaster Laboratories management and/or the client.

If an issue does arise which could compromise data integrity, personnel are instructed to perform the following activities:

- Clearly document the situation and maintain all data generated. There is a big difference between poor judgment and fraud. Fraud usually involves intent to conceal an action taken. Therefore, the more documentation that is maintained, the less likely an action is considered fraudulent if further scrutinized.
- When out-of-specification results or quality type issues are detected, all supporting data and relative background information must be documented and presented for management review. Problem resolution and client contact, as applicable, must also be documented.
- Review any questionable situations and decisions with a supervisor.
- Bring a questionable or uncomfortable issue directly to the QA Director or a member of the QA Department as part of our QA open door policy.
- Utilize the company's Ethics Committee. See Section 12.4 of this manual.

3. BUILDINGS AND FACILITIES

3.1. Facility

Lancaster Laboratories is located at 2425 New Holland Pike (Route 23), Lancaster, PA 17601. The facility consists of three primary buildings (A, B, and C). Building A and B are connected by a pedestrian bridge spanning Route 23.

Building A resides on a commercial plot measuring 13.6 acres on the north side of Route 23. Building A is a three-story building of concrete and steel construction. It is approximately 116,000 square feet and consists of approximately 62,000 square feet of laboratory space; 25,000 square feet of office space; and 29,000 square feet of storage, mechanical, and service space. On this plot, adjacent to Building A, sits a 1000 square foot chemical storage building (Building I) (solvent, acid and gas cylinder storage) and an 8000 square foot storage building which also houses stability chambers (referred to as Building J). The bottles packing area, which includes preservation of bottles being sent to clients for sampling, is located in a separate 3000 square foot building (referred to as Building K). In addition, there are two other buildings on the north side of Route 23 that include 1200 square feet for supply storage, 600 square feet for recycling, and 3500 square feet for shop and facilities maintenance areas.

Building B resides on a commercial plot measuring 13.7 acres on the south side of Route 23. Building B is a three-story building of steel and concrete construction. It is approximately 55,000 square feet and consists of approximately 15,000 square feet of laboratory space; 18,000 square feet of office space; and 22,000 square feet of storage, mechanical, and service space.

Building C is also located on the south side of Route 23, connected to Building B. Building C is a three-story building of steel and concrete construction providing approximately 50, 000 square feet of space used for Biopharmaceutical and Analytical Development testing laboratories. The first floor houses the main lobby, visitor's entrance, and conference rooms.

An automatic fire alarm monitors the entire facility. The system is monitored by the central dispatch station. Building B, Building C, and Building J are fully protected by sprinklers for fire suppression. High-risk areas of Building A are protected by sprinklers as well. The entire campus and all exterior doors are monitored by video surveillance.

3.2. Security

Lancaster Laboratories is considered a secure facility. All outside doors except the main lobby entrance are kept locked during normal business hours to prevent unauthorized entry. An attendant monitors these entrances at all times.

During evenings, weekends, and holidays, all doors are locked and Security personnel are on site to prevent unauthorized entry into the building. Video cameras are utilized by Security personnel to monitor the facility grounds.

Every employee is issued a photo ID badge, which also serves as a building access card. This badge must be worn at all times while on laboratory property so that employees are easily identified. Access to secured/designated areas within the building is limited to only applicable employees through the building security system. This system is administered by Security staff.

All visitors must register with the lobby attendant and are issued a visitor badge. A staff person must accompany visitors while in the facility. Additional visitor rules are outlined in the *Visitor Security and Safety Rules* pamphlet, which is provided to all guests.

Building access cards are issued on a temporary basis to contractors or service technicians (e.g., electricians and plumbers) who need access to the building to work on a project. These cards provide the contractor with limited access during the normal workday and must be returned when the work is complete.

3.3. Disaster Recovery

A disaster recovery plan is in place to provide direction for situations where normal operations of the laboratory are not possible. In the event that the building would be severely challenged, a designated disaster recovery team, which includes Physical Services, Maintenance, Safety, Corporate Management, Public Relations, and other applicable personnel depending on the scope of the disaster, would assemble at a designated area to assess the situation and formulate a plan.

The plan addresses, in general terms, how to approach the following issues: electrical failures, heating/air conditioning failures, fire/building evacuation, computer failures, hazardous material spills, injury to employees, pandemic flu, disruption of phone service, and stability chamber failures.

3.4. Environmental Monitoring

The air handling system for the main laboratory is specially designed to protect sensitive instruments from harmful vapors to ensure that samples are not contaminated. The Physical Services/Maintenance Group is responsible for maintaining the HVAC and exhaust hood systems. This is particularly important in our instrumentation rooms and computer center where a controlled environment, positive pressure system is maintained.

Most refrigerators, freezers, incubators, and ovens used for analysis are monitored by a computerized system equipped with stationary thermometer temperature probes linked to a master panel that is accessed through a computer in the Plant Engineer's office. If a unit is outside of a predefined temperature range for a specified period of time, the system alarms. Units not on the computerized system must be monitored manually by recording thermometer temperature readings twice daily.

The laboratory is set up so that there is effective separation between neighboring areas in which there is potential for contamination. Laboratory storage blanks are also used to evaluate conditions under which samples for volatile analysis are stored to monitor for cross-contamination potential. QA provides oversight of the environmental monitoring system.

3.5. Water Systems

Well water and the public sewer system service the facility. The water system is monitored to meet the permit requirements of the Pennsylvania Department of Environmental Protection.

Quality control of laboratory analyses involves the control and quality of laboratory water available to analysts for preparation, dilutions, and rinsing of glassware. Two reverse-osmosis deionized water systems deliver highly purified water to a sealed fiberglass storage tank. From the storage tank the water is delivered to an ion-exchange-carbon filter system for further polishing. The water is also exposed to an in-line ultraviolet sterilization lamp before being circulated to taps throughout the laboratory.

Daily monitoring and preventive maintenance for the system is the responsibility of the Maintenance Department. Monthly and annual testing is performed as required by regulatory guidance. QA provides oversight of the water system monitoring. In addition, method blanks are tested with each batch (≤20) of samples.

3.6. Housekeeping/Cleaning

Lancaster Laboratories is dedicated to providing a clean workplace. A third party professional cleaning service provides routine cleaning of "common areas" that include lavatories, drinking fountains, floors, and windows. Technical staff are responsible for the cleaning (or the contract of cleaning) of specific laboratory work areas.

Detergents used for cleaning contain no to very low levels of metals, pesticides/herbicides/ fungicides, or volatile solvents.

3.7. Insect & Rodent Control

Steps are taken to prevent, monitor, and control insect and rodent infestation. The coordination of this program is the responsibility of the Physical Services Department under the direction of QA. An outside service firm is contracted to perform routine and ongoing monitoring of the facility to ensure that preventive measures which are in place are effective and are working as intended.

No insect or rodent control chemical agents in a liquid or vapor form are applied or sprayed in any laboratory building, unless there is no other option, in which case department management must be contacted for approval.

3.8. Emergency Power Supply

The laboratory is located at the junction of two power grids that supply electrical service to the facility. If one of the power grids fails, we have the ability to work with the power company to have service switched to the other grid. Various types of diesel and natural gas generators are also available on a standby basis to supply power to selected areas of the laboratory in case of a power outage.

To reduce spikes and spurious line voltage changes to laboratory instruments that can affect results or damage electronic equipment, "conditional power" is fed to these sensitive instruments. All essential computer systems are on uninterrupted power supply (UPS) which is a battery system that provides continuous conditional power for a limited time period in the event of a short power outage.

3.9. Facility Changes

Procedures are in place to manage change, ensure communication, and to minimize negative consequences through active participation of personnel involved in a facility change. The goal is to ensure that physical and environmental condition changes are adequately evaluated for impact and reduction of risk to quality, safety, health, employee, environment, property, analytical services, and business operations before and after the change is implemented.

4. DOCUMENT CONTROL

The administration of the document control system including tracking, filing, updating, distribution of new procedures, and archiving of historical copies is the responsibility of the Office Services (OS) Department.

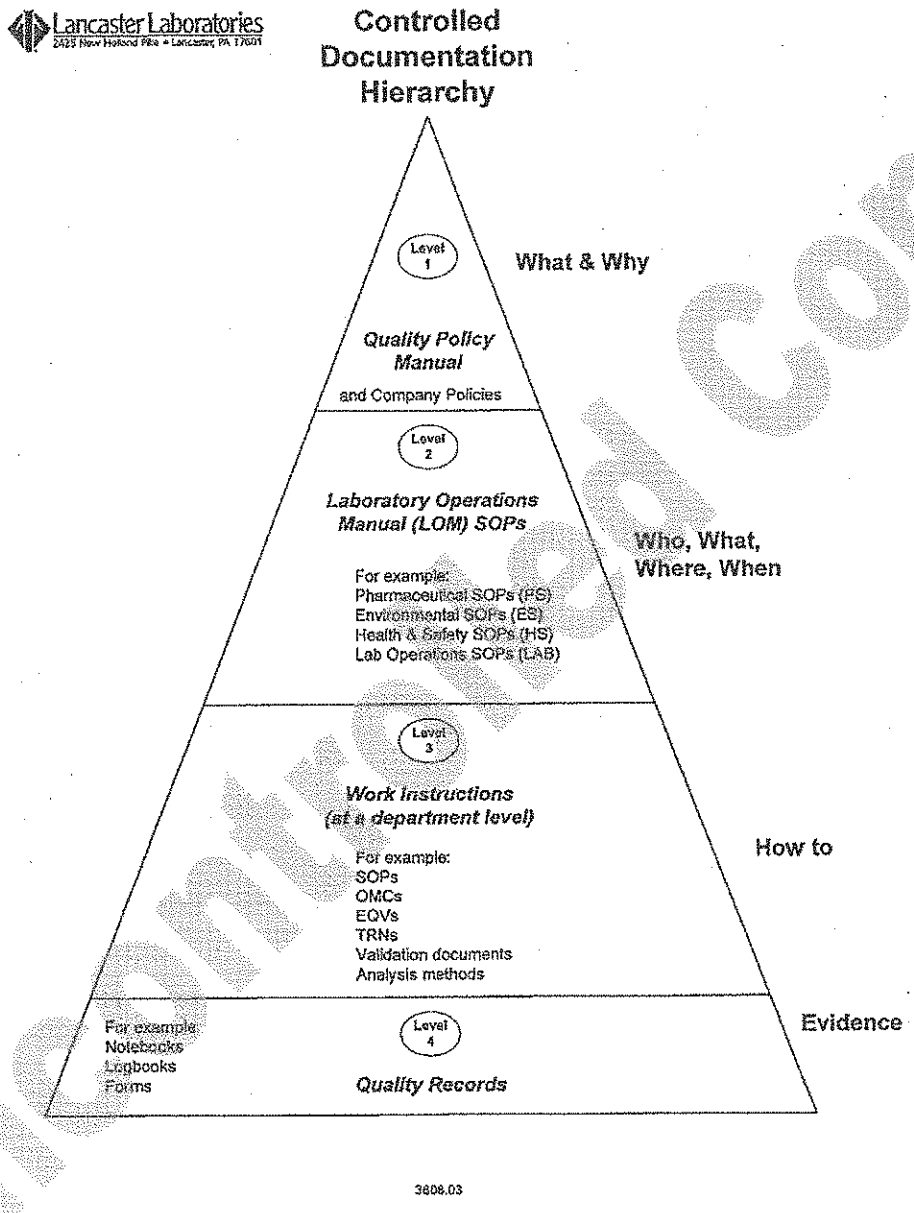
It is our policy to restrict the distribution of our internal procedures to clients and we discourage the distribution of company confidential documents outside of the facility. Clients are permitted to review our procedures while on-site as part of an audit or visit. Any documents that are distributed are only sent with the approval of QA.

The goals of the document control process are:

- Format documents according to consistent and defined standards
- Review and approve new documents
- Schedule review of existing documents
- Control of document versions and effective dates
- Review and approval of document changes
- Control document distribution and return of obsolete documents
- Archive and protect obsolete documents

4.1. Hierarchy of Internal Operating Procedures

The hierarchy of controlled procedures at Lancaster Laboratories is defined in the following pyramid diagram. These procedures and documentation are made available to promote consistency throughout the organization and to meet regulatory requirements. A list of relevant methods and procedures is located in Appendix E. The development of new procedures and the updating and reclassification of current procedures is an ongoing project.



4.1.1. Level 1 – *Quality Policy Manual* and Company Policies

The intent of these documents is to define "what" we do with emphasis on Executive and Senior Management's responsibility for quality.

The purpose of the *Quality Policy Manual* is to provide a framework to outline the quality systems at Lancaster Laboratories. Organizational charts, list of SOPs, a list of equipment, instrumentation, and personnel resumes are included as attachments to this manual.

- Executive Management is responsible for ensuring adequate personnel, resources, and support are available to carry out the requirements of this *Quality Policy Manual*.
- Senior Management is responsible for ensuring that SOPs or other appropriate documents are written and available to personnel to define the practices and systems which support these policies.
- All employees are responsible for conducting business in a manner, which is compliant with quality and company policies and associated SOPs or other appropriate documents. Review of these policies and procedures must be documented.

Additional company policies are written to support and expand upon this *Quality Policy Manual*. These policies contain more detailed information about a subject with approval signatures executed at the Executive and/or Senior Management level.

4.1.2. Level 2 – Laboratory Operations Manual (LOM) SOPs

The intent of these standard operating procedures is to define "who, what, where, and when." These procedures provide specific information for a process or topic so that the requirements outlined in this *Quality Policy Manual* and company policies can be achieved. The review and approval of these SOPs is performed at the director/manager/group leader level, including QA review and signoff, and the responsibility of these SOPs lies with the area or person directing the operation.

SOPs are organized into different categories dependent on subject matter and area to which they apply within the company. They can apply across the entire company, across a division, or a specific operating area. Some examples of areas addressed at this level are:

LAB – Laboratory Section
HS – Health and Safety
ES – Environmental Sciences

4.1.3. Level 3 – Work Instructions (at a departmental level)

The intent of these procedures or documents is to define in greater detail the specific "how to". The level of detail in these documents must be sufficient so any appropriately trained person can perform the task accurately. Examples include, but are not limited to standard operating procedures (SOPs); operation, maintenance and calibration (OMC) procedures; equipment, qualification, and validation (EQV) procedures; validation documents; and Lancaster Laboratories'

analytical methods. Departmental level procedures/documents are reviewed and approved at the manager or group leader level including QA review and signoff.

4.1.4. Level 4 – Quality Records

The intent of these documents is to provide documented evidence to support our quality systems and operations. Examples include but are not limited to, data notebooks/logbooks, and preformatted data recording forms.

4.2. Document Approval, Issue, Control, and Maintenance

The document control process ensures that documents are approved and adequate for use. It ensures that documents are readily available to personnel and at locations where essential operations are performed. Distribution of each document is controlled to ensure that analysts are working with the correct version.

Controlled policies, procedures, and work instructions are reviewed and approved by appropriate individuals and are formally issued and administered through the Office Services Group. Each document is uniquely identified and includes an effective date, revision identification, and page numbering (totaling number of pages). All documents are indexed and identified on a "master list." Each procedure has a unique file record that contains pertinent information used in the tracking process.

The original signed hard copy of the procedure is maintained in a secure area while in the active status. Electronic copies of each procedure are stored in a secure directory that is accessible only to designated personnel. Office Services also monitors the number of copies of each procedure in the laboratory.

Procedures are reviewed to ensure they remain accurate and current. The frequency of review is either annual or biennial, depending on the level of the procedure. Upon the receipt of new or updated documents, all copies of obsolete documents are removed from service and destroyed. The original historical copy of each outdated/obsolete procedure is clearly identified as a historical version and maintained in a permanent archive file separate from any current versions. (Note: OH EPA is required to review all revised documents applicable to its certification).

Company policies and corporate level procedures are available in electronic form on the company's intranet site. Electronic copies are made available to enhance communication across the company. Electronic copies are scanned-in versions of the most recent hard copy of the document. These procedures cannot be printed from this system. The Office Services Group maintains this system in a current and accurate state.

4.3. Client-Supplied Methods and Documentation

Client documentation to support environmental testing at Lancaster Laboratories is maintained in a centralized area. This information is organized by client/project in the Client Services/Project Management Group. Client documentation includes the following information depending on project size and scope:

- Client supplied analyte lists
- Client supplied project plans
- Client contract quality manuals with specified limits, QC criteria, etc.

- Communication/correspondence records which relate to testing requirements, interpretation of results, or reporting formats

4.4. Laboratory Notebooks, Logbooks, and Forms

Procedures are in place to ensure that all data is traceable, authentic, complete, and retrievable. The following general requirements outline our system for the issuing, control, and archival of laboratory notebook and logbooks.

- The administration of notebooks and logbooks is controlled by the Office Services Group. They maintain a master index to uniquely number and identify each book distributed.
- Notebooks and logbooks can contain blank or preformatted pages.
- Notebooks and logbooks are bound, uniquely identified and have sequentially pre-numbered pages.
- If notebooks or logbooks contain preprinted laboratory form pages:
  - A unique identification number is assigned to each form
  - Forms are approved by appropriate management personnel before they are put into production use
  - Forms are reviewed on a routine basis to ensure they are still accurate and current
- Completed notebooks are returned to an archivist. Incomplete books are returned to Document Control:
  - when an employee leaves the company
  - when an employee transfers to another division
  - when the project for which it was used is complete
  - at a defined time line from the issue date
- Office Services verifies the status and location of any notebook or logbook which has been signed out for longer than two (2) years.
- In specific situations, records are bound to create books at the time of archival (e.g., temperature charts).
- At the time of archival any page(s) in the notebook or logbook that does not contain data documentation is crossed-out or a statement is written on the last page used to note that the book is complete to prevent data from being entered at a later date.
- Notebooks and logbooks identified as requiring permanent archival are assigned a designated qualifier.

4.5. Control of External Documents

Hard copy versions of external documents are controlled through the form system.

External documents such as copies of the 40 CFR and ASTM methods are stored exclusively in the QA Department. QA also keeps applicable agency documents on file, these include, but are not limited to, the TNI (The NELAC Institute) and ISO 17025 standards.

Environmental methods from the EPA or Standard Methods are available in the QA Department, but the technical areas also have copies that pertain to the tests that they perform. Any external document that is maintained in these areas must be inventoried and listed on a controlled form. Some methods are available on-line and are accessed through the Internet. Regulatory methods are used as references by the laboratory and testing is performed as per written SOPs that fall under our existing document control system and have scheduled reviews. It is the laboratory's understanding that the need to control external documents is to ensure that the most current version of a method is referenced or appropriate manual is being used. While using the most current version of an analytical method is our typical practice, there are specific client needs and accreditation rules that require previous versions of a method be used. Our scheduled review of SOPs is used to ensure that the proper version of a method is referenced.

The technical areas are responsible for ensuring that all manufacturer's manuals are current and available to analysts. The vendor provides instrument manuals when new equipment is purchased or existing instruments are updated. These manuals are kept with the instruments to which they are associated. The laboratory labels the instrument books with the corresponding identification number of the instrument. Logbooks, which fall under the document control system also include the title and date/version of the instrument manual.

5. SAMPLE HANDLING

5.1. Sample Collection

In order for meaningful analytical data to be produced, the samples analyzed must be representative of the system from which they are drawn.

It is the responsibility of the client to send us representative and/or homogeneous and properly preserved samples of the system from which they are drawn. Lancaster Laboratories assumes that all multiple sample containers with the same designator/description and bottle type contain a homogeneous, representative sample. We also assume that it is acceptable to deplete one container and move to the next, without implications unless otherwise indicated by the client.

The laboratory provides the appropriate sample containers, required preservative, chain-of-custody forms, shipping containers, labels, and seals. The laboratory also provides trip blanks and analyte-free water for field blanks. Preparation of methanol containers for field preservation of volatile soil samples is available.

Sample containers are purchased pre-cleaned by the supplier. Special containers with traceability documentation are available upon request. For pre-preserved bottles, each lot of preservative is checked for contaminants before use and this testing is documented.

The laboratory provides instructions with all bottle orders that define how to sample, preserve, store, and ship the samples prior to their delivery at Lancaster Laboratories. These instructions inform the client of the importance of proper sampling and advise them that non-compliant samples are rejected or reported with a qualifier.

If samples are collected by Lancaster Laboratories personnel, applicable sampling methods are in place to perform the sampling operation.

As samples are analyzed at Lancaster Laboratories, there are times when additional sample volume is necessary to complete testing or perform retesting. If this situation arises, "additional sample" is requested by Lancaster Laboratories and/or submitted by a client to supplement current work being performed within our facility. Additional sample received is either assigned a new Lancaster Laboratories sample ID number and/or a comment noted on the final report to state that additional sample was received, depending on the situation. It is our goal to provide accurate traceability between sample submission and when testing is performed.

5.2. Sample Receipt and Entry

5.2.1. Sample Receipt

Samples can be received at the laboratory 24 hours a day, 7 days a week, 365 days of the year. Receipt can occur in one of three ways:

- Lancaster Laboratories courier services (i.e., Transportation Department)
- Personal delivery
- Commercial courier

All samples received for testing are delivered to the Sample Administration Department immediately upon arrival. This group is responsible for the unpacking and organizing of the samples. This process includes checking custody seals if present, paperwork agreement, signing the chain of custody, recording cooler temperatures, documenting the condition of containers, accounting for all sample bottles, and observing any safety hazards, and reporting any problems to Client Services for communication to the client. This receipt process is documented.

5.2.2. Sample Entry

As soon as practical after sample receipt, all samples are entered into our laboratory information management system (LIMS). Samples awaiting log-in are stored in temporary holding areas, at appropriate storage conditions to maintain sample integrity. If there is doubt about the suitability of items received or if items do not conform to the description provided or the testing required is not clear or specified, the client is contacted and the conversation documented.

At the time of entry, the LIMS assigns a unique Lancaster Laboratories' sample number to each sample. This number is sequentially assigned and a label is generated and is attached to the sample container.

Samples are tracked to the minute upon arrival. This allows the client to see exactly how long it took the samples to pass through receipt, unpacking, and entry.

A sample acknowledgement prints from the LIMS per sample delivery group (SDG). This notification is sent to the client to confirm sample receipt and entry on the day following sample log-in. Internally, appropriate personnel audit all applicable sample entry and client paperwork.

5.2.3. Sample Preservation Check

Support personnel check and document preservation of non-volatile liquid samples after the samples have been entered into the LIMS and before they are placed into storage. Any checks of volatile samples are performed at the time of analysis and documented.

5.2.4. Sample Rejection Policy

Any time a sample is received in a condition that does not meet the method requirements, the condition of the sample is clearly documented on a sample administration documentation log or sample problem form. These forms are forwarded to the project manager and the client is contacted to discuss the best course of action. The client is given the option to resample or have the sample analyzed and reported with a comment.

5.3. Sample Identification and Tracking

A sample label is generated for each sample and; in addition to the assigned Lancaster Laboratories' sample number; the following information is printed on the label: client name, sample identification assigned by the client, sample collection information, storage area, bottle code ID, analyses requested, and any applicable notes to laboratory personnel.

To ensure accountability of results, the unique sample number assigned is used to identify the sample in all laboratory data documentation, including notebooks, instrument printouts, and final reports. The sample number is also used to identify additional containers of the sample that are created during sample preparation and analysis (e.g., subsamples, extracts, digests).

5.4. Sample Storage

After sample entry, samples are placed in an assigned and identified storage location until needed for analysis. Room temperature, refrigerated, and freezer storage are available and samples are stored in accordance with regulatory, method, or client direction. The LIMS is used to assign storage locations, which assists in the orderly storage of samples. Sample storage locations are secured and monitored for accurate temperature control.

The central locked storage facility contains 3430 square feet of refrigerated space, including 2740 square feet equipped for automated sample retrieval. Samples are stored in the laboratory's automated storage and retrieval system (ASRS) or other assigned storage locations (separate volatiles areas) within the laboratory until completion of all analytical work.

When a sample is scheduled for analysis, the analyst retrieves it from the storage area. To maintain the integrity and security of the sample(s), the amount needed for analysis is removed and the sample(s) returned to storage as soon as possible

5.5. Sample Return/Disposal

Samples remain in the storage area following analysis until the testing results have been authorized and the analysis report has been generated. On a regular basis, a list is printed from the LIMS that summarizes samples that can be removed from the storage area. Samples are either returned to the client or disposed of in accordance with local, state, and federal regulations.

Due to the variety of waste generated at Lancaster Laboratories, several general categories of wastes and waste streams have been identified. Identification of waste occurs through information provided by the client, historical information, and/or analytical testing. Lancaster Laboratories uses a sophisticated, computerized sample management system, which includes programming to assist in the identification of hazardous wastes at time of discard.

For reasons of environmental liability, client confidentiality, proprietary product formulation protection, etc., wastes generated by Lancaster Laboratories are disposed of via incineration at EPA licensed facilities. The three exceptions include bulk neutralized acid waste, COD analysis waste, and lab pack waste containing mercury. None of these exceptions involve containers with client information.

5.6. Chain of Custody

Samples being tested for litigation require locked storage and documentation of the time and personnel responsible when the sample was not in storage. Procedures to define these activities are in place and include the following:

- A chain-of-custody document is initiated for each bottle type submitted by the client.
- The chain of custody is signed each time the sample is stored, removed from storage, or changes hands.
- Clients requesting internal chain-of-custody documentation receive the completed forms after the analysis is complete.

5.7. Representativeness of Samples

Each analytical method provides specific procedures for ensuring that a representative aliquot of the sample is used for testing. These procedures include shaking water samples and mixing solid samples. Analysts are instructed in sampling techniques that prevent contamination of samples.

6. TECHNICAL REQUIREMENTS – TRACEABILITY OF MEASUREMENTS

6.1. Reagents and Solvents

The reliability of our analytical results can be directly affected by the quality of reagents used in the laboratory. Procedures are in place to address labeling, storing, and evaluation of these materials. Reagents and solvents include acids, bases, indicators, buffer solutions, colorimetric solutions (CS), test solutions (TS), and volumetric solutions (VS). *The Lancaster Laboratories' Chemical Hygiene Plan* provides safety information in regard to the storage and handling of laboratory chemicals.

Each analytical method includes a list of reagents needed to perform the test. Reagents are fully described, including chemical name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed. The laboratory is responsible for checking that new supplies meet the method requirements. These checks are documented and maintained.

Departmental management ensures that an adequate inventory of reagents needed to perform testing is maintained. Reagents received at the laboratory funnel through the Shipping and Receiving Department and deliveries are verified and labeled with the date of receipt. Large volume reagents (e.g., solvents, acids) are stored in a building outside of the laboratory until needed for use.

In addition to the name and concentration of the reagent, all reagents are labeled with the manufacturer/vendor, storage conditions, the date opened, and an expiration or re-evaluation date. Before using any reagent, the analyst must ensure that the material was properly stored and labeled. If a reagent has passed its expiration date or shows signs of deterioration, the material is not to be used in the laboratory and must be discarded. If a re-evaluation date is reached before a reagent is completely consumed, the reagent will be inspected by physical observation for signs of degradation. Physical signs include, but are not limited to, color changes, clumping or other texture changes for solids and formation of precipitate in solutions. This evaluation is performed by an experienced chemist or microbiologist.

Subsequent reagent solutions or mixtures prepared at the laboratory are fully documented in a logbook and labeled to include: unique name, concentration, date prepared, name of analyst preparing or reference to the logbook, storage conditions, and expiration/re-evaluation date. The information recorded allows these solutions to be traced to the original stock solution.

All reagent certificates and MSDSs are retained by the laboratory.

6.2. Media

Within the microbiology laboratory, procedures are in place to address preparation, labeling, storage, expiration, documentation, and quality/sterility evaluation requirements for these materials. These procedures are described in Appendix K of this manual.

6.3. Calibration Standards

Written calibration procedures are required, where applicable, for all instruments and equipment used in the laboratory. The source and accuracy of standards used for calibration purposes are integral to obtaining quality data. Requirements for calibration are provided in each analytical method including specifications for the standards used. Calibration measurements made by the laboratory must be traceable to national standards of measurement (e.g., NIST) where available. C of As are maintained for each material, as applicable.

Standards are usually purchased from commercial supply houses either as neat compounds or as solutions with certified concentrations. The accuracy and quality of these purchased standards is documented on a C of A and these certificates are maintained on file in the laboratory. Upon receipt at Lancaster Laboratories, material must be labeled with a date of receipt and stored appropriately.

Most solutions and all neat materials require subsequent dilution to an appropriate working range. Records of all standard preparations include the dilution(s) made and a reference to the original and any intermediate mixtures. Solutions are labeled according to laboratory procedures and assigned unique names or code numbers that provide traceability to the original components and stored appropriately. Each new preparation of standard is tested for integrity by comparison to standards from another source or previously prepared solutions. Standards are not to be used in the laboratory past their expiration date.

6.4. Equipment and Instrumentation

The laboratory is equipped with all equipment and instrumentation required for testing the scope of work which it supports. All equipment and instrumentation is maintained in proper working order. A master list of our equipment is maintained by our accounting department and includes the date that the instrument was received and the condition at receipt (new v. used). Our major equipment capabilities are summarized within Appendix F of this manual. In addition, we have numerous other instruments including pH meters and analytical balances along with support equipment such as ovens, incubators, muffle furnaces, centrifuges, etc.

6.4.1. General Requirements

- Equipment/instrumentation is assigned a unique designation. This unique number or system identification is used to track the piece of equipment within data documentation.
- An equipment logbook is established in conjunction with installation and is readily available to document all incidents that pertain to the equipment as they occur.
- All test, measuring, and inspection of laboratory systems, equipment, and instrumentation used at Lancaster Laboratories is routinely calibrated and maintained in accordance with applicable standard operating procedures.
- A member of the technical group, or designated individual, performs routinely scheduled maintenance and calibration of laboratory equipment as required by laboratory procedures. These activities are documented.
- If appropriate standards or expertise for calibration or maintenance are not available in-house, the operation is conducted by an outside service firm. Certificates or other data generated by the service firm are reviewed by applicable Lancaster Laboratories personnel to verify acceptability. This information is maintained on file.
- All equipment taken out of service is tagged "DO NOT USE". The following minimum information is documented:
  - Date taken out of service
  - Employee who took the equipment out of service
  - Reason for tag-out
- The date that the instrument is returned to service, the corrective action taken, and performance checks performed must be documented.

6.4.2 Standard Operating Procedures

Information regarding operation, maintenance, and calibration of equipment and instrumentation are found in respective SOPs. The procedures include a routine schedule for preventive maintenance and calibration as applicable, along with acceptance criteria and remedial action to be taken in the event of failure. These procedures are maintained in the document control system and reviewed on a regular basis to verify they remain current and accurate. Equipment manuals are also available to provide additional information in regard to operation and maintenance.

6.4.3. Maintenance

- Equipment maintenance is performed as either a preventive or corrective operation.
- Preventive maintenance procedures and schedules are developed for each piece of equipment, where applicable. Preventive maintenance operations are performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel). Documentation is maintained for the procedure(s) performed as part of the preventive maintenance operation. It is the responsibility of departmental management to ensure that a preventive maintenance schedule is addressed by a procedure where appropriate and is followed.
- Corrective maintenance is performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel) in response to indications of equipment malfunctions. The unit must be clearly tagged as out of service. All corrective actions taken to bring the unit back into service are documented. After repair, a notation is made in the logbook to note whether the function has been fixed. Calibration activities are performed as applicable, before the instrument is placed back into service.
- A supply of commonly needed replacement parts is maintained by the laboratory.
- A preventive maintenance schedule for major instruments is given in Appendix G. Maintenance of equipment used in microbiological testing is documented in Appendix K of this manual

6.4.4. Calibration

- Calibration is the establishment of, under specified conditions, the relationship between the values/response indicated by a measuring instrument or system and the corresponding known/certified values associated with the standards used. Some types of calibrations are performed with a set frequency (e.g. daily), while others provide intermediate checks to ensure that the instrument response has not changed significantly.
- All measuring and testing equipment having an effect on the accuracy, precision, or validity of calibrations and tests are calibrated and/or verified on an on-going and routine basis. Methods for calibration of instruments and equipment vary widely with the nature of the device and the direction given by analytical procedures, departmental procedures, or manufacturer recommendations. Frequency of calibration can also depend on additional factors including ruggedness of the instrument or equipment and the frequency of use.
- Departmental management is responsible for developing or acquiring written calibration procedures for the types of relevant equipment and instruments employed within their area, as applicable. Procedures address the following aspects: description of the calibration method, frequency/schedule for calibration, acceptance criteria, and corrective actions if failure occurs.

- Calibration information is recorded in a logbook that is associated with the instrument/equipment and/or a calibration certificate is maintained and/or data printouts are generated to document the activity.
- Calibration measurements are traceable to national standards of measurement (e.g., NIST) where available. Physical standards, such as NIST certified weights or thermometers, are re-certified on a routine basis. Calibration certificates are maintained on file, where applicable, to indicate the traceability to national standards of measurement. These physical standards are used for no other purpose than calibration.
- Calibration failures are documented in the logbook for the instrument and/or within the data printouts from the instrument. Management personnel perform an evaluation and review of failures and assess any potential impact the failure might have on previously generated data. Lancaster Laboratories utilizes "real-time" controls to ensure the accuracy of the data. These controls are used to assist in assessing the impact of the situation.
- After repair, adjustments, or relocation that could affect instrument response, calibration/verification activities are performed, as applicable, before the unit is returned to service.
- Analytical data is not reported from instrumentation or equipment that fails to meet calibration requirements.
- A summary of the calibrations for most major equipment is given in Appendix H.
- Procedures for calibration of equipment used in microbiological testing are documented in Appendix K of this *Quality Policy Manual*.

6.5. Computerized Systems and Computer Software

6.5.1. Computer Usage

Lancaster Laboratories provides computer equipment for employees to use as a tool in performing their work. Computer equipment is the property of LLI and used in accordance with defined terms and conditions. Our goal is to provide standard hardware and software that meets the needs of the user. The majority of desktop PCs in use are standardized using cloning software.

6.5.1.1. Physical security of computer systems – It is company policy to protect computer hardware, software and data documentation from misuse, theft, unauthorized access and environmental hazards. The corporate computer area and computer "Hot-Site" is locked and requires identification/building card access. All vendors, contractors, or other visitors must be escorted into this area. Controlled access of the laboratory buildings is outlined in Section 3.2.

6.5.1.2. Passwords – Passwords are important for the security of company data and resources. Lancaster Laboratories' primary network operating system is Windows and each employee must have a user ID and password combination to access the system. Other computer systems within the Environmental Division also require a user ID password combination for access. The following procedures apply regardless of what system(s) is being utilized:

- Passwords must be kept confidential
- Users must log-out of a system when not in use to prevent unauthorized access.
- Forgotten passwords can only be reset by the Computer Systems Department or by an appropriate System Administrator.
- Network passwords automatically expire every 90 days. The computer prompts a user to change the password when the expiration date nears.

6.5.1.3. Computer viruses – Lancaster Laboratories centrally and continuously monitors the computer network for computer viruses. Employees are prohibited from using the company's computer equipment to propagate any virus. Anti-virus software is employed to detect viruses on the Windows network. A notification is sent when there is a particularly dangerous or virulent data destructive program that employees need to be aware of. However, employees are reminded to always be cautious and observant even if there are no current warnings. Employees must report any virus concerns to the anti-virus administrator or Computer Service Management as soon as possible. Employees who share files between their home computer and the laboratory should install anti-virus software on their home computer. If an employee does not have such software, the laboratory can suggest various no-cost anti-virus software products.

6.5.1.4. Internet and e-mail system – The e-mail system is used primarily for Lancaster Laboratories' business purposes. The *Lancaster Laboratories' Personnel Manual* provides additional information in regard to system usage. Employee access to the Internet is restricted to those employees who have a business need for it. All employees have access to e-mail. Access to the internet is configured through a user's Windows network account. All internet and e-mail activity is subject to monitoring. All messages created, sent or received over the internet are the property of LLI and can be regarded as public information. E-mail and website filtering software is utilized.

6.5.1.5. Lancaster Laboratories' Intranet (LabLinks) – The Lancaster Laboratories' Intranet is designed to be a useful tool for employees to acquire company information and to provide a company communication system. The *Lancaster Laboratories' Personnel Manual* provides additional information in regard to usage.

6.5.1.6. Software policy

- Copyright laws protect software, and Lancaster Laboratories' intent is to abide by all software agreements.
- Software purchases must be formally requested and approved by management and/or validation personnel, as necessary.
- All software is used in accordance with applicable license agreements.
- Employees are not to install any software on computer(s) unless authorized by the Computer Systems Department.

- Software upgrades must occur in accordance with applicable change control procedure
- Employees must not give software to outsiders (e.g., clients, contractors), unless approval is granted by management.
- Users must not make copies of any licensed software or related documentation without permission. Any user that illegally reproduces software is subject to civil and criminal penalties including fines and imprisonment.

6.5.1.7. Computer system backup, data restoration, and data archival – Mission critical data is stored on several computers throughout the laboratory. These computers are connected through the local area network. Selected files on these computers are backed up using an enterprise-level backup software program. The objective of this backup is to have the ability to restore data after a total loss (e.g., theft, fire, natural disaster). Procedures are in place to perform data backups and restores.

6.5.1.8. Remote access to computer systems – Employees are able to remotely connect to the laboratory computer systems through an encrypted (SSL) login. When logging in, users are authenticated with their Windows Active Directory account and password.

6.5.2. System and Software Verification – Before a new computer system or significant modification of an existing system is implemented in our laboratory, it is necessary to meet the following documents:

- Requirements documents – Describe the required system functionality and specifications
- Design documents – System overview, screen design, report layout, data description, system configuration, file structure and module design
- Testing documentation for system development/verification – Structural testing of the internal mechanisms and user testing of the installation and system qualification
- Standard operating procedures and/or manuals

6.5.3. CROMERRR – The laboratory has reviewed and evaluated EPA's proposed Cross-Media Electronic Reporting and Record-keeping Rule. We monitor the rules progress; and the laboratory will wait to make any definitive changes in response to the rule until it is clear what direction the agency plans to take and within what timeline. Working with FDA's 21 CFR Part 11 regulation in our Pharmaceutical Division has given the laboratory a head start in understanding the demands of CROMERRR.

6.6. Change Control

Procedures are in place to define how to maintain processes, instrumentation, equipment, computerized systems, and computer software in a validated or controlled state through a plan of change control. Successful changes require a thorough evaluation and testing for potential consequences prior to implementation. Planning, authorizing, testing, and reviewing of proposed changes are documented throughout the change process. Changes are planned or could be made in response to an emergency situation. The following "general" elements apply to changes, as appropriate:

- Request to perform a change
- Evaluation of a change
- Authorization of a change request
- Preparation for an authorized change
- Execution and testing of the change
- Documentation of the change
- Approval of the change
- Change implementation and follow-up (Documentation is required to summarize the change and to reflect the outcome of the change. Formal approval of the change is performed by designated responsible individuals and QA.)

6.7. Labware Cleaning

Dedicated washroom personnel are in place to support the laboratory operations in regard to labware preparation, washing, rinsing, and drying. Labware can include, but is not limited to glassware, plasticware, utensils, and pipettes. Procedures are in place to outline the washing process for each type of labware. Most labware is cleaned using a Miele glass washing machine. Some labware is still washed by hand and either air-dried or dried in specifically designed ovens.

Most of the labware used in the laboratory is "common or non-dedicated" labware (common to a department), but some of the labware used in the laboratory is identified as "dedicated" labware. Dedicated labware is exclusively used for certain analyses. Examples of dedicated labware include glassware used for MBAS and Ortho (acid washed) and "oils" glassware. This labware is isolated and cleaned only with "like" labware.

All glassware is type A and 100% visually inspected for breakage (e.g., cracks, chips), cleanliness, and dryness before being returned to the laboratory for use.

Generally, each test has controls in place to ensure that results were not negatively affected by unclean labware. These controls include blanks to detect positive interferences and controls to detect negative interferences.

7. PURCHASING EQUIPMENT AND SUPPLIES

7.1. Procurement

It is the responsibility of management personnel within each department to ensure that the appropriate supplies are available and/or ordered with sufficient lead-time to perform analytical testing or to provide support to the testing areas. The individual technical departments have trained personnel who enter the supply order into the company's requisition software system. The selection of these products is based on technical input at the analyst level and authorized by technical departmental management. The Purchasing Department maintains an ordering system in which purchase requisitions are managed. Common laboratory items (e.g., beakers, flasks, reagents) are ordered directly through the Purchasing Department. Purchase orders over a specified dollar amount require verification from the appropriate member(s) of the Executive Management Group before an order can be placed.

Upon receipt of an order, the Purchasing Department checks the order to ensure that all items were received as specified. Products that have specific storage requirements are taken to the technical area upon receipt. It is the technical area's responsibility to ensure that the product is stored in the appropriate manner. Any checks on the quality of the materials received for use in a specific test are the responsibility of the laboratory using them. This is based upon the experience of the laboratory with the usability of the product. Generally, each test has controls in place to ensure that test results are not negatively affected by the materials.

Any problems encountered when using a material in the laboratory must be brought to the attention of the Purchasing Department and/or Quality Assurance as applicable, to ensure that follow-up and corrective action occur.

7.2. Supplier Evaluation

Procedures are in place to evaluate vendors who supply us with: new equipment, instrumentation, computerized systems and computer software; commercially purchased glassware, including sample bottleware, reagents, chemicals, solvents, gases, media, and standards; and contracted and subcontracted services.

Lancaster Laboratories strives to ensure our suppliers continually improve their quality systems and we reserve the right to purchase from suppliers of our choice in order to best fulfill the needs of our clients and our business. When directed by a client to purchase from a specific supplier, we will do so. In this instance it is the client's responsibility to "qualify" the specified supplier. We attempt to purchase from businesses that we have an established purchase history or have previously acquired information regarding the supplier's quality programs.

Lancaster Laboratories does not evaluate every supplier. Risk assessment is taken into consideration when making this decision. The risk assessment analysis includes system, material, services, and number of samples or operations the purchase may affect or support. Evaluations are not required for computer operating systems, utilities, toolsets, or systems software. They also are not required for any off-the-shelf configurable software package that has an extensive market performance history (e.g., Microsoft Word, Excel, Access).

Additional quality systems are also in place within the laboratory to further verify and support the materials used:

- C of A for every lot of purchased prepared microbiological media and for purchased chemicals, where available, are reviewed and maintained on file.
- For many chemical analyses (e.g., HPLC, GC, IC) a blank is routinely run which serves as real time suitability testing of the reagent being used.
- Microbiological testing often employs positive and negative controls, which serve as real time control checks.

8. ANALYTICAL METHODS

8.1. Scope of Testing

Samples are analyzed in accordance with client-supplied methodology, official published methods, standard methods, or validated in-house methods. We recognize the importance of providing verifiable results and, therefore, use methods accepted and approved by a broad range of federal and state regulatory agencies. In order to meet the needs of our clients as well as regulatory agencies, the laboratory sometimes needs to support different versions of the same method (i.e. SW-846 8081A and 8081B). The laboratory can also assist in developing and validating analytical methods for specific products and matrices. All methods submitted for our review, as well as all analytical results, are considered confidential.

The laboratory performs a wide variety of environmental testing in support of the Safe Drinking Water Act (SDWA); Clean Water Act (CWA); Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA/Superfund); and the Clean Air Act (CAA). Standard methods approved by ASTM are also used in testing. Potable water, wastewater, soil, sediment, sludge, oils, biota, tissue, soil gas and air are among the matrices typically analyzed.

Our areas of expertise include:

- Gas Chromatography (GC)
- Gas Chromatography/mass spectrometry (GC/MS)
- High Performance Liquid Chromatography (HPLC)
- High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS)
- Liquid Chromatography/mass spectrometry/mass spectrometry (LC/MS/MS)
- Ion Chromatography (IC)
- Purge and Trap
- Selected Ion Monitoring (SIM)
- Atomic absorption spectrophotometry (CVAA)
- Cold vapor atomic fluorescence spectrometer (CVFA)
- Inductively coupled spectrophotometry (ICP)
- Inductively coupled spectrophotometry/mass spectrometry (ICP/MS)
- Autoanalyzer
- UV/VIS spectrophotometry
- Fourier transform spectrophotometry (FTIR)
- TOC Analyzer
- Water Quality and inorganic analysis
- Summa Canister & Tedlar Bag Air analysis
- Microbiology
- Full range of petroleum analysis/UST (including state-specific methods such as AK-101, AK-102, AK-103, CT ETPH, FL PRO, MA VPH, MA EPH, NW-DX/GX, NW-HCID, NY STARS, OA-1&2, QAM 025, TX-1005, TX-1006, WI DNR GRO, WI DNR DRO)
- Method development
- Data Package deliverables
- Electronic data deliverables
- QAPP development
- Consulting services

A list of tests covered under the laboratory's NELAP accreditation can be found in Appendix I. A complete list of the tests routinely performed by the laboratory can be found in the *Schedule of Services*.

8.2. Analytical Test Methods

Each laboratory is required to establish and maintain an analytical methods manual containing current copies of all the methods used for standard testing. The sources for these methods include the most recent versions of these compendia:

- Test Methods for Evaluating Solid Waste, SW-846
- Standard Methods for the Examination of Water and Waste
- Code of Federal Regulations, Chapter 40
- EPA 100 through 600 and 1600 series methods
- Contract Laboratory Program Statement of Work

Most of the test methods used are re-written into a laboratory standard format, which provides consistency in content and allows the analysts to locate the information they need quickly. Procedures are in place to define the format, required approvals, and the control system for these method documents. The format requirements include:

- Uniquely assigned method number, which is used extensively for scheduling and documentation purposes.
- Reference to the original source of the method (e.g. SW-846)
- Scope
- Basic Principles
- Apparatus and Reagents
- Personnel Training and Qualifications
- Safety and Waste Disposal
- Detailed procedure (including any method modifications)
- Calculations
- QA/Quality Control
- Revision Log
- Approval signatures from technical, management, and QA personnel

Analytical methods are maintained as controlled documents to ensure that analysts are always working with the most current version and are reviewed periodically for accuracy.

8.3. Client Supplied Methods

Most of the client-supplied method requirements presented to us involve achieving specific quality control criteria or limits of quantitation using standard EPA methods. These requirements would be communicated to the appropriate technical groups prior to the project start up. Each technical group would evaluate the scope of work and the requirements to assure the criteria can be met using the standard EPA method. They would also monitor the data to assure the criteria are met throughout the project. A client service representative would notify the client if there is a more appropriate method available or if the client's criteria could not be achieved on a certain sample matrix (i.e., due to matrix or dilutions). Occasionally, we are asked to transfer a non-standardized method from a client into our lab or to develop a new method, when one is not available. In the case of a method transfer, we would set up the client's method and perform some initial

evaluation. After the initial evaluation, we may make recommendations on how to improve method performance. If the method appears to be adequate, we would determine linearity, specificity, precision, accuracy, LOD, and LOQ by performing calibrations, analyzing method blanks, and carrying out method detection limit and quad studies. In the case of method development, we would work with the client and/or data user to determine the level of validation required ensuring that the method meets its intended purpose. In addition to the elements above, we also determine standard and sample stability and robustness depending on the scope of the project. Typically, a standard operating procedure would be written and submitted to the client along with the results of the validation. These steps would be completed prior to analysis of field samples. Data related to the set up of the method would be archived at Lancaster Laboratories.

8.4. Method Validation

Before new or revised analytical methods are authorized for routine use in the laboratory, validation data is required to demonstrate that the method and analysts performing it are capable of meeting data quality objectives for precision and accuracy. A procedure is in place to outline this process.

Many methods published by USEPA include instructions for performing an initial demonstration of capability, which typically consist of determining the method detection limit and analyzing fortified samples in quadruplicate. This demonstration is performed and compared to acceptance limits for precision, accuracy, and detection limits, when available.

Methods that do not include specific validation requirements are validated by analyzing fortified samples or standard reference materials in replicate. The results of these analyses are used to assess accuracy and precision. Results of validation studies are documented and subject to review and approval.

8.5. Procedural Deviations

Analysts are required to follow a documented method for all tests performed. Procedures are in place to ensure that deviations from analytical methods are documented, approved, and justified in an appropriate and consistent manner (Note: Deviation from the OH EPA approved SOPs is not permitted). We classify method deviations as either being a planned deviation or an unplanned deviation. "In general," the following information is captured to document both types of situations:

- Description of the deviation
- Reason or justification for the deviation
- Impact the deviation had on the testing
- Signature/date of analyst performing test involved
- Signature/date of LL director approving the deviation
- Signature/date of client approval, if necessary

Deviations to written procedures are documented in raw data notebooks or through the ICAR (Investigation and Corrective Action Report) system. Both types of documentation require management review and approval.

9. INTERNAL QUALITY CONTROL CHECKS

9.1. Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. As required in the procedure on written methods, each analytical method specifies (or cross-references another procedure) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the acceptable range.

The types of QC samples and the information each provides are discussed in the following paragraphs.

Quality control checks used for microbiological tests can be found in Appendix K of this *Quality Policy Manual*.

9.1.1. Blanks - A blank is a designated sample designed to monitor for sample contamination during the analysis process. A volume of deionized laboratory water is typically used to monitor water sample analysis, while solid sample analysis blanks consist of a purified solid matrix or just the reagents used in the test. The blank and field samples are treated with the same reagents, internal standards, and surrogate standards and carried through the entire analytical procedure. Ideally, blanks demonstrate that no artifacts were introduced during the analysis process. The specific acceptance criteria for each test is given in the analytical method and is usually based on the required reporting limit.

9.1.2. Surrogates - Surrogates are organic compounds, which are chemically similar to the analytes of interest, but are not naturally occurring, in environmental samples. When required by the analytical method, surrogates are spiked into all the field and QC samples to monitor analytical efficiency by measuring recovery on an individual sample basis. The percent recovery is determined and compared to the acceptance criteria. Acceptance criteria limits are set as required by the method or based on a statistical determination from laboratory data.

9.1.3. Matrix Spikes - A matrix spike sample is created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. The acceptance criteria are given in the analytical method and limits are set as required by the method or based on a statistical determination from laboratory data.

9.1.4. Laboratory Control Samples - Laboratory control samples (LCS) are samples of known composition that are analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Laboratory fortified blank is another term used to describe a LCS. Percent recovery is calculated and compared to acceptance criteria, which are set as required by the method or based on a statistical determination from laboratory data.

9.1.5. Duplicates and Matrix Spike Duplicates and Laboratory Control Sample Duplicates - A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. To compare the values for each compound, the relative percent difference (RPD) is calculated by dividing the difference between the numbers by their average. Precision for analytes that are not typically found in environmental samples (i.e., organic contaminants) is determined by analyzing a pair of matrix spike duplicates, defined as two spiked samples and comparing the RPD for the spiked compounds. The acceptance criteria are described as a maximum for the RPD value, which are set as required by the method or based on a statistical determination from laboratory data.

9.1.6. Internal Standards - Internal standards are organic compounds, which are chemically similar to the analytes of interest, but are not naturally occurring in environmental samples. When required by the method, internal standards are added to every field and QC sample after extraction but prior to analysis. Comparison of the peak areas of the internal standards is used for quantitation of target analytes. Internal standard peak area and retention time also provide a check for changes in the instrument response. The acceptance criteria is stipulated in the analytical method.

9.1.7. Serial Dilutions - A serial dilution is the dilution of a sample with sufficiently high concentration by a factor of five to check for the influence of interferents. This QC check is performed for inorganics analyzed by ICP or ICP-MS. When corrected by the dilution factor, the diluted sample result must agree with the original sample within specified limits.

9.1.8 Interelement Correction Standard – Analyzed to verify interelement and background correction factors. A solution containing both interfering and analyte elements of known concentration is analyzed at the beginning and end of each analysis run or a minimum of twice per 8 hours.

9.1.9. Second Source Check - A second source check is analyzed using either the LCS and/or an ICV (Initial Calibration Verification). The second source is a standard that is made from a solution or neat purchased from a different vendor than that used for the calibration standards. For some organic custom mixes, the same vendor but a different lot and preparation is used. This ensures that potential problems with a vendor supply would be evident in the analysis. Some areas of the lab use the continuing calibration verification standards as a second source from the initial calibration.

9.2. Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples. A summary is provided in Appendix J. The corrective action required when a QC result fails to meet the acceptance criteria is also given.

The QC acceptance criteria are available to analysts in the laboratory. If the method reference requires the use of specific limits, such as in Contract Laboratory Program methods, the laboratory uses the published limits that are documented as part of the analytical method. Many methods require that each laboratory determine their own acceptance criteria based on statistics from performance of the method. In these cases, the limits are available to the analysts and are entered into the laboratory's computerized QC system described below. Statistically determined acceptance criteria are frequently subject to change as the laboratory recalculates its control limits. Due to their dynamic nature, acceptance criteria are not included in this manual.

The results of all quality control samples are entered into the computer in the same way as the results of client samples. The LIMS compares the individual values with the acceptance limits (statistically determined or method specified) and identifies quality control sample results that are out of specification. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This includes, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a comment stating the observed deviation, and reanalysis of the samples in the batch. In addition, computerized reports on the results for all quality control analyses including mean and standard deviation are generated monthly. These statistical analyses are used by the QA Department to check for trends that indicate method bias.

The laboratory allows for marginal exceedances based on the number of analytes in the LCS. The exceedances are carefully monitored so that any systemic problems would be identified and corrective action taken. If the LCS is being reported based on the marginal exceedance allowance, a comment is printed on the analytical report.

9.3. Quality Control Charts

Quality control results entered into the computer are used to generate control charts that are plotted via computer and can be accessed at any time by all analysts and Quality Assurance. The system charts results from surrogates, matrix spike/matrix spike duplicates, duplicates, and laboratory control samples. These charts provide a graphical method for monitoring precision and bias over time. They can be used to detect quality problems by observation of patterns. The computerized quality control system is used to report QC data to clients and to collect data for assessment of precision and accuracy statistical limits.

9.4. Measurement Uncertainty

(ISO 17025) "All uncertainty components which are of importance in a given situation shall be taken into account using appropriate methods of analysis" (5.4.6.3). This means the laboratory must determine the uncertainty contribution of all steps in the testing process such as equipment, calibration, standards, reagents, preparation, cleanups, etc. Since, in most methods, the laboratory control sample (LCS) goes through the entire process of preparation to analysis; all factors that would contribute to uncertainty is evident through the LCS results. LCSs are performed with every batch of samples where appropriate for the method.

Measurement uncertainty is calculated as two times the standard deviation of the LCS recoveries for the group and date range of data points selected for all applicable methods. This is reported as a percentage.

Tests that do not have LCSs (e.g. TCLP and paint filter test), are evaluated on a case-by-case basis by taking into account the uncertainty of each of the steps taken to perform the test.

Reports for uncertainty are generated and submitted to QA on an annual basis. At this point, it is not necessary to apply or report the uncertainty determination with sample results. When a client requests the measurement uncertainty it is applied by multiplying the determined analyte concentration by the uncertainty percentage.

10. ASSURING QUALITY OF TEST RESULTS

10.1. Data Management

At a minimum, data management is initiated when Lancaster Laboratories receives the samples from the client. More often the process begins with client communication of their needs and requirements for a specific project and/or testing. The client service representatives/project managers are responsible for entering the information in the sample set up function of the LIMS. Upon receipt of the samples the unique tracking number is generated based on this information. At this point, computer technology becomes an integral part of tracking the samples through laboratory operations. The flow of data from the time samples enter the laboratory until the data is reported is summarized in the following table:

Sample and Data Flow

Action	Personnel Involved
Sample received at Lancaster Labs • Unpacked and reconciled against the client paper work or Chain of Custody • SA Documentation log completed	Sample Administration
Sample is entered into sample management system • Lab ID number assigned • Analyses entered • Chain of custody started • Storage location assigned • Electronic record of sample number • Labels generated • Acknowledgement printed (record of samples received and analysis entered)	Sample Administration
Sample stored in assigned location (refrigerator, freezer, etc) • Electronic record of sample #, bottle code, and location	Sample Support
Acknowledgment sent to client	Sample Administration
Sample removed from storage for analysis • Electronic requisition of sample number by bottle code • Necessary aliquot taken • Sample returned to storage	Technical Personnel
Analysis is performed according to selected analytical method • Raw data recorded • Reviewed • Transferred to computer by chemist or technician* (This is tracked by the unique sample number and batch number.)	Technical Personnel
Computer performs calculations as programmed according to methods	Data Processing
Second chemist or supervisor verifies raw data	Technical Personnel
Generation/signing of reports	Billing and Reporting Group, technical report signers
Data package deliverables are assembled	Data Package Group
Electronic Data Deliverables (EDDs) are generated	EDD Group
Data packages are reviewed prior to sending to client	QA, Data Package Personnel, and Laboratory Management
Data packages are scanned Hard copy of batch raw data is archived Electronic files are backed up and archived	Data Package Personnel, Office Services

*Analyses requiring the chemist's interpretation may involve manual data reduction before entry into the computer.

10.2. Data Documentation

Analytical data generated in the laboratory is collected on printouts from the instruments or associated data system or is manually documented in bound notebooks. Analysts review data as it is generated to determine that the instruments/systems are performing within specifications. If any problems are observed during an analytical run or the testing process, corrective action is taken and documented.

Procedures are in place to ensure that all data is traceable, authentic, and complete. The following general requirements outline our system for notebook, logbook, and documentation recording:

- Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task
- Entries are legible, signed, and dated
- Errors are corrected in a manner that does not obliterate the original entry, initialed and dated
- Blank pages or substantial portions of pages which are left blank are crossed-out to eliminate the possibility of data entry at a later date
- Notebook pages and instrument printouts are signed/dated to indicate second party data review
- At periodic intervals a supervisor or data reviewer checks equipment/instrument logbook entries and temperature recordings for completeness, legibility, and conformance to procedures.
- At a minimum, the following information is recorded as part of data documentation:
  - Date of analysis/operation
  - Signature/date of analyst performing test/operation
  - Identification of client sample(s) and material(s) analyzed
  - Materials, reagents, standards used to perform the testing/operation
  - Method used to perform testing/operation (including version number and/or effective date)
  - Equipment/instrumentation used to perform testing/operation
  - Calculations and how they were derived
  - Departures, planned or unplanned, from the analytical method
  - Signature/date of person reviewing data documentation
- For computer generated data, the following information is recorded:
  - Sample(s) analyzed/operations performed
  - Date of analysis/operation
  - Unique instrument identification
  - Name/date of person operating the instrument
  - Name/date of person reviewing data
  - Any manual notations or interpretations made on instrument printouts are signed, dated, and reviewed

10.3. Data Calculations

Most instruments either include or are connected to a data system programmed to perform calculations needed to reduce the raw data to a reportable form. All calculations are maintained in the instrument manuals and/or as part of the analytical method.

In many cases, the data from the local instrument system are uploaded directly to the laboratory information management system for review and reporting. This direct upload eliminates the need to retype data and an associated source of transcription errors from the analytical scheme.

Some instruments report data that require application of additional factors before the data is in final form. For example, an extract concentration may be reported by the instrumental data system, but additional dilution and preparation factors may be needed before the result represents the concentration of analyte in the sample. Analysts input these additional factors into the laboratory sample management system, where final calculations are performed.

Analysts type manually collected data, such as pH and titration data, into the laboratory sample management system, which is programmed to perform calculations for final reporting. Documentation of the programming for each calculation performed by the sample management system is maintained.

10.4. Reporting Limits

It is important to ascertain the limit of quantitation that can be achieved by a given method, particularly when the method is commonly used to determine trace levels of analyte. The Environmental Protection Agency has set forth one method for determining method detection limits (MDLs) from which limits of quantitation (LOQs) can be extrapolated which is summarized in a laboratory procedure.

MDLs are verified or determined annually on each instrument and are the basis for the LOQ used in the default reporting format. Because MDLs change each time they are re-evaluated, they are not included in this manual, but are available in each laboratory and available to clients upon request.

The reporting limit used to determine whether a result is significant and reported as detectable is dependent upon agency and client requirements. A variety of formats are available and include use of the MDL, LOQ, method specified limits, and project specific limits. The MDL and LOQ for each analyte are programmed into LIMS for reporting purposes.

10.5. Data Review

Final review and verification of the data is performed by a trained analyst using the sample results and quality control information entered into the laboratory sample management system. A second analyst or supervisor knowledgeable in the test, other than the employee responsible for performing the test, reviews the data. The review includes checks for correct transcription, calculations, passing calibrations, and quality control results that meet acceptance criteria. Any errors identified during this stage are corrected and reviewed with the responsible person.

After determining that all necessary requirements for valid data are met, the reviewer electronically approves the data by changing the status of the data from "complete" to "verified". The computer is programmed with a list of approved reviewers for each test, and the system is password protected to ensure that only qualified individuals verify the data.

10.6. Data Qualification

Data qualifiers are used to provide additional information about the results reported. The most typical use for data qualifiers is for results that fall below the quantitation limit, in the region where it becomes more difficult to distinguish a positive result from the background instrument signal. The data systems used to generate and report results are programmed to flag values in this range as estimates.

Other qualifiers are applied to advise data users of any validation issues associated with the data. The laboratory makes every effort to meet all of the requirements for generation of data. Occasionally, generation of data that does not meet all the method requirements occurs due to sample matrix or other analytical problems. If the test can not be repeated or reanalysis would not yield better quality data, qualified data is reported. Qualifiers can be in the form of comments on the analytical report or flags applied to the results.

10.7. Data Reporting

When all analyses are completed, reviewed and verified, a report is generated. The client receives a copy of the report containing the results of the analysis, plus comments added by the analyst, where necessary. To avoid ambiguity in interpreting results, the reverse side of the client's copy of the report contains an explanation of all symbols and units used in reporting data. Copies of reports and associated supporting raw data are retained in our archives. The report contains the signatures of the people who reviewed the final report. Since each result was previously reviewed, the final report review provides a last look for obvious typographical errors and ensures that the results are consistent with each other. Personnel responsible to review and sign reports are noted in the key personnel list provided in Appendix C.

Lancaster Laboratories offers a variety of data levels and formats, from a basic report of results only, to a comprehensive data package of quality control information and raw data. The client and any agency involved direct the selection of report type. A summary of report formats and data packages types is provided in the laboratory *Schedule of Services*. Various electronic formats are also available formatted to client-specified file structure and sent via e-mail, direct upload, web-site access (LLabWeb), or common courier.

Client confidentiality of LLabWeb data is ensured by the use of a secured firewall internet environment coupled with the use of a user ID and password to gain login access to the system. User accounts are configured to only allow access to specific data associated with the user's Lancaster Laboratories business account number.

Amendments to a final report after issue are in the form of an additional document or data transfer and will include a reference to the original report. When a completely new final report is required, it is uniquely identified and includes a reference to the original report it replaces. A letter is sent with each revised report that clearly identifies the reason for the revision.

10.7.1. Reporting the Results

Analytical reports are printed with a cover page that summarizes all samples in that group. This page lists the Lancaster Laboratories' assigned sample number and the corresponding client description. The cover page identifies the laboratory contact person's name and phone number if there is a question about the report. Within this package, each page is uniquely identified and paginated. Analytical test results for methods listed on the laboratories' accreditation scope meet all requirements of NELAP accreditation and ISO 17025 unless noted otherwise. Ohio EPA VAP requires that a signed, notarized affidavit accompany each analytical report.

10.8. Data Storage, Security, and Archival

Lancaster Laboratories has documented procedures and instructions for the identification, collection, access, indexing, filing, storage, maintenance, and disposition of data records. Records are in the form of hard-copy paper records, electronic data files, magnetic tape, and CD-ROMs.

Data records are legible and identifiable to the samples or operations to which they apply. Lancaster Laboratories maintains records to demonstrate conformance to specified requirements and the effective operation of the quality system. Records are stored and maintained in such a way that they are readily retrievable in facilities that provide a suitable environment to minimize deterioration or damage and to prevent loss. Retention time for records is in accordance with specific procedures or instructions. At the end of Lancaster Laboratories defined archival period, the client is notified if requested and asked to provide the laboratory with instruction regarding whether the data on file are to be disposed of or whether the documentation is to be returned to the client.

If specified in client contract(s), archived records are transferred according to their instructions in the event of a change in laboratory ownership or if the laboratory go out of business. If not specified by the client, the sale agreement must require that archived records be maintained as scheduled by the new owners. In the case of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed.

The laboratory maintains all documentation which is necessary for historical reconstruction of data.

- Analysis reports
- Data notebooks
- Data logbooks
- Instrument printouts
- Correspondence and client files
- Instrument and equipment logbooks
- QA records
- Corporate documents
- Electronic records

11. AUDITS AND INSPECTIONS

11.1. Internal Quality Assurance Audits

The QA Department, which is independent of laboratory activities, performs routine and on-going system, traceability, and observation audits to objectively review current systems, operations, and procedures as well as automated data integrity audits of electronic data records. The goal of the audits is to ensure that the quality system activities are effective and in compliance with regulatory, including NELAP and ISO 17025, as well as internal policies and procedures. Audits are documented and tracked in a QA database.

Audits are scheduled and conducted following a predefined schedule, based on criticality of operation and prior audit results, with the goal of evaluating systems and technologies across the operation. If warranted, additional audits are performed to follow up on promised corrective action or areas of concern.

Results of an audit are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an audit.

Audit reports and responses are circulated to Management to communicate the outcome of the audit and the proposed plan(s) for corrective action, if warranted. If any of the audit findings cast doubt on the validity of the results, the clients must be notified within three business days of the investigation.

All records maintained as part of an audit are kept on file.

On an annual basis, an audit of the QA Department is performed as directed by the company Chairman of the Board. The auditors assigned to carry out this operation are qualified staff members independent of the QA Department.

The specific content and findings of internal audits are not shared with clients.

11.2. Review of the Quality Assurance Program

All levels of management are continually updated on the status of quality and compliance by circulation of pertinent documents. Management review is documented by signatures on the route list, along with any comments or request for additional follow-up. The types of documents circulated real-time include:

- Internal, client, and agency audit reports
- Plans for corrective action
- Proficiency test results
- Investigation and corrective action reports
- Monthly and quarterly QA status reports

Executive management reviews the elements of the total QA program on an annual basis to ensure its continuing suitability and effectiveness in meeting the stated objectives outlined in Section 2.4 of this manual. The evaluation entails review of reports to management, all audit findings, client complaints, laboratory investigations, staff adequacy and training, and projected

growth in workload. Patterns or trends in any of these areas are reviewed as a means to continually improve the quality system. This review also includes an evaluation of any audit

findings resulting from the audit of the QA Department. At the conclusion of this quality system review, executive management determines the need to introduce changes or improvements into the quality systems at Lancaster Laboratories. The minutes from the meeting and any recommendations for improvement are documented and a copy is forwarded to the QAU for review and follow-up.

11.3. Good Laboratory Practice Critical Phase Inspections

Any project that is subject to Good Laboratory Practice (GLP) regulations is audited by the QA Department at intervals adequate to ensure the integrity of the study, as required by the regulations. Inspections of a GLP project include direct observation of analysts as they perform various phases of the study. Documentation is reviewed as part of the inspection. The purpose of this type of audit is to ensure that there are no deviations from written methods, procedures, or study protocols.

Results of inspections are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an inspection. Inspection reports and responses are circulated to applicable Lancaster Laboratories management and an off-site study director, as applicable, to communicate the outcome of the inspection and the proposed plan(s) for corrective action, if warranted.

All records maintained as part of an inspection are kept on file.

11.4. Client Audits

Because clients place great importance on compliance with applicable regulations, data quality, and project requirements, they may audit our facility as assurance that their objectives are being met. QA, Project Management, and the analytical laboratories play a key role in these audits. Visits by clients can range anywhere from a tour (to verify laboratory facilities and instrumentation) to an intensive inspection of technical operations, procedures, regulatory compliance, and/or review of specific project(s).

- Audits are scheduled directly with the Environmental Project Management Group or QA. The request to audit is communicated to all applicable laboratory departments.
- In accordance with our policy on client confidentiality, a client is permitted to review only data and results that apply to their work, or which have been approved by Lancaster Laboratories' personnel.
- An escort (Lancaster Laboratories' employee) remains with an auditor at all times.

The following responsibilities are assigned to the following groups in regard to client audits:

11.4.1. QA Department

- Research previous audit reports and laboratory responses to past deficiencies.

- Follows-up with the applicable analytical laboratory areas to ensure follow-up items were completed from the last audit, as necessary.
- Function as an escort during the audit
- Answer questions the auditor has in regard to laboratory and quality systems.
- Take notes of areas where corrective action or suggestions are recommended during the audit.
- Communicate audit issues to management at the completion of the audit.
- Respond to client audit reports.
- Ensure follow-up to cited items are performed in a timely manner.

11.4.2. Project Management

- Work with client to set audit agenda.
- Gather and organize relevant information (e.g., client correspondences, analysis/project requests, copies of analytical data from archives).
- Be knowledgeable about client-specific project requirements and issues.
- Function as an escort during the audit.
- Communicate issues/problems to appropriate personnel.

11.4.3. Laboratories

- Gather and organize laboratory data and documentation in preparation for client review.
- Assure corrective action was implemented from past audit findings, if necessary.
- Be prepared to discuss project data/testing results during the audit.
- Be familiar with client-specific project requirements and be prepared to answer client questions.
- Be familiar with the location of routine laboratory information and equipment (e.g., SOPs, data notebooks, calibration data, etc.).
- Be prepared to answer specific technical questions in regards to laboratory procedures and instrumentation within the area.
- Functions as an audit escort within the department during the audit.

11.5. Agency Inspections

It is Lancaster Laboratories' policy to cooperate to the fullest extent and maintain cordial relations with all government agencies. The QA Department is assigned the responsibility of hosting and working with agency representatives. Their role includes, escorting the investigator(s); ensuring all questions are answered, promptly and accurately; making note of all unresolved issues; informing management of the audit status and outcome; responding to the audit report and ensuring that appropriate corrective action is completed.

Inspections can be performed by investigators or auditors from the FDA, DEA, United States Department of Agriculture (USDA), EPA, states, third-party accreditors (A2LA), or other regulatory agencies outside of the United States.

Government agencies have the right to investigate and inspect Lancaster Laboratories during normal business hours and permission to inspect is granted by Executive Management.

Clients are notified if their data or projects are being reviewed as part of an agency inspection.

Designated members of the QA Department are primary contacts for announced inspections. The QA Director is the primary contact for all unannounced agency inspections. If the QA Director is unavailable, the Chairman of the Board is notified, in addition to a designated member of the QA Department. The QA Director, or their designee, must obtain evidence of the investigator's authority either in the form of a letter or examination/explanation of credentials.

Inspections include the examination of records or the inspection of facilities. Investigators are usually concerned only with the records relating to their responsibilities. As a general rule, they are given copies of records and documents, if requested. All copied records taken by an investigator must be stamped as being confidential material. Lancaster Laboratories must make and keep duplicate copies of all items taken by an investigator.

Investigators must be escorted through the laboratory. The laboratory is not obligated to show an investigator the following types of information: sales, financial or pricing information, or any personnel data other than training or qualification documentation. On a case-by-case basis, internal QA audit reports and investigation reports that address internal problems, are made available for agency review. Investigators can not use recording devices and photographs must not be taken. Any questions or doubts about a request made by an investigator in regard to recording devices or photographs must be reviewed with legal counsel.

Lancaster Laboratories' personnel are not permitted to sign affidavits. If an affidavit is presented during an inspection, all personnel are directed not to sign it, read it, nor listen to it being read. The only document that is acceptable to sign is an acknowledgement that an inspection report has been received. If there is any doubt as to what should be signed, legal counsel must be consulted.

11.6. Proficiency Testing

Many of the organizations that certify our laboratory to perform various analyses require proof of our competency. Laboratory performance is checked regularly by participation in a variety of proficiency testing programs. When available, blind samples are obtained from vendors that are accredited to provide PT samples for NELAP for all test and matrices routinely tested in the Environmental Division at Lancaster Laboratories. In addition, some individual certification programs require analysis of specific sets of proficiency samples, and the laboratory also chooses to participate in a double blind program.

Generally, the proficiency test programs consist of samples or ampulated spiking solutions used to fortify laboratory water samples. Some studies provide spiked air and soil samples. The laboratories analyze the samples in the same manner as a client sample and the data is sent to the agency or vendor for evaluation. After the study results are returned to the laboratory, any data falling outside the acceptance criteria is investigated and corrective action is implemented, if needed. Results are circulated to management and communicated to the analyst. No proficiency testing samples or portion of a proficiency test sample are sent to another laboratory for analysis.

Double blind samples are submitted to the laboratories by the Client Services Department using a fictitious client name so that the analysts are not aware that the samples are proficiency tests. The samples are submitted quarterly with the scope of testing alternating between organic and inorganic tests. The acceptance criteria for these double blind samples are developed statistically using data from participating laboratories, providing a source of inter-laboratory comparison. Results are reviewed and investigated as needed and circulated to management.

If a trend in PT failures is identified, additional blind samples are ordered for that specific test as corrective action.

Clients routinely submit blind and double blind samples to evaluate the laboratory's performance. If a report is issued to the laboratory, it is handled in the same manner as a scheduled PT study evaluation and follow-up.

12. CORRECTIVE AND PREVENTIVE ACTION

12.1. Laboratory Investigations and Corrective Action

Due to the technical nature of laboratory work and the encompassing nature of our QA program, a wide variety of laboratory issues can require investigations, documentation, and corrective action. Prompt investigation and implementation of corrective action ensure that only data of known quality are reported and prevent the reoccurrence of errors. The following list provides "examples" of the type of issues that warrant investigation:

- Out-of-specification QC results
- Failed performance evaluation samples
- Reporting incorrect results
- Contamination issues
- Client technical complaints
- Procedural errors
- Missed holding times
- Systematic problems that compromise the accuracy or compliance of the data generated
- Problems with instrumentation and equipment which could compromise the data generated

Depending on the situation, system, and severity of the issue, Lancaster Laboratories uses a number of procedures to investigate laboratory problems. A "common" investigation and documentation format, which is outlined below, applies to each of the various types of investigations that need to be performed:

- Identification of the problem
- Steps taken to investigate the problem
- Explanation of probable cause(s) of the problem
- Steps taken to prevent future occurrence
- Determination of samples or systems affected by the problem

Management is informed of problem situations and the QA Department tracks documentation and the status of the investigation activities. The goal is to identify root cause, have the corrective action implemented promptly, and to the degree appropriate for the magnitude and risk of the problem. Corrective action issues are subject to follow up by the QA Department. Tracking and trending of laboratory issues is performed by the QA Department and reported to management on a monthly and quarterly basis.

12.2. Investigation Processes

All results from quality control (QC) samples are logged into the computerized quality control system, which is programmed to alert analysts to unacceptable results. Analysts are required to review the results and determine the source of the problem. The source of the problem and proposed corrective action must be documented. Corrective action may include, but is not limited to, re-analysis, re-extraction or re-digestion, instrument maintenance, or re-calibration. If these actions do not yield compliant data within the required hold time, a Nonconformance Form is initiated to document actions and communication with the client. The original form is archived with the associated raw data. Nonconformance Forms are reviewed by the technical department's management, or designee. A copy of the form is reviewed by QA.

Missed holding times are investigated and documented according to a procedure specific to this issue. A standard form is used for documenting this type of incident and signed by a representative of all areas involved, in addition to management and QA. Clients are informed of any problems involving holding time.

Other types of problems having the potential for impact on the quality of data are investigated and documented using a form titled Investigation and Corrective Action Report (ICAR). This process was developed to ensure that laboratory problems are investigated, documented, and corrective action is put into place to prevent reoccurrence. Any employee can initiate an ICAR to document a laboratory problem. Once initiated, the QA Department is notified to assign a unique tracking number and the due date for the investigation. The QA Department reviews and approves the completed ICAR then monitors the corrective action.

If a laboratory error is identified from the outcome of the investigation that impacts client data, the client must be immediately notified in writing of the situation. If the root cause of the problem has affected any other client sample results, all affected clients are notified immediately of the problem.

12.3. Client Feedback

Lancaster Laboratories is in the business of providing high quality analytical testing services. The data that we supply to our clients must be technically complete, accurate, and compliant with applicable regulations. Complaints can be received via letter, phone call, fax, e-mail, or face-to-face meeting.

When a complaint is received, it is our responsibility to determine, to the best of our ability, the extent of the issues and what data is in question. The person receiving the complaint documents this information and promptly forwards it to the appropriate management personnel where the work in question was performed. If a transcription or calculation error is discovered, the final report and/or data must be regenerated with the correct value(s).

The Client Service Representative is responsible for entering client concerns into the LIMS and an automated summary report is sent to QA weekly for review. In many cases, an investigation is initiated to address and document the situation.

On an annual basis, the Client Services and Business Development Groups send a client satisfaction survey to all clients. The results of these surveys are compiled and used to identify areas of improvement for the laboratory.

12.4. Preventive Actions

Various training courses are provided to all employees to assist with building quality and efficiency into their daily jobs. They stress a proactive approach/environment to problem solving and to review quality systems and operational efficiencies.

- "Making Quality a Science" is an introductory TQM course required for all employees to teach why quality is important and to explain the Lancaster Laboratories' quality philosophy and processes, and how to apply quality thinking and techniques on the job. Topics discussed include: communication, teamwork, serving the client, measurement, quality tools, and continuous process improvement. To foster continuous improvements of laboratory systems, MOS process improvement teams are formed, as needed, if an employee needs help in solving a problem or addressing an issue. The goal of these groups is to have representation from various areas of the laboratory work together to look at a problem, evaluate the need for a temporary fix, brainstorm root causes, plan process improvement, implement the process improvement, evaluate and follow-up to the corrective action.

- "Putting our Values to Work" is a seminar required for all employees to teach the Lancaster Laboratories Statement of Values by examining how it translates to our everyday jobs and ethical decision making. Topics discussed include: Statement of Values, ethical paradigms, and ethical decision making. Mandatory ethics training refresher seminars are offered on an annual basis.

  Lancaster Laboratories has an Ethics Committee that meets on a regular basis to discuss and handle ethical issues or situations that cause concern or make employees feel uncomfortable. The mission of this group is to promote sharing of concerns on ethical issues; encourage and maintain commitment among employees to our core ethical values; and to maintain an environment that ensures open access to committee members and all levels of management and the confidential handling of ethical issues.

- The laboratory also utilizes a formal program to encourage preventive action called, Practical Process Improvement (PPI). PPI embodies three principles: logical simplicity, practical methods & tools, and involve everyone. Using proven hands-on methodology, teams of employees learn the tools and immediately apply them to a real business problem in their functional area. Measurable results are key to process improvement therefore, the teams collect data, analyze it to find a solution, and then test the results, using metrics. Once the solution has been proven effective, the team implements it and then monitors the solution to ensure that the results are sustained.

- The Quality Assurance Group prepares monthly and quarterly program status reports for management. The reports include a variety of metrics and graphs which are used to evaluate trends in laboratory performance across all quality and compliance areas. Management responds to any negative trends by developing a corrective action plan.

- Employees are encouraged to communicate to their supervisor area(s) or operation(s) they feel could be streamlined, make their job easier, would provide a quality improvement, or could provide a cost savings to the company.

13. SERVICE TO CLIENTS

13.1. Service to Clients

We value our client relationships and support these partnerships through the following principles:

- Honesty and Fairness – Our corporate culture is founded on the principles of professionalism and high ethical standards in dealing with our clients. This may mean declining to provide the service requested (if we are convinced that to do so would be meaningless) or it may mean referring clients outside of our Lab if we believe that another company can better meet their needs.

- Complete Service – We will give our clients full value on every service provided. We will provide detailed information on our methods, procedures, and QA programs if requested, and take a personal interest and initiative in helping solve our client's problems within the area of our professional expertise.

- Trustworthiness – All data and information developed for a client will be held confidential and not disclosed to a third party except on written request of the client. If information is subpoenaed, we must, by law, release it, but the client will be informed of the release.

- Commitment to Quality – We constantly strive to improve our service in quality, flexibility, and dependability, to keep our competitive edge. We will achieve this through: meeting the requirements of those we serve, staying apprised of regulatory and industry expectations, and providing prompt responses to client concerns.

- Basics of Superlative Service – Our focus is on our client's success. Through proactive collaborative communication, our leadership ensures we understand our client's expectations and strives to exceed them. We foster a service culture in our training, reward and recognition, and performance management process so each employee takes ownership to deliver superlative service to our clients. Feedback from clients, whether positive or negative, is an important part of our continuous improvement system. Ways in which feedback is gathered can include, but is not limited to: customer satisfaction surveys, client audits, and the customer complaint system, which is described within section 12.3.

We also view our fellow employees as our clients since they frequently receive the results of our labor. Meeting the requirements of the next employee in the workflow process is just as important as meeting the needs of an external client.

13.2. Review of Work Requests, Tenders, and Contracts

Lancaster Laboratories places great importance on understanding client requirements for a project. We ensure, to the best of our ability, that client/project requirements are identified, including accreditations held by the laboratory, inconsistencies clarified, and nonstandard work requests are discussed and addressed with both the client and the technical laboratories before the project is accepted and samples arrive. This can be achieved in various ways, including the review of analytical methods, protocols, business contracts, and quality agreements. Project kick-off meetings can also be arranged through the Business Development and/or the Environmental Project Management Group. These meetings allow the client and key technical personnel to discuss project issues and requirements prior to project initiation.

A key client contact is assigned to oversee the project and review all results in a timely manner. Communication between the client and LL technical staff is available and is coordinated through the Environmental Project Management Group.

As a project continues, the Environmental Project Management Group provides continuous communication and status reports about the project to the client. This group relays any project changes or modifications to the technical groups. They also relay issues encountered by the technical laboratories back to the client.

13.3. Timely Delivery

Evaluating laboratory capacity and ability to perform specific projects is a joint responsibility between the Technical Director , Business Development, and the laboratory managers. We recognize that one of the most important aspects of the service we offer is turnaround time.

Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in the laboratory area creating operation flexibility for routine work. Larger projects are reviewed against capacity estimates before bids are submitted to ensure that the client's schedule is met. Turnaround time is continually measured.

Regularly scheduled meetings are held with senior management, technical and support management, and project management personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Management receives a daily report of the status of all samples in the lab, including a printout of those with priority status or those that have exceeded a preset turnaround time. This is of inestimable value in planning and organizing the workload through efficient scheduling.

Any changes to the established timeline by the client or the laboratory must be communicated to the client or laboratory as soon as possible. Upon communication of changes, a new timeline is established and agreed upon by both parties. If a client requires a change in the scope of the project (e.g., number of samples submitted, change in analyses, revised protocol) the laboratory must be informed in writing and a new timeline and cost estimate is be provided.

Verified results are available by phone, fax, diskette, direct access (modem and password), or hardcopy report.

13.4. Subcontracting

Occasionally, Lancaster Laboratories subcontracts tests to other laboratories if the requested testing is not routinely performed in our laboratory or when backlog is high. Testing is only subcontracted with the client's knowledge and approval. Subcontract laboratories are selected based on their qualifications and review of their QA information. If tests require a specific agency certification, only another appropriately certified laboratory must be used.

Data obtained from subcontract laboratories is clearly marked as such when reported by Lancaster Laboratories.

13.5. Use of NELAP and A2LA logo

It is not laboratory policy to use these logos on any company letterhead, including analytical reports.

Lancaster Laboratories

Environmental Quality Policy Manual

Appendix A
Procedure Cross Reference List

Current as of October 05, 2011
5 Total Pages (including this coversheet)

Procedure Cross Reference List

Section #	Title	Procedure(s)
1	Introduction	
1.1.	Vision Statement	Personnel Manual
1.2.	Mission Statement	Personnel Manual
1.3.	Quality Policy	Personnel Manual
1.4.	Statement of Values	Personnel Manual
1.6.	Certifications, Accreditations, and Registrations	Form 2528
2	Organization and Personnel	
2.2.	Organizational Structure	Organization Charts
2.3.	Management Responsibilities	PMDs (Performance Management & Development)
2.4.	Overview of the Quality Assurance Program	SOP-QC-024
2.5.	Quality Assurance Responsibilities	SOP-QC-024 "QC" SOP Series
2.6.	Communication of Quality Issues to Management	SOP-QC-022 SOP-QC-025
2.7.	Personnel Qualifications and Responsibilities	LOM-SOP-LAB-231 PMDs Task Specific Training
2.8.	Relationship of Functional Groups and the Quality Assurance Program	Quality Orientation "QC" SOP series TQM Training PMDs
2.9.	Balancing Laboratory Capacity and Workload	PMDs
2.10.	Identification of Approved Signatories	LOM-SOP-ES-218
2.11.	Personnel Training	LOM-SOP-LAB-231 PMDs Task Specific Training
2.12.	Regulatory Training	LOM-SOP-LAB-204
2.13.	Employee Safety	Analytical Methods Chemical Hygiene Plan Policy #0010 "EHS"/"HS" SOP Series
2.14.	Client Services/Project Management Responsibilities	"CL" SOP Series
2.15	Confidentiality	Personnel Manual LOM-SOP-LAB-205 SOP-QC-010 SOP-CL-005
2.16.	Business Conduct	Personnel Manual
2.17.	Operational Integrity	Policy #0001 Policy #0007 LOM-SOP-LAB-226 LOM-SOP-ES-232
3	Buildings and Facilities	
3.1.	Facility	Floor Plans
3.2.	Security	LOM-SOP-LAB-212
3.3.	Disaster Recovery	LOM-SOP-HS-212

Section #	Title	Procedure(s)
3.4.	Environmental Monitoring	LOM-SOP-ES-205 LOM-SOP-ES-210
3.5.	Water Systems	LOM-SOP-LAB-214
3.6.	Housekeeping/Cleaning	LOM-SOP-LAB-221
3.7.	Insect & Rodent Control	LOM-SOP-LAB-213
3.8.	Emergency Power Supply	LOM-SOP-HS-212
3.9.	Facility Changes	LOM-SOP-LAB-209
4	Document Control	
4.1.	Hierarchy of Internal Operating Procedures	LOM-SOP-LAB-201
4.2.	Document Approval, Issue, Control, and Maintenance	LOM-SOP-LAB-202 LOM-SOP-ES-226
4.3.	Client-Supplied Methods and Documentation	LOM-SOP-ES-221 SOP-QC-030 SOP-CL-007
4.4.	Laboratory Notebooks, Logbooks, and Forms	LOM-SOP-LAB-202 LOM-SOP-LAB-220
5	Sample Handling	
5.1.	Sample Collection	"FS" SOP Series SOP-TR-001 SOP-TR-003
5.2.	Sample Receipt and Entry	"SA" SOP Series
5.3.	Sample Identification and Tracking	"SA" SOP Series
5.4.	Sample Storage	"SS" SOP Series
5.5.	Sample Return/Disposal	LOM-SOP-HS-219 SOP-EHS-006
5.6.	Chain of Custody	LOM-SOP-ES-212
5.7.	Representativeness of Samples	Analytical Methods SOP-SS-009
6	Technical Requirements - Traceability of Measurements	
6.1.	Reagents and Solvents	LOM-SOP-ES-225 Analytical Methods
6.3.	Calibration Standards	LOM-SOP-ES-225 Analytical Methods
6.4.	Equipment and Instrumentation	LOM-SOP-ES-222 LOM-SOP-LAB-208 LOM-SOP-ES-208 Technical SOPs, MCs and OMCs
6.5.	Computerized Systems and Computer Software	LOM-SOP-LAB-206 LOM-SOP-ES-219 SOP-CS-031 Personnel Manual
6.6.	Change Control	LOM-SOP-VAL-205
6.7.	Labware Cleaning	Technical SOPs
7	Purchasing Equipment and Supplies	
7.1	Procurement	LOM-SOP-LAB-218 SOP-PU-005
7.2	Supplier Evaluation	LOM-SOP-LAB-218 LOM-SOP-ES-204
8	Analytical Methods	
8.1.	Scope of Testing	Schedule of Services
8.2.	Analytical Test Methods	LOM-SOP-ES-226

Section #	Title	Procedure(s)
8.3.	Client Supplied Methods	LOM-SOP-ES-221
8.4.	Method Validation	LOM-SOP-ES-226
8.5.	Procedural Deviations	LOM-SOP-ES-230
9	Internal Quality Control Checks	
9.1.	Laboratory Quality Control Samples and Acceptance Criteria	LOM-SOP-ES-207 LOM-SOP-ES-213 Analytical Methods
9.2.	Quality Control Sample Frequency and Corrective Action	LOM-SOP-ES-209 LOM-SOP-ES-213 Analytical Methods
9.3.	Quality Control Charts	LOM-SOP-ES-213
9.4.	Measurement Uncertainty	LOM-SOP-ES-207
10	Assuring Quality of Test Results	
10.1.	Data Management	LOM-SOP-LAB-220
10.2.	Data Documentation	LOM-SOP-LAB-220 LOM-SOP-ES-224
10.3.	Data Calculations	LOM-SOP-ES-224 Analytical Methods
10.4.	Reporting Limits	LOM-SOP-ES-203
10.5.	Data Review	LOM-SOP-LAB-220 LOM-SOP-ES-218 LOM-SOP-ES-224
10.6.	Data Qualification	LOM-SOP-ES-209
10.7.	Data Reporting	LOM-SOP-ES-218 LOM-SOP-ES-224 LOM-SOP-ES-227
10.8.	Reporting Data from Subcontract Laboratories	LOM-SOP-ES-215
10.9.	Data Storage, Security, and Archival	LOM-SOP-LAB-203
10.10.	Investigation of Nonconforming Work	LOM-SOP-ES-218 LOM-SOP-ES-230 LOM-SOP-ES-231
11	Audits and Inspections	
11.1.	Internal Quality Assurance Audits	SOP-QC-006 SOP-QC-021 SOP-QC-032
11.2.	Review of the Quality Assurance Program	SOP-QC-022 SOP-QC-025
11.3.	Good Laboratory Practice Critical Phase Inspections	SOP-QC-032
11.4.	Client Audits	Personnel Manual SOP-QC-010
11.5.	Agency Inspections	Personnel Manual SOP-QC-008
11.6.	Proficiency Testing	LOM-SOP-ES-216 SOP-QC-003 SOP-QC-007
12	Corrective and Preventive Action	
12.1.	Laboratory Investigations and Corrective Action	LOM-SOP-ES-209 LOM-SOP-ES-230 LOM-SOP-ES-231
12.2.	Investigation Processes	LOM-SOP-ES-223 LOM-SOP-ES-230
12.3.	Client Technical Complaints	LOM-SOP-ES-231

Section #	Title	Procedure(s)
12.4.	Preventive Actions	Corporate Training
13	Service to Clients	
13.1.	Service to Clients	Personnel Manual TQM Training
13.2.	Review of Work Requests, Tenders, and Contracts	SOP-CL-007 SOP-QC-030
13.3.	Timely Delivery	SOP-CL-005 SOP-CL-010 TAT Tracking Report
13.4.	Subcontracting	LOM-SOP-ES-215 SOP-QC-023

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Appendix B
Certifications, Accreditation, Registrations, and Contracts

Current as of October 05, 2011
4 Total Pages (including this coversheet)

NOTE: Current certification status information maintained by QA Department.

Lancaster Laboratories, Inc. • 2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681

Lancaster Laboratories

Certifications, Accreditations, Registrations, and Contracts

Agency	Parameter	Applicable Matrices	Lab ID No. Certificate No.
Federal Programs:			
American Association for Laboratory Accreditation (A2LA)	Various testing technologies in the environmental field using EPA methods, client specific methods, ISO 17025, DoD QSM 4.1	Nonpotable water, solid and hazardous waste, air, tissue and tobacco	0001.01
USDA Quarantine Soil Permit	All	All	S-50452
State Programs:			
State of Alaska, Department of Environmental Conservation	Organics, inorganics, UST analysis	Nonpotable water, solid and hazardous waste	UST-061
State of Arkansas, Department of Environmental Quality	Organics, inorganics	Nonpotable water, solid and hazardous waste	88-0660
State of California, Department of Health ELAP	Organics, inorganics	Potable water, nonpotable water, solid and hazardous waste	2501
State of California, Department of Health NELAC	Dioxin and NDMA	Nonpotable water, solid and hazardous waste	10276CA
State of Colorado, Department of Health	Organics, inorganics	Potable water	None
State of Connecticut, Department of Public Health	Organics, inorganics	Potable water, nonpotable water, solid and hazardous waste	PH-0746
State of Delaware, Health and Social Services	Organics, inorganics, micro	Potable water	None
[3]State of Florida, Department of Health	Organics, inorganics	Potable water, nonpotable water, solid and chemical materials, air and emissions	E87997
[1]State of Illinois, Environmental Protection Agency	Organics, inorganics	Nonpotable water, solid and chemical materials	002445
State of Indiana, Department of Health	Organics, inorganics	Potable water	C-PA-02
State of Iowa, Department of Natural Resources	Organics, inorganics, UST analysis	Nonpotable water, solid and hazardous waste	361
[3]State of Kansas, Department of Health and Environment	Organics, inorganics	Potable water, nonpotable water, solid and chemical materials	E-10151
[4]State of Kentucky, Division of Environmental Services	Organics, inorganics	Potable water	90088
State of Kentucky, Department for Environmental Protection – UST Branch	Organics, inorganics	UST	89
[3]State of Louisiana, Department of Environmental Quality	Organics, inorganics	Nonpotable water, solid and chemical materials, air and emissions	02055
State of Maine, Department of Health and Human Services	Organics, inorganics, micro., UST analysis	Potable, nonpotable water, solid and chemical materials	2010033
State of Maryland, Department of the Environment	Organics, inorganics, micro	Potable water	100
Commonwealth of Massachusetts, Department of Environmental Protection	Organics, inorganics	Potable water, nonpotable water	M-PA009

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Certifications, Accreditations, Registrations, and Contracts

Agency	Parameter	Applicable Matrices	Lab ID No. Certificate No.
State of Michigan, Department of Public Health	Organics, inorganics	Potable water	9930
[1]NELAP Primary AA: Air and Emissions [2]NELAP Primary AA: Potable Water, Nonpotable water, solid and chemical materials [3]NELAP Secondary AA [4]Approval for UST work by A2LA			
State of Montana, Department of Environmental Quality	UST analysis	Nonpotable water, solid and chemical materials	None
[3]State of Nevada, Division of Environmental Protection	Organics, inorganics	Nonpotable water, solid and chemical materials	PA00009007A
[3]State of New Hampshire, Department of Environmental Services	Organics, inorganics	Potable water, nonpotable water, solid and chemical materials	2730
[1,2]State of New Jersey, Department of Environmental Protection (NJDEP)	Organics, inorganics, micro	Potable water, solid and chemical materials, air and emissions (direct accreditation)	PA011
[3]State of New York, Department of Health	Organics, inorganics	Nonpotable water, potable water, solid and chemical materials, air and emissions, Analytical Services Protocol	10670
State of North Carolina, Department of Environment and Natural Resources	Organics, inorganics	Nonpotable water	521
North Carolina, Department of Health and Human Services	Volatile Organic Chemicals	Potable water	42705
State of Ohio, Environmental Protection Agency (Voluntary Action Program)	Organics, inorganics, UST analysis	Nonpotable water, solid and hazardous waste, air and emissions	CL0070
State of Oklahoma, Department of Environmental Quality	Organics, inorganics	Nonpotable water, solid and hazardous waste	9804
[3]State of Oregon, Public Health Laboratory	Organics, inorganics	Nonpotable water, solid and chemical materials, air and emissions	PA200001
[2]Commonwealth of Pennsylvania, Department of Environmental Protection (Bureau of Laboratories)	Organics, inorganics, micro	Potable water, nonpotable water, solid and chemical materials	36-00037
State of Rhode Island, Department of Health Laboratory	Organics, inorganics	Potable water, nonpotable water	None
State of South Carolina, Department of Health and Environmental Control	Organics, inorganics	Potable water, nonpotable water, solid and hazardous waste	89002002
State of Tennessee, Department of Health	Organics, inorganics	Potable water	TN02838
[2]State of Texas, Commission on Environmental Quality	Organics, inorganics	Potable water, nonpotable water, solid and chemical materials, biological tissue (direct accreditation), air and emissions	T104704194-10-04
[3]State of Utah, Department of Health	Organics, inorganics	Nonpotable water, solid and chemical materials	LANC

Lancaster Laboratories

Certifications, Accreditations, Registrations, and Contracts

Agency	Parameter	Applicable Matrices	Lab ID No. Certificate No.
State of Vermont, Department of Health Laboratory	Organics, inorganics	Potable water	VT 38-037
Commonwealth of Virginia, Department of General Services	Organics, inorganics	Potable water	00187
State of Washington, Department of Ecology	Wet chem, metals, organics, inorganics	Nonpotable water, solid and hazardous waste, air and emissions	C574
State of West Virginia, Department of Health	Organics, inorganics	Potable water	9906C
State of West Virginia, Division of Environmental Protection	Organics, inorganics	Nonpotable water	055
State of Wisconsin, Department of Natural Resources	Organics, inorganics	Nonpotable water, solid and hazardous waste	998035660

NOTE: This list accurately reflects the certifications, accreditations, registrations, and contracts held at the time of publication and is subject to change. Check with your account manager on the status of any certification needed for a specific project.

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Lancaster Laboratories

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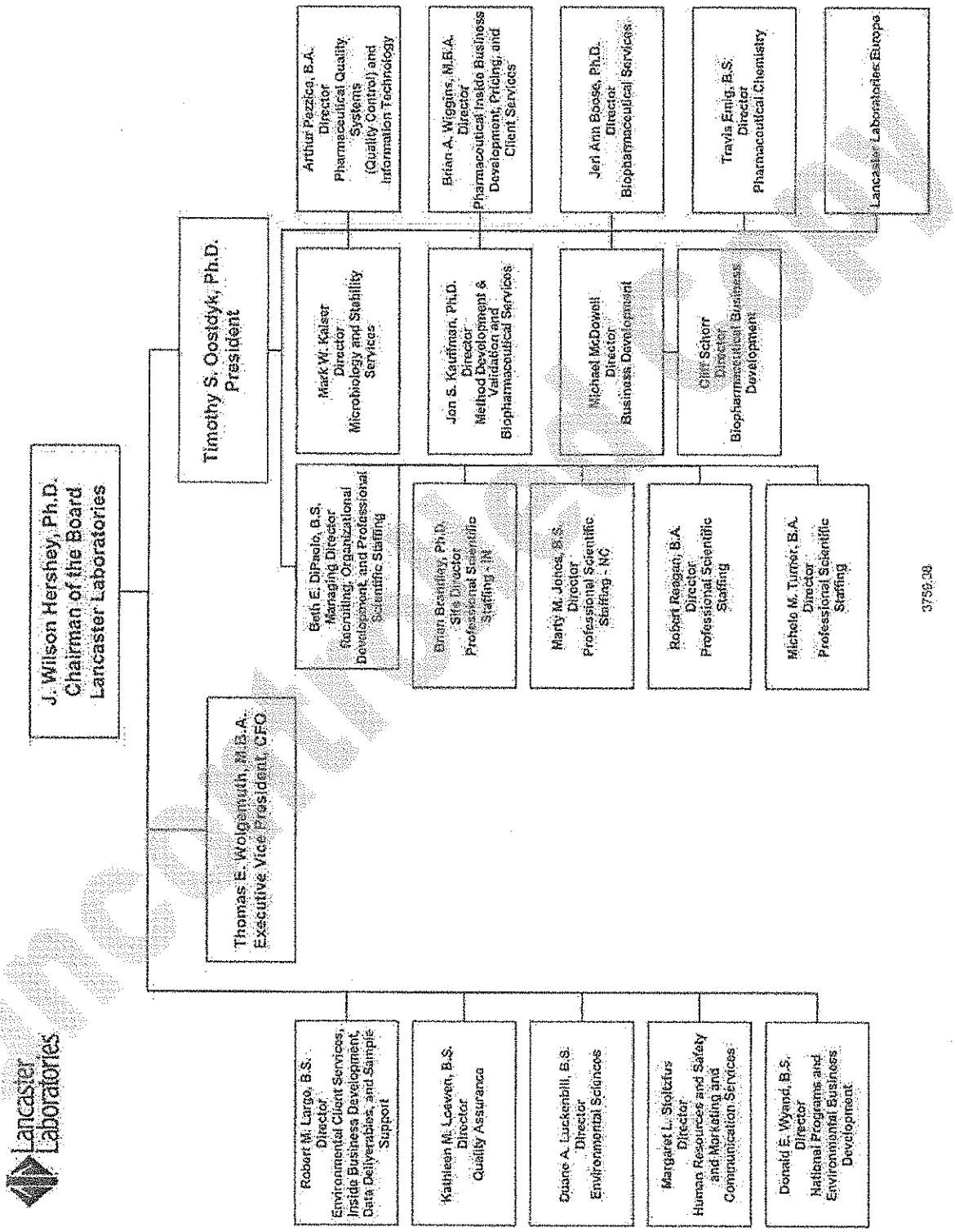
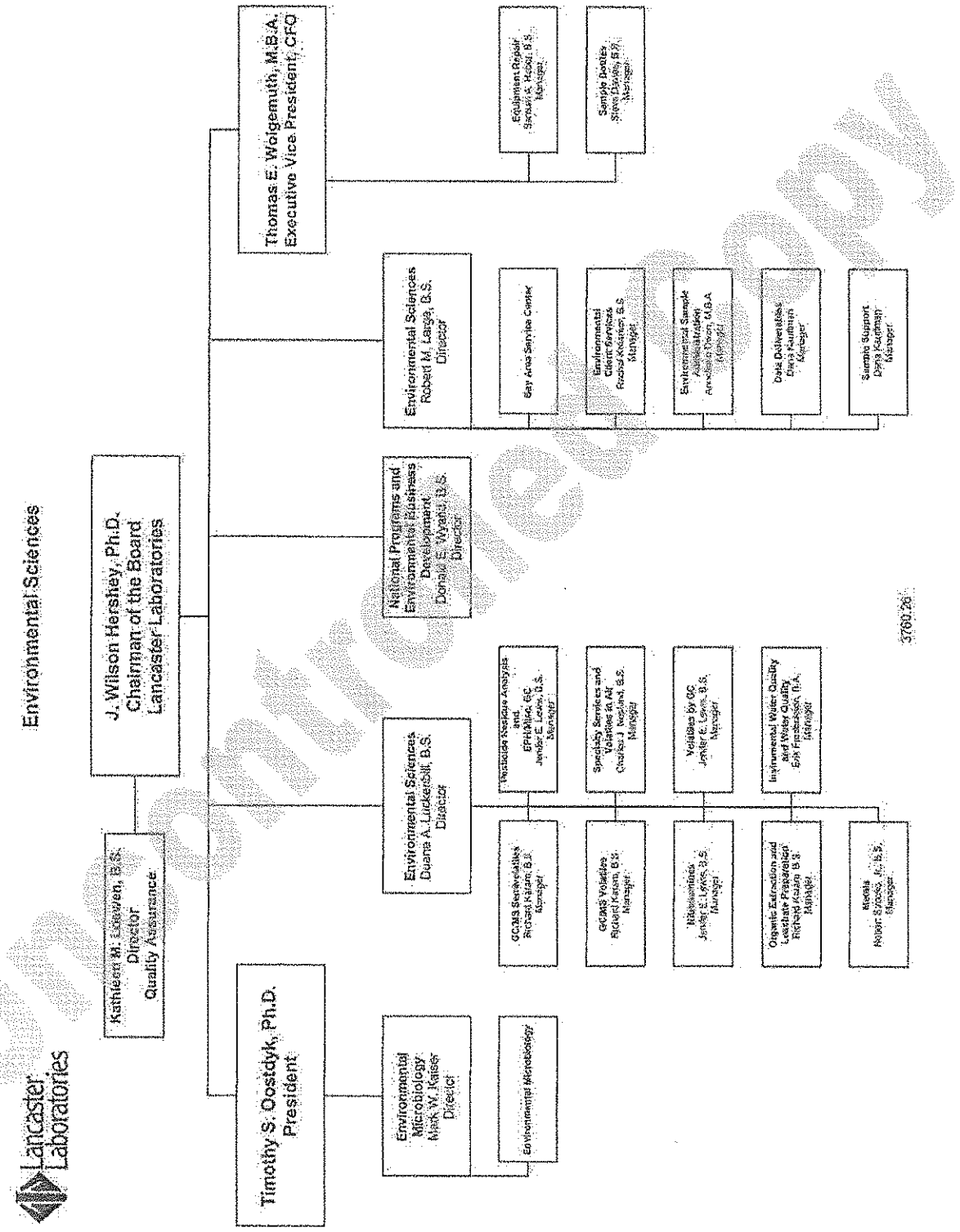
Appendix C
Organizational Charts
Personnel to Sign Reports

Current as of October 05, 2011
12 Total Pages (including this coversheet)

NOTE: Current organizational charts available from Document Control. Current personnel to sign reports available in QA.





Name	Degree	Title
Corporate Services		
J. Wilson Hershey	Ph.D.	Chairman of the Board
Timothy Oostdyk	Ph.D.	President
Quality Assurance		
Kathleen Loewen	B.S.	Quality Assurance Officer
Dorothy Love*	B.S.	Principal Specialist Group Leader
Kathryn Brungard		Senior Specialist
Amy Doupe*	B.S.	Principal Specialist
M. Louise Hess	B.S.	Principal Specialist
Martina Janke	B.S.	Senior Specialist
Laura Judy	B.S.	Principal Specialist
Barbara Reedy*	B.S.	Senior Specialist
Joann Schweitzer	B.A.	Senior Specialist
Gary Siko	M.S.	Principal Specialist
Jill Sproat	B.S.	Senior Specialist
Alicia Staz	B.S.	Senior Specialist
Lee Ulmer	A.A.S.	Senior Specialist
Environmental Sciences		
Donald Wyand	B.S.	Director
Christine Jampo	M.S.	Senior Specialist
Kevin Moran	M.B.A.	Senior Specialist
Client Services/Business Development		
Robert Large	B.S.	Director
Rachel Kreamer	B.S.	Manager
Lynn Frederiksen	B.S.	Principal Specialist Group Leader
Wendy Kozma	B.S.	Principal Specialist Group Leader
Nicole Maljovec	M.S.	Senior Specialist Group Leader
Nancy Bornholm	B.S.	Principal Specialist
Marianne Bragg	B.S.	Principal Specialist
Loran Carter	B.S.	Specialist
Teresa Cunningham	B.S.	Principal Specialist
Irene Dodd	M.S.	Principal Specialist
Katherine Klinefelter	M.S.	Principal Specialist
Natalie Luciano	B.A.	Specialist
Angela Miller	B.S.	Specialist
Megan Moeller	B.S.	Senior Specialist
Jill Parker	B.S.	Senior Specialist
Tara Spaide		Senior Specialist
Barbara Weyandt	M.S.	Specialist
Susan Wike	A.S.	Senior Specialist
Additional support personnel in this group: 1		
Data Deliverables		
Robert Large	B.S.	Director
Dana Kauffman		Manager
F. Bradley Ayars		Senior Specialist Group Leader
Grace Salm		Specialist Group Leader

Name	Degree	Title
Luz Torres		Senior Specialist Group Leader
Jessica Baron		Specialist
Judi Brown		Specialist
Kathy Fair		Specialist
M. Susan Kreider		Senior Specialist
Raymond Longacre		Specialist
Patricia Madrigal-Kauffman	A.S.	Specialist
Audrey McClune		Specialist
Tina McNeil		Specialist
Betsy Menefee	B.S.	Senior Specialist
Sandra Miller		Specialist
Tracy Pang-Ward		Specialist
Nancy Saunders	B.S.	Specialist
Elizabeth Smith	B.S.	Specialist
Lydia Steinke	B.S.	Specialist
Christiane Sweigart	B.S.	Senior Specialist
Michelle Tuel	B.S.	Specialist
Betty Umble		Specialist
Additional support personnel in this group: 6		
Bay Area Service Center		
Robert Large	B.S.	Director
Elizabeth Leonhardt	M.S.	Senior Specialist Group Leader
Additional support personnel in this group: 2		
Environmental Microbiology		
Mark Kaiser		Director
Harolyn Clow	M.S.	Manager
Jeffrey Groff*	B.S.	Microbiologist Group Leader
Hannah Conner	B.S.	Microbiologist
Martha Helwig*	B.S.	Senior Microbiologist
Keith Hoover*	B.S.	Microbiologist
Amy MacKay*	B.S.	Principal Microbiologist
Kimberly Small	B.A.	Senior Microbiologist
Extractable Petroleum Hydrocarbons (EPH)/Miscellaneous GC		
Duane Luckenbill	B.S.	Director
Jenifer Hess*	B.S.	Manager
Robert Brown		Principal Chemist Group Leader
Tracy Cole*		Senior Specialist
Melissa McDermott*	B.A.	Senior Chemist
Dustin Underkoffler	B.S.	Chemist
Heather Williams	B.S.	Senior Chemist
Additional support personnel in this group: 1		
Field Sampling		
Duane Luckenbill	B.S.	Director
Samuel Huber*	B.S.	Manager
Jeffrey Allen		Specialist Group Leader
Timothy Hauck		Specialist

Name	Degree	Title
Flexible Staffing		
Kimberly Davies	M.B.A.	Manager
Andrew Agnew	B.S.	Chemist
Joseph Anderson	B.S.	Senior Chemist
Elizabeth Appleman	B.S.	Scientist
Audrey Baker		Senior Administrator
Catherine Cammauf		Specialist
Barton Conner	B.S.	Senior Chemist
Suzette Lehman		Specialist
Stacie Powroznik	B.S.	Senior Chemist
Douglas Seitz	B.S.	Principal Scientist
Christopher Smith	B.S.	Scientist
Holly Weller	B.S.	Microbiologist
Matthew Woods	B.S.	Chemist
Additional support personnel in this group: 2		
GC/MS Semivolatiles		
Duane Luckenbill	B.S.	Director
Richard Karam*	B.S.	Manager
Rachel Cochis*	B.A.	Senior Specialist Group Leader
Chad Moline*	B.S.	Senior Chemist Group Leader
Matthew Barton*	B.S.	Senior Specialist
Ryan Byrne	B.S.	Senior Chemist
Mark Clark	B.S.	Principal Chemist
Gregory Drahovsky	B.S.	Senior Chemist
Joseph Gambler	B.S.	Senior Chemist
Brian Graham	B.A.	Senior Chemist
Linda Hartenstine	B.A.	Senior Chemist
Mark Ratcliff	B.A.	Senior Specialist
Jennifer Riggs	B.S.	Chemist
Dale Stoneroad	B.S.	Senior Chemist
Andrew Strebel		Principal Chemist
GC/MS Volatiles		
Duane Luckenbill	B.S.	Director
Richard Karam	B.S.	Manager
Kenneth Boley	B.S.	Senior Chemist Group Leader
Susan Goshert*	B.S.	Principal Specialist Group Leader
Roy Mellott	B.S.	Senior Chemist Group Leader
Kathrine Muramatsu	B.S.	Chemist Group Leader
Ryan Nolt	B.S.	Principal Chemist Group Leader
Holly Berry	B.S.	Senior Chemist
Anita Dale		Chemist
Christine Dulaney*	B.S.	Senior Specialist
Chelsea Eastep	B.S.	Chemist
Daniel Heller	B.S.E.	Chemist
Sara Johnson	B.S.	Senior Chemist
Kelly Keller		Chemist

Name	Degree	Title
Laura Krieger	B.S.	Chemist
Kerri Legerlotz	B.S.	Chemist
Jason Long	B.S.	Senior Chemist
Marla Lord*	B.S.	Senior Specialist
Linda Pape	B.A.	Senior Chemist
Kristen Pelliccia	B.S.	Chemist
Nicholas Rossi	B.S.	Chemist
Robin Runkle*	B.S.	Senior Specialist
Stephanie Selis	B.S.	Senior Chemist
Angela Sneeringer	B.S.	Chemist
Kevin Sposito	B.S.	Chemist
Emily Styer	B.S.	Chemist
Lawrence Taylor*	B.S.	Senior Specialist
Lauren Temple	B.S.	Senior Chemist
Abraham Uysal	M.E.	Senior Specialist
Frank Valla, Jr.	M.S.	Chemist
Additional support personnel in this group: 3		
Instrumental Water Quality		
Duane Luckenbill	B.S.	Director
Erik Frederiksen*	B.A.	Manager
Nicole Kepley		Senior Chemist Group Leader
Ashley Adams	B.S.	Chemist
Elyse Brunstetter	B.S.	Chemist
K. Robert Caulfeild-James	M.S.	Chemist
William Hamaker		Chemist
James Mathiot		Chemist
Additional support personnel in this group: 5		
Metals		
Duane Luckenbill	B.S.	Director
Robert Strocko*	B.S.	Manager
Debra Bryan		Specialist Group Leader
Nina Haller*		Senior Specialist Group Leader
David Beck	B.S.	Chemist
Eric Eby	B.S.	Senior Chemist
John Hook	B.S.	Senior Chemist
Deborah Krady	B.S.	Specialist
Parker Lindstrom*	B.S.	Senior Chemist
Nelli Markaryan	B.S.	Chemist
Jennifer Moyer	B.S.	Senior Specialist
Max Snavely*	B.S.	Senior Specialist
Tara Snyder	B.S.	Chemist
Choon Tian	B.A.	Chemist
Damary Valentin		Chemist
John Yanzuk	B.S.	Chemist
Additional support personnel in this group: 5		
Nitrosamines		
Duane Luckenbill	B.S.	Director

Name	Degree	Title
Jenifer Hess	B.S.	Manager
John Perkins		Chemist
Organic Extraction		
Duane Luckenbill	B.S.	Director
Richard Karam	B.S.	Manager
Joseph Feister		Chemist Group Leader
David Hershey		Chemist Group Leader
Wanda Oswald		Chemist Group Leader
Kelli Barto		Chemist
Maria Davenport		Chemist
Kerrie Freeburn	B.S.	Chemist
Heidi Ortenzi	B.S.	Senior Chemist
Edwin Ortiz		Chemist
Robert Vincent	B.S.	Principal Chemist
Darin Wagner	B.A.	Chemist
Additional support personnel in this group: 22		
Pesticide Residue Analysis		
Duane Luckenbill	B.S.	Director
Jenifer Hess*	B.S.	Manager
Michele Hamilton*	B.S.	Senior Chemist Group Leader
Jamie Brillhart	B.S.	Senior Chemist
James Place	B.S.	Senior Chemist
Lisa Reinert	B.S.	Chemist
Richard Shober	B.S.	Principal Chemist
Sarah Snyder*	B.A.	Senior Specialist
Specialty Services Group		
Duane Luckenbill	B.S.	Director
Charles Neslund*	B.S.	Manager
Paul Cormier	B.A.	Principal Specialist
Ginelle Haines		Chemist
Nelson Risser	M.B.A.	Principal Chemist
Michele Smith*	B.S.	Senior Specialist
Timothy Trees	A.S.	Principal Chemist
Meng Yu	M.S.	Principal Chemist
Deborah Zimmerman		Chemist
Volatiles by GC		
Duane Luckenbill	B.S.	Director
Jenifer Hess*	B.S.	Manager
Valerie Tomayko*	B.S.	Senior Specialist Group Leader
Tyler Griffin	B.S.	Chemist
Marie John	B.S.	Chemist
Elizabeth Marin	B.S.	Chemist
Carrie Miller	B.S.	Chemist
Volatiles in Air		
Duane Luckenbill	B.S.	Director
Charles Neslund*	B.S.	Manager
Jeffrey Smith	B.A.	Senior Chemist Group Leader

Name	Degree	Title
Florida Cimino	B.S.	Senior Chemist
Christine Ratcliff	B.S.	Principal Specialist
Michael Ziegler	B.S.	Chemist
Water Quality		
Duane Luckenbill	B.S.	Director
Erik Frederiksen*	B.A.	Manager
Kenneth Bell*	B.S.	Senior Chemist Group Leader
Yolunder Bunch		Chemist
Susan Engle		Chemist
Michele Graham	B.S.	Chemist
Robert Heisey*	B.A.	Senior Specialist
Susan Hibner	B.S.	Chemist
Michelle Lalli		Chemist
Hannah Royer	B.A.	Chemist
Additional support personnel in this group: 3		
Accounting & Finance		
Thomas Wolgemuth	M.B.A.	Executive Vice President Chief Financial Officer
Tammy Robinson	B.B.A.	Senior Specialist Group Leader
Jeffrey Cooper	A.S.B.	Specialist
Lindsay Fisher	B.S.	Specialist
Marjorie Hollinger		Senior Specialist
Administration		
Katiria Agosto		Specialist
Gerry Hershey		Principal Specialist
Billing & Reporting		
Thomas Wolgemuth	M.B.A.	Executive Vice President Chief Financial Officer
Beatrice Stauffer*		Manager
Adrienne Kuhl*		Senior Specialist Group Leader
Amanda Chao	A.A	Specialist
Jaime Ferguson*	A.S.	Senior Specialist
Shirley Habalar		Specialist
Lauren Kready	A.S.B.	Specialist
Jacqueline Miller		Specialist
Victoria Zacharias		Specialist
Additional support personnel in this group: 3		
Computer Applications Development		
Art Pezzica	B.A.	Director
Gordon Beitzel	B.S.	Manager
Holly Trego	B.S.	Manager
Tiffany Betz	B.S.	Senior Specialist
Catherine Holt	B.S.	Principal Specialist
Chadwick Hershey	B.S.	Senior Specialist
Kevin Lasher	B.S.	Principal Specialist
S. Scott Paist	B.A.	Specialist
Harry Thompson	B.A.	Principal Specialist
Timothy Weaver	B.A.	Senior Specialist

Name	Degree	Title
Andy Whang	B.S.	Senior Specialist
Jon Wright	B.S.	Principal Specialist
Computer Systems		
Art Pezzica	B.A.	Director
Cynthia Ayars	M.B.A.	Manager
Shawn Beamenderfer	B.S.	Senior Specialist
James Butler		Senior Specialist
Justin Risser	B.S.	Senior Specialist
Emiley Rodak	B.A.	Specialist
Lee Seats	M.B.A.	Principal Specialist
Susan Shorter	B.S.	Senior Specialist
Destry Usner	B.S.	Senior Specialist
Thomas Wise	B.S.	Principal Specialist
Edward Zeigler	A.A	Senior Specialist
Additional support personnel in this group: 1		
Environmental Sample Administration		
Robert Large	B.S.	Director
Anneliese Owen	M.B.A.	Manager
Carolyn Cyms	B.S.	Senior Specialist Group Leader
Deborah Neslund		Senior Specialist Group Leader
Traci Bedard	B.S.	Specialist
Katie Hartlove		Specialist
Tamara Helsel		Senior Specialist
Christine Knoedler	B.A.	Specialist
Katherine Metzger	B.A.	Specialist
Kristin Zeigler	B.S.	Specialist
Additional support personnel in this group: 4		
Equipment Maintenance & Repair		
Thomas Wolgemuth	M.B.A.	Executive Vice President Chief Financial Officer
Samuel Huber	B.S.	Manager
Robert Allison		Senior Specialist
Human Resources		
Beth DiPaolo	B.S.	Director
Margaret Stoltzfus		Director
Jodi Ho	B.A.	Senior Specialist Group Leader
Cindy Weiser		Senior Specialist Group Leader
Jeanette Beisel		Principal Specialist
William Gambler	B.S.	Specialist
Matthew Gehman	B.S.	Senior Specialist
Melanie Nixon-Stillman	B.A.	Senior Specialist
Beth Rich		Senior Specialist
Jill Wilson	B.S.	Senior Specialist
Corporate Training		
Kimberly Davies	M.B.A.	Manager
Harry Ward	Ph.D.	Principal Specialist Group Leader
Dennis Urban	M.S.	Principal Specialist

Name	Degree	Title
Barbara Weaver	M.S.	Principal Specialist
Marketing & Communication Services		
Margaret Stoltzfus		Director
Lisa Bamford	B.S.	Principal Specialist
Sherri Harlan	M.B.A.	Principal Specialist
Office Services		
Thomas Wolgemuth	M.B.A.	Executive Vice President Chief Financial Officer
Denise Splain		Manager
Maureen Caputo	A.S.	Specialist Group Leader
Dana Defibaugh	A.S.	Senior Specialist Group Leader
April Gibson		Principal Specialist Group Leader
Raymond Bowen		Specialist
Nancy Broderick		Specialist
Nicole Hanna		Specialist
Carol Martin		Specialist
Marta Rodriguez Rivera		Specialist
Lee Ann Ressler		Specialist
Jazzire Sierra	A.A.S.	Specialist
Tracey Salkeld		Specialist
Mary Stem		Specialist
Michele White		Specialist
Additional support personnel in this group: 4		
Physical Services		
Samuel Huber	B.S.	Manager
Gerald Clipper		Principal Specialist Group Leader
Mark Allison		Principal Specialist
Robert Bishop		Specialist
Traci Bowman		Specialist
Barry Gehman		Senior Specialist
Edward Huegel		Specialist
Robert Hufford		Principal Specialist
Ronald Hufford		Senior Specialist
Thomas Koller		Specialist
Ronald Reed		Specialist
David Splain		Specialist
Additional support personnel in this group: 2		
Purchasing		
Thomas Wolgemuth	M.B.A.	Executive Vice President Chief Financial Officer
Charles Kurtz		Senior Specialist Group Leader
Thomas Dull	A.S.	Senior Specialist
Adam Huegel		Specialist
Lester Metzger		Specialist
Sample Bottles		
Steven Davies	B.S.	Manager
Jeffrey Moyer	B.S.	Senior Specialist Group Leader
Theresa Carlson	A.S.	Specialist

Name	Degree	Title
Samantha DeFalcis		Specialist
Karen Guito		Specialist
Sandra Muckle		Specialist
Sample Support		
Robert Large	B.S.	Director
Dana Kauffman*		Manager
Lisa Cooke		Chemist Group Leader
Chad Wettig		Chemist Group Leader
Stephanie Sanchez		Chemist
Additional support personnel in this group: 9		
Transportation		
Steven Davies	B.S.	Manager
Tony Luque		Specialist
L. Kenneth Miller		Specialist
Timothy Miller		Specialist
Christopher Winters		Specialist
Leon Wolf		Specialist On-Call
Additional support personnel in this group: 13		

*Denotes those employees that sign reports for Environmental Sciences.

Lancaster Laboratories

Environmental Quality Policy Manual

Appendix D
Personnel Qualifications and Responsibilities

Current as of October 05, 2011
50 Total Pages (including this coversheet)

Joseph D. Anderson, B.S., Senior Chemist, Flexible Staffing

Education:

B.S. General Science, Pennsylvania State University (2004)

Professional Experience:

ALSI, GC GC/MS Analyst (2004-2010)
Responsibilities included preparing, running, and reviewing samples according to client and industry methods using various instrumentation including GC and GC/MS; performing analysis for various departments as determined by work volume and staffing needs; reviewing and reporting data within client specified criteria
With Lancaster Laboratories since 2010
Senior Chemist, Flexible Staffing (2010)
Responsibilities include preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation, which may include but is not limited to, gas chromatography, liquid chromatography, IC, and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

F. Bradley Ayars, Senior Specialist Group Leader, Data Deliverables

Continuing Education:

Environmental Law & Policy, Franklin & Marshall College (1991)

Professional Experience:

With Lancaster Laboratories since 1988
Client Services Specialist (1992)
Environmental Project Management (1994)
Senior Specialist Coordinator, Electronic Data Deliverables (1997)
Responsibilities included supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues
Senior Specialist Group Leader, Electronic Data Deliverables (2005)
Responsibilities include supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues

Cynthia A. Ayars, M.B.A., Manager, Computer Systems

Education:

B.S. Chemistry, Shippensburg University (1987)
M.B.A., Penn State University (1994)

Continuing Education:

Lancaster Labs University of Education: Hazardous Waste/Chemical Transfer, DOT: Safe Transport of Hazardous Materials, Respiratory Protection
Unix Database Administration, Lawson Software (1998)
Unix System Administration, Lawson Software (1998)
Unix Technical Foundations, Lawson Software (1998)
Oracle 8 Backup and Recovery Workshop, Oracle (2000)
Software Quality Engineering – Systematic Software Testing (2004)

Professional Experience:

With Lancaster Laboratories since 1987
Chemist (06/87-10/89)
Client Service Specialist I (10/89-11/91)
Group Leader II, Sample Support (11/91-08/98)
Senior Specialist, Computer Applications Development (1998)
Responsibilities included Oracle based administrating, Lawson system administrating, and participating in development of Parallax system
Senior Specialist/Coordinator, Computer Applications Development (2002)
Responsibilities included developing software quality documentation and coordination of software quality effort for both Parallax and Nautilus
Manager, Computer Applications Development (2005)
Responsibilities included developing software quality documentation and coordination of software quality effort and database administration for both Parallax and Nautilus

Manager, Computer Systems (2008)
Responsibilities include developing software quality documentation and coordination of software quality effort and database administration for both Parallax and Nautilus

Matthew Rusty E. Barton, B.S., Senior Specialist, GC/MS Semivolatiles

Education:

B.S. Biochemistry, East Stroudsburg University (1991)

Professional Experience:

With Lancaster Laboratories since 1991
Senior Chemist (1998)
Senior Chemist/Coordinator (1999)
Responsibilities included: supervise personnel; schedule lab work; perform purge and trap gas chromatography testing; operate O.I. 4560/4551, Tekmar 3000, Archon 5100, and HP5890 Series II OC instruments; review and approve data; and developing and evaluating new methods.
Senior Chemist, Nitrosamines (2003)
Responsibilities included: Analysis of nitrites in tobacco samples
Senior Chemist, EPH/Misc. GC (2004)
Responsibilities include: Analysis of environmental samples for diesel range organics via gas chromatography
Senior Specialist, GC/MS Semivolatiles (2008)
Responsibilities include: audit and upload of departmental data

Shawn Beamenderfer, B.S., Senior Specialist, Computer Systems

Education:

A.A.S. Computer Networking, Thaddeus Stevens College (2003)
B.S. Computer Info System, Alvernia College (2006)

Professional Experience:

With Lancaster Laboratories since 2006
Software Quality Specialist, Computer Applications Development (2006)
Responsibilities included creating and executing test plans for pharmaceutical software
Specialist, Computer Systems (2007)
Responsibilities included creating and executing test plans for pharmaceutical software
Senior Specialist, Computer Systems (2009)
Responsibilities include creating and executing test plans for pharmaceutical software

Awards, Citations, Honorary Societies, and Publications:

Dean's List, Alvernia College (2003-2006)
Certified Tester, Foundation Level – ASTQB

Gordon Beitzel, B.S., Manager, Computer Applications Development

Education:

B.S. Electrical Engineering, Pennsylvania State University (1987)

Continuing Education:

Microsoft Solutions Framework, Microsoft Consulting Services (1997)
Mastering Visual Basic 6 Development, Productivity Point International (1999)

Professional Experience:

Lancaster Laboratories, Inc., Computer Systems Specialist (1988-1994)
Data Pipeline Systems, Inc., Software Developer (1994-1996)
CDS Solutions Group, Project Manager (1996–1998)
With Lancaster Laboratories since 1998
Manager (previously titled Group Leader), Application Development (1998)
Responsibilities include management of various software development projects. This involves personnel management, coordinating the timelines, systems analysis, and communication of project progress and status.

Memberships & Appointments:

Microsoft Certified Solution Developer (1997)

Kenneth A. Bell, B.S., Senior Chemist Group Leader, Water Quality

Education:

B.S. Chemistry, Millersville University (1997)

Professional Experience:

Johnsons Chemical, Laboratory Assistant (1989-1992)
Responsibilities included collecting samples and performing testing on raw material
With Lancaster Laboratories since 1994
Senior Laboratory Technician, Water Quality (1994)
Responsibilities included routinely performing analytical testing using wet chemistry methods
Chemist/Coordinator, Water Quality (1994)
Responsibilities included performing wet chemistry analyses, sample verification, and coordinating workflow
Senior Chemist/Coordinator, Water Quality (1994)
Responsibilities included coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews
Senior Chemist Group Leader, Water Quality (2005)
Responsibilities include coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews

Holly Berry, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Forensic Chemistry, Buffalo State College (SUNY) (2006)

Professional Experience:

New York State Police, Toxicology Intern (2005-2006)
Responsibilities included performing analysis of alternative medicines using FPIA, SPE, GC/NPD, and GC/MS
With Lancaster Laboratories since 2006
Chemist, GC/MS Volatiles (2006)
Responsibilities included analyzing soils and waters for VOAs using purge and trap and GC/MS instrumentation
Senior Chemist, GC/MS Volatiles (2010)
Responsibilities include analyzing performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation; assisting other employees with any questions that may arise and helping to train new employees

Memberships and Appointments:

Emergency Response Team (Hazmat technician) – LLI (2006-present)

Tiffany D. Betz, B.S., Senior Specialist, Computer Applications Development

Education:

B.S. Computer Science, Millersville University (2001)

Continuing Education:

Oracle Exam #1Z0-007, Introduction to Oracle 9i: SQL (May 17, 2004)
Oracle Exam #1Z0-147, Oracle 9i: Program with PL/SQL (August 4, 2004)

Professional Experience:

With Lancaster Laboratories since 2000
Specialist, Computer Applications Development (2000)
Responsibilities included computer applications development and maintenance.
Senior Specialist, Computer Applications Development (2006)
Responsibilities include computer applications development and maintenance.

Kenneth L. Boley, Jr., B.S., Senior Chemist Group Leader, GC/MS Volatiles

Education:

B.S. Chemistry, Messiah College (1995)

Professional Experience:

Heritage Custom Kitchens, Inc., Face Frame Assembler (1997–2001)
Responsibilities included reading and interpreting job orders; overseeing daily production of department; performing various manufacturing duties daily; member of the safety committee, first aid team, and security team
With Lancaster Laboratories since 2001
Chemist, GC/MS Volatiles (2001)
Responsibilities included analyzing samples and QC by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; following methods and SOPs
Senior Chemist, GC/MS Volatiles (2005)
Responsibilities included performing routine and non-routine analyses; diagnosing and solving technical problems; maintaining and troubleshooting instrumentation; writing and revising SOPs; training new analysts; auditing and uploading data as work load deems necessary
Senior Chemist Group Leader, GC/MS Volatiles (2009)
Responsibilities include maintaining GC/MS instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing corrective action and system improvements when necessary; performing all duties with minimal supervision; working on special assignments; diagnosing complex problems and offering solutions with a high degree of independence; assisting in "brainstorming" client problems and projects; completing assigned projects on time; researching new and emerging technologies; producing written and oral reports on research activities; performing both technical and personnel aspects of group operations; performing work within the department or other areas as required; acting as a technical resource, trainer, and troubleshooter to specific department; making recommendations for operational and/or technical improvements; communicating effectively within the group; coaching and developing direct reports; planning and monitoring workflow

Nancy J. Bornholm, B.S., Principal Specialist, Environmental Client Services

Education:

B.S. Chemistry (magna cum laude), Muhlenberg College (1981)

Continuing Education:

Instrumental Analysis of Paints and Polymers, FBI Academy (1984)
Analytical Chemistry of Contaminants in Surface and Groundwater, ACS Short Course (1986)

Professional Experience:

University of Connecticut Health Center, Laboratory Technician (1977-1980)
Institute for Cancer Research, Research Technician (1981)
Baltimore City Crime Laboratory, Mobile Crime Unit Trainee (1981-1982)
Maryland State Police Crime Laboratory, Forensic Chemist III (1982-1985)
With Lancaster Laboratories since 1985
Senior Specialist, Environmental Client Services (1987)
Responsibilities included project management; audit sample entries; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers
Principal Specialist, Environmental Client Services (2004)
Responsibilities include project management; audit sample entries; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers

Awards, Citations, Honorary Societies, and Publications:

Quarterly Impact Award (2008)
Superlative Service President's Award (2008)

Marianne L. Bragg, B.S., Principal Specialist, Environmental Business Development

Education:

B.S. Biology, Millersville University (1987)

Professional Experience:

With Lancaster Laboratories since 1985
Coordinator
Group Leader (1990)
Principal Specialist (1994)
Responsibilities included: advise clients on testing; provide price quotes and proposals; answer client questions; schedule sample submissions and provide sampling containers; communicate client requirements to lab areas; and assist with client visits to the lab.
Principal Specialist/Coordinator, Environmental Business Development (2002)
In addition to the responsibilities listed above, manage workload and workflow among business development staff.
Principal Specialist/Group Leader, Environmental Business Development (2005)
In addition to the responsibilities listed above, manage workload and workflow among business development staff.
Principal Specialist, Environmental Business Development (2007)
Responsibilities include: advise clients on testing; provide price quotes and proposals; answer client questions; schedule sample submissions and provide sampling containers; communicate client requirements to lab areas; and assist with client visits to the lab.

Jamie L. Brillhart, B.S., Senior Chemist, Pesticide Residue Analysis

Education:

B.S. Physical Science, York College of Pennsylvania (2003)

Professional Experience:

B-H Laboratories Inc./Analytical Laboratory Services Inc., Inorganic Laboratory Technician/Inorganic Chemist (2003-2005)
Responsibilities included performing wet chemistry testing on drinking waters and waste water; being responsible for analyses included fluoride, cyanide, phosphorus, nitrate/nitrite, cadmium reduction, and grease and oil testing when needed; prepping and analyzing for mercury on a mercury analyzer; analyzing for various metals on a graphite furnace; prepping leachates; prepping standards as needed
Hercon Laboratories, Inc., QC Analyst I (2005-2007)
Responsibilities included performing Quality Control Testing on Transdermal Systems; performing assays, dissolutions, degradation, residual solvents, and raw material testing; prepping necessary standards and performing instrument maintenance as needed
With Lancaster Laboratories since 2007
Chemist, Pesticide Residue Analysis (2007)
Responsibilities included analyzing soils for PPL Pesticides using 5890 and 6890 GCs with ECD detectors; performing instrument maintenance; prepping standards; auditing calibrations as necessary; being able to analyze for OPPAs, ACMOs, EDBs, PCBs, and Herbicides as needed
Senior Chemist, Pesticide Residue Analysis (2011)
Responsibilities include analyzing soils for PPL Pesticides using 5890 and 6890 GCs with ECD detectors; performing instrument maintenance; prepping standards; auditing calibrations as necessary; being able to analyze for OPPAs, ACMOs, EDBs, PCBs, and Herbicides as needed

Robert Brown, Principal Chemist Group Leader, EPH/Misc. GC

Education:

Attended 2.5 years at Pennsylvania State University towards B.S. in Microbiology (1988)
Completed 20 credits towards B.S. in Environmental Biology, Millersville University (1993)

Professional Experience:

With Lancaster Laboratories since 1988
Chemist (1993)
Senior Chemist (1997)
Responsibilities included: perform extractable petroleum testing; operate multiple Hewlett-Packard gas chromatographs (GC) instruments; data interpretation and entry; and developing and evaluating new methods.
Principal Chemist (2004)
Responsibilities included: perform extractable petroleum testing; operate multiple Hewlett-Packard gas chromatographs (GC) instruments; data interpretation and entry; and developing and evaluating new methods. Serve as primary technical contact for client service representatives and their clients.
Principal Chemist Group Leader, EPH/Misc. GC (2005)
Responsibilities include: perform extractable petroleum testing; operate multiple Hewlett-Packard gas chromatographs (GC) instruments; data interpretation and entry; and developing and evaluating new methods. Serve as primary technical contact for client service representatives and their clients.

Kathryn A. Brungard, Senior Specialist, Quality Assurance

Continuing Education:

Clinical Laboratory Science, Temple University (1984-1988)

Professional Experience:

Environmental Partners, Inc., Environmental Technician/Health and Safety Coordinator (2003-2005)
Responsibilities included determining personnel health and safety risks on each work site and determining appropriate measures to be taken for personal protection; maintaining and servicing sampling equipment; calibrating meters and analytical equipment; collecting and processing representative samples at each monitoring site following state mandated procedures; routinely measuring field water and soil quality parameters; performing product recovery as part of site remedial measures; evaluating and reporting upon trends and/or results that were out-of-range
Maxwell House Coffee/Kraft Foods, Quality Assurance Technician (2004-2005)
Responsibilities included conducting hourly audits on operating production lines which included weight of product, oxygen content, density, caffeine level by HPLC, moisture content, inspection for foreign or incidental materials, and packaging compliance; performing weekly water testing for level of chlorine and microbial contamination; producing result spreadsheets and accurate logs; notifying upper management of all results in a timely manner
Columbia Analytical Services, Inc, Quality Assurance Program Manager (2005-2009)
Responsibilities included being responsible for the overall coordination of the NELAP certified environmental laboratory program; monitoring laboratory quality systems through audits; identifying potential problem areas, recommending corrective actions, and providing technical assistance and training as necessary; informing management of potential problems and recommending remedial measures in a timely basis both orally and by written communication; maintaining performance evaluation records; maintaining accreditations for regulatory agencies and client programs; providing audit responses and initiating changes in procedures; maintaining the calibration of all weights, balances, and thermometers
With Lancaster Laboratories since 2010
Senior Specialist, Quality Assurance (2010)
Responsibilities include ensuring quality of data being produced in the laboratories by performing data review, auditing laboratories, and reviewing written procedures; ensuring laboratory adherence to government regulations and client requirements; reviewing client and government documents for requirements outside our usual laboratory practices; setting up and testing new analysis in the laboratory sample management system as required by the departments

Memberships and Appointments:

Florida Society of Environmental Analysts (2005-2009)

Ryan P. Byrne, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Biology, College/University (2003)

Professional Experience:

With Lancaster Laboratories since 2003
Chemist, GC/MS Semivolatiles (2003)
Responsibilities include preparing standards; performing maintenance and calibration of GC/MS systems; responding to audits
Senior Chemist, GC/MS Semivolatiles (2007)
Responsibilities include performing analysis and review of all departmental analyses; responding to audits

Florida A. Cimino, B.S., Senior Chemist, Volatiles in Air

Education:

B.S. Chemistry, Shippensburg University (2004)

Professional Experience:

With Lancaster Laboratories since 2005
Chemist, Flexible Staffing (2005)
Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation including, but not limited to, gas chromatography, liquid chromatography, IC and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs
Senior Chemist, Flexible Staffing (2008)
Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation including, but not limited to, gas chromatography, liquid chromatography, IC and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

Senior Chemist, Volatiles in Air (2010)
Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

Awards, Citations, Honorary Societies, and Publications:

Girl Scout Gold Award (2000)
Who's Who Among College Students (2001-2004)

Mark A. Clark, B.S., Principal Chemist, GC/MS Semivolatiles

Education:

B.S. Biochemistry, Millersville University (1986)

Professional Experience:

With Lancaster Laboratories since 1985
Senior Chemist, GC/MS Semivolatiles (1985)
Responsibilities included performing GC/MS semivolatiles testing; operating GC/MS instruments; performing data interpretation and entry; developing and evaluating new methods; calibrating and repairing instruments
Principal Chemist, GC/MS Semivolatiles (2001)
Responsibilities include performing PAH by HPLC analysis and assisting with GC/MS operations on third shift

Gerald L. Clipper, Principal Specialist Group Leader, Physical Services

Continuing Education:

Electrical Engineering, West Virginia University, Morgantown, WV (1965-1967)
Basic Electronics, US Navy, Great Lakes, IL
Advanced Electronics, US Navy, Bainbridge, MD
Radar and Special Circuits, Weapons Direction Equipment, US Navy, Dam Neck, VA
Telemetry, US Navy, San Francisco, CA
IBM-MRP MAPIC I and II
SMART CAM and CNC Programming
Industrial and Commercial Power Distribution, Energy Efficient Commercial Buildings, Power Quality
Data Communications for Engineers and Technicians
R&D Facilities: Concepts for Cost Effective Buildings
Raising FM Performance and Cutting Costs
Advanced Level Laboratory Ventilation, Laboratory Remodeling and New Lab Buildings
Fume Hood: Selection, Design, and Certifying
Engineering Calculations for Heat Load and Equipment Selection
Proportional Controls for HVAC Systems
Andover System Programming
Contingency Planning for Equipment and Machinery

Professional Experience:

US Navy, Vietnam Veteran (1967-1971)
Responsibilities included maintaining all electronic missiles test and telemetry equipment onboard ship; performing function tests on all missiles onboard on a periodic basis; periodically assigned as an observer on other ships during drills to analyze performance
Donnelly Printing, Apprentice Assistant Pressman (1971-1973)
Responsibilities included supervising crew in operation and maintenance of press
Redman Industries, Production Supervisor (1973-1974)
Responsibilities included supervising employees in assembly and finishing of homes; controlling inventories of materials; supervising repair crews; supervising testing and inspection; hiring, reviewing, and firing
Anderson Bakeries, Packaging Supervisor (1974-1977)
Responsibilities included supervising maintenance and machine set up for baggers, sealers, and carton machinery; scheduling production for shift; supervising packaging and storage of materials; hiring, training, review, and firing
Liberty Homes, Production Supervisor (1977-1981)
Responsibilities included managing employees in assembly and finishing of homes; inventory control; supervising repair crews, testing, and inspection; hiring, review, and firing

High Energy Corporation, Plant Manager/Product Manager (1981-1987)
Responsibilities included scheduling all production; managing employees in electro-mechanical assembly operations (pressing, soldering, welding, testing, etc.); developed automated equipment, fixtures, and dies for improved productivity; managed machine shop in production of assemblies and subassemblies to support production lines; designed and supervised design of capacitors; consulted with clients on applications for new designs and replacement parts; developed and produced new products; established annual budget; managed maintenance staff in equipment and building maintenance; made sales calls to major clients and helped to negotiate annual contracts; established work rates, hired, reviewed, and fired; CAM system design and CNC programming for automatic lathe
With Lancaster Laboratories since 1987
Senior Specialist, Physical Services (1987)
Principal Specialist, Physical Services (1998)
Principal Specialist Group Leader, Physical Services (2001)
Responsibilities include physical plant operations; evaluation and selection of building systems and services; short and long range expansion planning; laboratory and office layout and design (new and renovations); contracting/coordination of new projects; develop solutions to problems relating to safety, equipment, building, and services; manage technical maintenance staff; engineering support for parent company labs; facility energy management; equipment design for laboratory use; evaluate and market used lab equipment; interview and train new employees of the HVAC group to perform required duties; serve as a technical source for all departments; maintain, repair, and trouble shoot the building's control system; monitor, trouble shoot, and upgrade the programming as needed for the security system; manage (based on cost effectiveness and high quality standards) all new equipment being purchased by the Physical Services department to ensure compatibility with our current systems (i.e., HVAC, electrical, plumbing, etc.); maintain, implement, and update preventative maintenance program on all facility equipment; review and assist in the design of new or remodeled space to ensure high quality and cost savings

Harolyn M. Clow, M.S., SM (NRCM), Manager, Pharmaceutical Microbiology

Education:

B.S. Microbiology, Colorado State University (1986)
M.S. Quality Assurance/Regulatory Affairs, Temple University (1995)

Continuing Education:

Laboratory Identification of Gram Positive Bacteria, Colorado Association for Continuing Medical Laboratory Education (1989)
Enterobacteriaceae, Colorado Association for Continuing Medical Laboratory Education (1990)
Laboratory Management: Quality Assurance/Quality Control, Colorado Association for Continuing Medical Laboratory Education (1990)
Current Issues in the Pharmaceutical Microbiology Laboratory Seminar/Workshop, Applied Analytical Industries, Inc. (1992)
Entry Level Management, Lancaster Laboratories (1993)
MIDI Microbial Identification System Training (1993)
Moving Pharmaceutical Microbiology into the 21st Century, Seminar/Workshop, Applied Analytical Industries, Inc. (1997)
Bacteriology, Colorado Association for Continuing Medical Laboratory Education (2001)
Principles of Biosafety/ BBP Exposure Control Plan, LLU (2003)
ISPE Baseline Guide Series: Biopharmaceuticals Guide, Interphex (2004)
Drinking Water Laboratory Training (2007)

Professional Experience:

Benedict Nuclear Pharmaceuticals, Inc., Supervisor of Quality Control (1987-1990)
Responsibilities included managing Quality Control laboratory; supervising operations related to quality assurance and GMP compliance
Cell Technology, Inc., Quality Assurance/Quality Control Analyst (1990-1991)
Responsibilities included developing and implementing environmental monitoring programs; evaluating systems for GMP compliance and performing testing of finished product
With Lancaster Laboratories since 1991
Microbiologist II, Pharmaceutical Microbiology (1991)
Responsibilities included writing/revising operating procedures for sterility testing, microbial limit testing, and related operations; performing sterility testing, endotoxin testing, microbial limit testing, environmental monitoring, and related testing associated with process/facility validation; performing data entry, data verification, and equipment maintenance
Microbiologist III, Pharmaceutical Microbiology (1992)
Responsibilities included coordinating scheduling for microbial limit testing, performing sterility testing, and tests associated with support of process validation and facility validation
Coordinator, Pharmaceutical Microbiology (1993)
Responsibilities included managing and scheduling of personnel and verification of data; supervising daily laboratory operations; coordinating and conducting client method transfers; evaluating compliance of operations with corporate requirements and GMP regulations; performing duties related to support of client facility validations and process validations/method development
Group Leader, Pharmaceutical Microbiology (1996)
Responsibilities included managing daily operations of pharmaceutical microbiology department including personnel; performing quality assurance and regulatory compliance functions to maintain departmental operations in accordance with corporate requirements and GMP regulations; being responsible for management of the Facility Validation group and Media Preparation group within the department

Manager, Pharmaceutical Microbiology (2005)
Responsibilities include managing daily operations of pharmaceutical microbiology department including personnel; performing quality assurance and regulatory compliance functions to maintain departmental operations in accordance with corporate requirements and GMP regulations; being responsible for management of the Facility Validation group and Media Preparation group within the department

Awards, Citations, Honorary Societies & Publications:

Specialist Microbiologist in Consumer and Industrial Microbiology, National Registry of Certified Microbiologists of the American Academy of Microbiology
Publication: Lingenfelter, E.A., H.L. Evans, W.B. Atkins, and H.M. Clow. How to Improve Cleaning Processes. Pharmaceutical Formulation & Quality magazine. (June 2009)

Memberships & Appointments:

American Society for Microbiology
National Registry of Certified Microbiologists

Rachel R. Cochis, B.A., Senior Specialist Group Leader, GC/MS Semivolatiles

Education:

B.A. Science, Pennsylvania State University (1992)

Continuing Education:

Introduction to Mass Spec Interpretation, Hewlett-Packard (1995)
Gas Chromatography Principles & Practices (1994)

Professional Experience:

With Lancaster Laboratories since 1993
Chemist (1994), GC/MS Semivolatiles (1993)
Responsibilities included performing semvolatiles analysis on water and soil samples
Senior Chemist Coordinator, GC/MS Semivolatiles (1996)
Responsibilities included scheduling lab work, performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas
Senior Specialist Group Leader, GC/MS Semivolatiles (2005)
Responsibilities include scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas

Tracy A. Cole, Senior Specialist, EPH/Miscellaneous GC

Continuing Education:

Gas Chromatography: Principles and Practice, LLU (1997)

Professional Experience:

With Lancaster Laboratories since 1991
Laboratory Technician, Volatiles in Air (1991)
Responsibilities included preparing samples and standards; washing glassware; loading samples on instruments
Senior Technician, Volatiles in Air and EPH/Miscellaneous GC (1994)
Responsibilities included analyzing routine samples and QC by Gas Chromatography for DRO and miscellaneous organic compounds; preparing direct injection samples for analysis; preparing standards; reviewing chromatography data and uploading to the LIMS
Chemist, EPH/Miscellaneous GC (1999)
Responsibilities included analyzing routine and nonroutine samples and QC by Gas Chromatography for various organic analyses including DRO, TPH, and other petroleum related methods and miscellaneous organic compounds by direct injection; reviewing chromatography data and uploading to the LIMS; performing instrument maintenance; calibrating instruments for various methods
Senior Specialist, EPH/Miscellaneous GC (2008)
Responsibilities include reviewing/verifying data for technical correctness including raw chromatography data, initial calibrations, and analytical reports; ensuring that method and project requirements were followed and entry into the LIMS is correct; acting as a technical resource for the department; assisting in reviewing/writing SOPs and other technical documents

Paul R. Cormier, B.A., Principal Specialist, Specialty Services Group

Education:

B.S. Microbiology, Virginia Tech (1984)
B.A. Chemistry, Virginia Tech (1984)

Continuing Education:

Hewlett-Packard GC/MS Advance Operations/System Manager Course (1990)
Mass Spectral Interpretation, Finnigan MAT Institute (1991)
Technical Training, OI Analytical (1995)

Professional Experiences:

Environmental Testing & Certification (1985-1989)
Analytikem, Inc. (1989-1990)
With Lancaster Laboratories since 1990
- Senior Chemist (1990)
  - Responsibilities included: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
- Senior Specialist (2005)
  - Responsibilities included: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
- Principal Specialist, GC/MS Volatiles (2006)
  - Responsibilities include: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
- Principal Specialist, Specialty Services Group (2010)
  - Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Memberships & Appointments:

American Chemical Society

Teresa L. Cunningham, B.S., Principal Specialist, Environmental Client Services

Education:

B.S. Biology, St. Joseph's University (1999)

Continuing Education:

Chemical Monitoring Assistance Program, Pennsylvania Rural Water Association (2000)
How to Deliver Exceptional Customer Service, Fred Pryor Seminars (2000)
Organizational Behavior, Penn State University (2005)

Professional Experience:

With Lancaster Laboratories since 1999
- Specialist, Environmental Client Services (1999-2000)
- Senior Specialist, Environmental Client Services (2001)
- Senior Specialist Coordinator, Environmental Client Services (2001)
  - Responsibilities included serving as project manager for clients with petroleum-related testing accounts; coordinating client requests with laboratory groups to ensure that the client's needs are met; scheduling bottle shipments and sample pickups; preparing quotations; coordinating staff
- Senior Specialist Group Leader, Environmental Client Services (2005)
  - Responsibilities included serving as project manager for clients with petroleum-related testing accounts; coordinating client requests with laboratory groups to ensure that the client's needs are met; scheduling bottle shipments and sample pickups; preparing quotations; coordinating staff
- Manager, Environmental Client Services (2006)
  - Responsibilities included overseeing implementation of new projects; coordinating client requests with laboratory groups to ensure that the client's needs are met; coordinating staff
- Principal Specialist, Environmental Client Services (2008)
  - Responsibilities include performing project management; training new client service representatives; auditing sample entry; answering client questions; communicating client requirements to lab areas

Carolyn M. Cyms, B.S., Senior Specialist Group Leader, Environmental Sample Administration

Education:

B.S. Secondary Education/Chemistry, Bloomsburg University of Pennsylvania (1993)
Post Baccalaureate Certificate, Biology and MS Math, Millersville University (2002)

Continuing Education:

Accounting I, HACC (1996)
Introduction to the Internet, PC Focus (1996)
Self-Discipline & Emotional Control, Franklin-Covey (1997)
Child Growth & Development, HACC (1998)
Cell Biology, Millersville University (2000)
Botany; Genetics; Zoology; Biochemistry; Ecology, and Ecology Lab, Millersville University (2001)
Immunology; Animal Behavior; Teaching Biological Issues; Entomology, Millersville University (2002)
Introduction to Computer Programming, Millersville University (2003)

Professional Experience:

Lancaster Theological Seminary, Field Education Assistant-Special Project Coordinator (1996-1999)
Responsibilities included assisting with mailings, organization of the field education program; creating and preparing a student field education manual for the ministerial studies program; acting as liaison between Field Ed Professor, Field Ed sites, and students; preparing all written correspondences for the field ed office; organizing and preparing materials for meetings; tracking student progress through the program; assisting with other special projects requiring computer skills of PageMaker, WordPerfect, Quattro Pro, and Envoy
Self-Employed, Tutor (1994-2005)
Responsibilities included tutoring HACC students in Introduction to Chemistry, Chemistry, Biology, and Algebra
Millersville University – Biology Department, Assistant (2003)
Responsibilities included preparing Power Point presentations for a stream restoration monitoring program; photographing various stages of the project
With Lancaster Laboratories since 1994
Administrator III, Environmental Sample Administration (1994)
Responsibilities included receiving samples, entering samples, auditing, filing, noting discrepancies, and unpacking samples
Administrator III/Coordinator, Environmental Sample Administration (1995)
Responsibilities included relaying technical/client information when it became available; answering questions from clients/technical areas when CSR was unavailable; coordinating/prioritizing entry; supervising and evaluating work of 2nd Shift Environmental Entry Staff; training new personnel in the entry/interpretation process; preparing Job Plans on an as-needed basis
Specialist I, Environmental Sample Administration (1996)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis
Senior Specialist, Environmental Sample Administration (2000)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed
Senior Specialist Coordinator, Environmental Sample Administration (2004)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed
Senior Specialist Group Leader, Environmental Sample Administration (2005)
Responsibilities include receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed

Awards, Citations, Honorary Societies & Publications:

Residential Life Award of Merit (1990)
Bloomsburg University Dean's List 6 of 8 semesters, graduated cum laude (1990-1993)
Kappa Delta Phi (National Co-Ed Honor Society) (1994)
Spirit of LLI (2001)

Memberships & Appointments:

Elizabethtown Fire Company (1993-present)
Safety Committee (1994-1998)
Alpha Phi Omega (National Co-Ed Service Fraternity) (1991-1993)
NSTA (2000-2008)
Kappa Delta Phi (1994, 2001-2003)

Kimberly A. Davies, M.B.A., Manager, Flexible Staffing

Education:

B.S. Biology, Shippensburg University of Pennsylvania (1991)
M.B.A., Pennsylvania State University (1999)

Professional Experience:

Polybac Corporation, Technical Services (1991-1992)
Upper Saucon Township Wastewater Treatment Plant, Technician (1992-1993)
With Lancaster Laboratories since 1993
- Client Services Senior Specialist (1996)
- Senior Specialist/Coordinator, Pharmaceutical Project Management (1998)
- Principal Specialist/Coordinator, Pharmaceutical Project Management (2000)
- Group Leader, Pharmaceutical Project Management and Data Support (2001)
  - Responsibilities included managing pharmaceutical project management and data support staff; facilitating group meetings to communicate with staff; supporting company and division policies and provide information to department; supporting employee development and acknowledge innovative ideas; promoting group and department teamwork and collaboration
- Manager (previously titled Group Leader), Pharmaceutical Project Management (2003)
  - Responsibilities included managing pharmaceutical project management staff; facilitating group meetings to communicate with staff; supporting company and division policies and provide information to department; supporting employee development and acknowledge innovative ideas; promoting group and department teamwork and collaboration
- Manager, Flexible Staffing (2005)
  - Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance
- Manager, Flexible Staffing and Technical Training (2006)
  - Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance; managing the technical training staff responsible for designing and facilitating technical training
- Manager, PPI Process and Flexible Staffing (2008)
  - Responsibilities include managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance; managing the technical training staff responsible for designing and facilitating technical training; qualified Practical Process Improvement process manager responsible for facilitating PPI project team training and PPI efforts within LLI

Steven C. Davies, B.S., Manager, Transportation and Sample Bottles

Education:

B.S. Elementary Education, Lancaster Bible College (1987)

Professional Experience:

With Lancaster Laboratories since 1990
- Transportation Coordinator (1991)
- Transportation Group Leader (1994)
- Transportation and Sample Bottles Group Leader (1998)
  - Responsibilities included supervise personnel; schedule lab work; manage financial resources; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers.
- Transportation and Sample Bottles Manager (2005)
  - Responsibilities include supervise personnel; schedule lab work; manage financial resources; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers.

Irene Lynn Dodd, M.B.A., Principal Specialist, Environmental Business Development

Education:

B.A. Chemistry, Washington & Jefferson College (1988)
M.B.A. Pennsylvania State University (1993)

Continuing Education:

Mass Spectral Interpretation Course (1991)
High Impact Communication Skills (1992)
GC Troubleshooting Course (1993)
Selected courses at Millersville University (1996)
Effective Technical Communication (2000)
Business Writing for Results (2002)
Signature Service (2002)
The Counselor Salesperson (2004)
Pennsylvania Chamber Annual Environmental Laws and Regulations Conference (2004, 2005, 2006, 2007)
Conceptual Selling (2009)
Intermediate II and Advanced Excel (2011)

Professional Experience:

Stauffer Chemical Company, Food Chemist (1987-1988)
With Lancaster Laboratories since 1988
Chemist (1991)
Senior Chemist (1995)
Senior Specialist (1997)
Principal Specialist, Environmental Business Development (2003)
Responsibilities include: project management; review and approve data; consult with clients regarding testing needs; work with external auditors; assist with client visits to the lab, advise clients on testing; provide price quotes; monitoring turnaround time; audit sample entry; answer client questions; communicate client requirements to lab areas; provide status reports, including results, to clients; provide sampling containers; and schedule sample submissions.

Memberships and Appointments:

American Chemical Society
National Society of Collegiate Journalists
American Business Women's Association
President (1998-1999); Vice President (1994-1995, 1997-1998); Secretary (2000-2001); Newsletter Chair (1993-1994, 2001-2003); Business Associate Night Chair (2000); Woman of the Year (1999, 2004); Thelma Farley Memorial Award (1995); Hospitality Chair (2003-2004) with Wheatland Conestoga Chapter
Vice President of Communications (2006-2007, 2007-2008) and Formation committee (2006-2007); Woman of the Year (2007) for Lancaster Area Express Network; Regional and National Newsletter Award Winner (2008)
Girl Scouts in the Heart of Pennsylvania
Leader (2008-Present)

Amy L. Doupé, B.S., Principal Specialist, Quality Assurance

Education:

B.S. Environmental Studies, Allegheny College (1989)

Professional Experience:

With Lancaster Laboratories since 1994
Senior Technician, Volatiles by GC (1994)
Responsibilities included performing sample pre-screening.
Senior Administrator, Quality Assurance (1995)
Responsibilities included performing administrative and certification support
Specialist, Quality Assurance (1997)
Responsibilities include maintaining documentation of agency certifications
Senior Specialist, Quality Assurance (2003)
Responsibilities included maintaining documentation of agency certifications
Principal Specialist, Quality Assurance (2009)
Responsibilities include maintaining documentation of agency certifications

Memberships & Appointments:

The NELAC Institute (TNI) Proficiency Testing Board
The NELAC Institute (TNI) Proficiency Testing Committee
Pennsylvania Association of Accredited Laboratories (1997-present)
Maryland Environmental Laboratory Association (1999-present)
Florida Society of Environmental Analysts (2010-present)

Gregory J. Drahovsky, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Forensic Science, Alvernia College (2006)

Professional Experience:

With Lancaster Laboratories since 2006
- Chemist Title, GC/MS Semivolatiles (2006)
  - Responsibilities included analyzing data for various methods; maintaining instrumentation including GC/MS (5890/5971) (5890/5972) (6890/5973) (6890/5975) (TRACE GC Ultra/DSQII); making standards for various types of methods; calibrating departmental syringes
- Senior Chemist, GC/MS Semivolatiles (2011)
  - Responsibilities include analyzing data for various methods; maintaining instrumentation including GC/MS (5890/5971) (5890/5972) (6890/5973) (6890/5975) (TRACE GC Ultra/DSQII); making standards for various types of methods; emptying waste in designated shed; training others on different analyses; calibrating departmental syringes

Awards, Citations, Honorary Societies, and Publications:

Berks County Undergraduate Research Conference Publication (2004)
Beta Kappa Chi science honors society (2006)

Christine M. Dulaney, B.A., Senior Specialist, GC/MS Volatiles

Education:

B.A. Biology, Meredith College (1984)

Continuing Education:

Waters Fundamentals of HPLC, Compuchem Laboratories (1989)

Professional Experience:

Compuchem Laboratories (1984-1998)
- Extraction Technician (1984-1986)
  - Responsibilities included performing extraction of various environmental matrices for pesticide GC analysis and semivolatile GC/MS analysis; extracting quarterly PE samples
- GC Technician (1986-1989)
  - Responsibilities included performing analysis of environmental extracts for pesticides, PAHs, and volatile organic compounds using GC, HPLC, and purge and trap, respectively; performing routine instrument maintenance
- Senior Chemist, Pesticide Review (1990-1995, 1996-1998)
  - Responsibilities included performing qualitative and quantitative review of pesticide, PAH, and volatile organic data; reviewing instrument maintenance and standard logbooks

With Lancaster Laboratories since 1998
- Chemist, Pesticide Residue (1998)
  - Responsibilities included reviewing GC pesticide residue data packages; responding to client inquiries and ICARs
- Project Management Specialist, Pharmaceutical Client Services (2003)
  - Responsibilities included managing details of various pharmaceutical client accounts using the laboratory information management system; acting as liaison between the client and internal laboratory personnel
- Senior Specialist, GC/MS Volatiles (2005)
  - Responsibilities include auditing data for various GCMS volatile analyses; verifying data within the laboratory information management system; reviewing standard preparation logbooks; signing final analytical reports

Eric L. Eby, B.S., Senior Chemist, Metals

Education:

B.S. Biology, Millersville University (1988)

Continuing Education:

OSHA 40-hour Hazardous Waste Management, Phoenix Safety Associates (1991)
DX500 Maintenance and Troubleshooting, Dionex (1996)
The Chemistry Behind the Techniques, EAS, Inc. (1996)
Cleaning Validation Strategies, Applied Analytical Industries, Inc. (1997)
Gas Chromatography Practical Theory and Applications, Lancaster Laboratories (1998)

Professional Experience:

With Lancaster Laboratories since 1988
Associate Chemist (1993)
Responsibilities included environmental wet chemistry testing and field sampling.
Chemist (1997)
Senior Chemist, Pharmaceutical Raw Materials (1998)
Responsibilities included IC, TOC analysis, IC maintenance, USP purified water testing, raw materials testing, USP <661> container closure testing.
Senior Chemist, Pharmaceutical Product Testing (2000)
Responsibilities included pharmaceutical product testing per client specific methods, IC and HPLC maintenance.
Senior Chemist, Metals (2005)
Responsibilities include ICP analysis for environmental testing and ICP instrument maintenance.

Jaime L. Ferguson, A.S., Senior Specialist, Billing & Reporting

Information not available at time of printing.

Erik J. Frederiksen, B.A., Manager, Water Quality and Instrumental Water Quality

Education:

B.A. Chemistry, University of Virginia (1990)

Continuing Education:

Infrared Spectral Interpretation (1993)

Professional Experience:

With Lancaster Laboratories since 1990
Chemist/Coordinator (1993)
Group Leader (1994)
Responsibilities included supervising personnel; managing laboratory operations; project management; managing financial resources; reviewing and approving data
Manager, Water Quality and Instrument Water Quality (2005)
Responsibilities include supervising personnel; managing laboratory operations; project management; managing financial resources; reviewing and approving data

Lynn Frederiksen, B.S., Principal Specialist Group Leader, Environmental Client Services

Education:

B.S. Conservation and Resource Development, University of Maryland (1981)

Professional Experience:

University of Missouri, Senior Research Lab Technician (1982 – 1984)
GPU Nuclear Corporation, Data Analyst (1985 – 1989)
With Lancaster Laboratories since 1989
Senior Specialist (1989)/Team Leader, Environmental Client Services (2006)
Responsibilities included: consult with clients regarding testing needs; revise and update SOPs; provide price quotes; audit sample entry; answer client questions; communicate client requirements to lab areas; provide status reports, including results, to clients; schedule sample submissions and provide sampling containers; assist Group Leader with training of new employees and delegating new projects.
Senior Specialist Group Leader, Environmental Client Services (2007)
Responsibilities included: managing a team of client service representatives, training of new employees, setting up and delegating new projects, serving as primary project manager for several large petroleum clients and consultants.
Principal Specialist Group Leader, Environmental Client Services (2011)
Responsibilities include serving as the primary contact or back-up with the laboratory for a number of assigned clients requiring specialized testing or complex projects; understanding and communicating technical information and client requirements to laboratory personnel, helping to ensure that requirements are met; leading broad-based complex projects to a satisfactory conclusion according to client technical and schedule requirements; developing strong relationships with major accounts resulting in additional sales; advising and training other members of the department; serving as a technical resource both internally and externally; proactively assisting Outside Business Development with client visits, presentations, and internal audits for assigned clients; participating on PPI teams

Joseph M. Gambler, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Chemistry, Millersville University (1996)

Professional Experience:

Wyeth, Biological Manufacturing Technician (1996)
With Lancaster Laboratories since 1996
Senior Chemist, GC/MS Semivolatiles (1996)
Responsibilities includes training new hires, maintaining GC/MS systems, preparing standards/stocks/spikes, maintaining Helium supply system, data interpretation, ordering supplies, auditing, and crosstrained in Pesticides Department.

Matthew R. Gehman, B.S., Senior Specialist, Environmental Health and Safety Officer, Human Resources

Education:

B.S. Occupational Safety and Environmental Health, Millersville University (2002)

Continuing Education:

24-Hour Emergency Response (HAZWOPER), Lancaster Laboratories (2004)
IATA/DOT 49 CFR, DGI Training Center (2004)
American Red Cross First Aid/CPR/AED certified, Lancaster Laboratories, Inc. (2004)
Advanced RCRA, Environmental Resource Center (2004)
In-depth Environmental Compliance, PA Chamber (2005)
In-depth Environmental Compliance, PA Chamber (2006)
National Incident Command System, Command School, Inc. (2006)
Life Safety Code, NFPA (2006)
International Conference on Biocontainment Facilities, Tradeline (2006)
In-depth Environmental Compliance, PA Chamber (2007)

Professional Experience:

United States Army Reserve, Military Police, Staff Sergeant (1996-2004)
Responsibilities included supporting joint FBI and military intelligence operations in the Iraq Theater (2003); supervising law enforcement and force protection activities in support of Operation Noble Eagle (2002); ensuring team members met training standards; monitoring health and welfare of team members
With Lancaster Laboratories since 2004
Senior EHS Specialist, Environmental Health and Safety, Human Resources (2004-2007)
Responsibilities included employee health program administration; maintaining current and developing new safety programs; managing environmental compliance program
Senior Specialist, Environmental Health and Safety Officer, Human Resources (2007)
Responsibilities include managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program

Memberships and Appointments:

Central PA section of American Industrial Hygiene Association (AIHA)
Member (2004-present)
VFW, Post 7362
Member (2004-present)
American Biological Safety Association (ABSA)
Member (2007-present)

Susan M. Goshert, B.S., Principal Specialist Group Leader, GC/MS Volatiles

Education:

B.S. Chemistry, Juniata College (1988)

Continuing Education:

Advanced Aquarius Report Training, Hewlett-Packard (1989)
How to Handle People with Tact and Skill, Harrisburg Area Community College (1992)
Positive Attitude and Peak Performance, Harrisburg Area Community College (1992)

Professional Experience:

With Lancaster Laboratories since 1988
Chemist (1990)
Senior Chemist Coordinator (1997)
Responsibilities include: supervise personnel; review and approve data; and monitoring turnaround time.
Senior Specialist Group Leader, EPH/Misc. GC (2005)
Responsibilities include: supervise personnel; review and approve data; and monitoring turnaround time.
Principal Specialist Group Leader, GC/MS Volatiles (2008)
Responsibilities include: supervise personnel; review and approve data; and monitoring turnaround time.

Brian K. Graham, B.A., Senior Chemist, GC/MS Semivolatiles

Education:

B.A. Mathematics, Millersville University (1996)

Professional Experience:

With Lancaster Laboratories since 1989
Chemist, GC/MS Semivolatiles (1989-2006)
Senior Chemist, GC/MS Semivolatiles (2006)
Responsibilities include maintaining GC/MS instrumentation; tuning and calibrating GC/MS; analyzing samples by GC/MS; reviewing and assembling all supporting GC/MS data; preparing standards for calibrations; training new analysts

Nina C. Haller, Senior Specialist Group Leader, Metals

Continuing Education:

State Dairy Lab Cert., State of PA (1993)
Butterfat Testing License, State of PA (1995)
Seminar ICP/ICPMS, Fisons Instruments (1995)
Three-day ICP Trace Training Course, Thermo Jarrell Ash, MA (1996)

Professional Experience:

Hazelton Research Products, Lab Technician (1981-1984)
Responsibilities included rabbit production facility, removal of ovaries, care, and maintenance
With Lancaster Laboratories since 1987
Technical Associate, Foods (1987)
Responsibilities included coordinating Listeria Testing Program; performing data entry and verification
Chemist, Metals (1993)
Responsibilities included performing daily tracking of rushes; operating and maintaining ICP instrumentation; reviewing and verifying of ICP data, data package review
Specialist Group Leader, Metals (2003)
Responsibilities included overseeing the ICP/ICPMS personnel and instrumentation workflow; verifying ICP/ICPMS/GFAA/Hg data
Senior Specialist Group Leader, Metals (2006)
Responsibilities included overseeing the ICP/ICPMS personnel and instrumentation workflow; verifying ICP/ICPMS/GFAA/Hg data
Senior Specialist Group Leader, Metals (2007)
Responsibilities include overseeing metals instrument and verification personnel and instrumentation workflow; verifying metals data

Michele D. Hamilton, B.S., Senior Chemist Group Leader, Pesticide Residue Analysis

Education:

B.S. Chemistry, Temple University (1990)

Continuing Education:

Gas Chromatography: Practical Theory and Applications for LL (1993)
Practice of Modern HPLC, LC Resources (1996)

Professional Experience:

With Lancaster Laboratories since 1991
Senior Chemist (1997)
Senior Chemist/Coordinator (2000)
Responsibilities included supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC and HPLC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data
Senior Chemist Group Leader, Pesticide Residue Analysis (2005)
Responsibilities include supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC and HPLC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data

Sherri L. Harlan, M.B.A., Principal Specialist, Marketing & Communication Services

Information not available at time of printing.

Linda M. Hartenstine, B.A., Senior Chemist, GC/MS Semivolatiles

Education:

B.A. Chemistry, Millersville University (1994)

Professional Experience:

With Lancaster Laboratories since 1994
Associate Chemist (1994)
Chemist (1997)
Senior Chemist, GC/MS Semivolatiles (1998)
Responsibilities include performing GC/MS semivolatiles testing; operating GC/MS instruments; data interpretation; developing and evaluating new methods; calibrating and repairing instruments; preparing standards; revising and updating SOPs and analytical methods; training other analysts

Robert G. Heisey, Jr., B.A., Senior Specialist, Water Quality

Education:

B.A. Chemistry, Millersville State College (1972)

Professional Experience:

RCA Corp., Engineering Technician (1972-1987)
With Lancaster Laboratories since 1988
Chemist Coordinator (1989)
Senior Chemist Coordinator (1997)
Responsibilities included: supervise personnel; schedule lab work; review and approve data; develop and evaluate new methods; prepare test standards.
Senior Chemist Group Leader (2005)
Responsibilities included: supervise personnel; schedule lab work; review and approve data; develop and evaluate new methods; prepare test standards.
Senior Specialist, Water Quality (2006)
Responsibilities include: review and approve data; develop and evaluate new methods; prepare test standards; order laboratory supplies; maintain department's chemical inventory.

Tamara J. Heisel, Senior Specialist, Environmental Sample Administration

Professional Experience:

Willow Valley Retirement Communities, Certified Nursing Assistant (2000-2001)
Responsibilities included assisting nursing home residents with their daily activities and personal hygiene
Bayada Nurses, Certified Nursing Assistant (2000-2001)
Responsibilities included assisting people with disabilities in their homes with their personal hygiene and daily activities

With Lancaster Laboratories since 2001
Senior Administrator, Environmental Sample Administration (2001)
Responsibilities included performing sample receipt, interpretation, and entry
Specialist, Environmental Sample Administration (2001)
Responsibilities included performing sample receipt, interpretation, and entry
Senior Specialist, Environmental Sample Administration (2007)
Responsibilities include performing sample receipt, interpretation, and entry

Memberships and Appointments:

Lancaster Laboratories Safety Committee (2003-2007)

J. Wilson Hershey, Ph.D., Chairman of the Board, Lancaster Laboratories

Education:

B.A. Chemistry, Millersville State College (1972)
M.S. Chemistry, Villanova University (1983)
Ph.D. Analytical Chemistry, Villanova University (1985)
M.B.A., Villanova University (1991)

Professional Experience:

With Lancaster Laboratories since 1972
Director of Environmental Sciences (1986)
Executive Vice President (1991)
President (1995)
Responsibilities included presiding over all support and technical operations of Lancaster Laboratories; managing resources; establishing priorities to ensure the continued success of our business
Chairman of the Board (2011)
Responsibilities include reporting operational and financial to senior leadership of parent company; ensuring the continued success of Lancaster Laboratories

Awards, Citations, Honorary Societies & Publications:

12 publications in analytical chemistry and laboratory management

Jenifer E. Hess, B.S., Manager, Pesticide Residue Analysis, EPH/Misc. GC, Nitrosamines, Volatiles by GC

Education:

B.S. Chemistry, University of Delaware (1984)

Continuing Education:

21 credits towards M.B.A., University of Delaware

Professional Experience:

J. M. Huber Corporation, Research Chemist (1984-1985)
With Lancaster Laboratories since 1985
Chemist/Coordinator, Pesticide Residue Analysis (1989)
Group Leader, Pesticide Residue Analysis (1992)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis (1992)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis, EPH/Misc. GC (1996)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis, EPH/Misc. GC, Nitrosamines (1998)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis, EPH/Misc. GC, Nitrosamines, Volatiles by GC (2005)
Responsibilities include supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs

John P. Hook, B.S., Senior Chemist, Metals

Education:

B.S. General Science, Pennsylvania State University (2002)

Continuing Education:

ICP/ICP-MS Seminar, Perkin-Elmer (2003)
ICP-MS Seminar, Agilent (2004)
ICP-MS training, Perkin-Elmer (2005)
PPI Team Training, Lancaster Laboratories (2008)
Facilitator Training, ThermoFisher Scientific (2009)

Professional Experience:

Sony Technology Corporation, Manufacturing Staff (2002-2003)
Responsibilities included assembly, final inspection, and packaging of television sets
ALCOA Primary Metals, Laboratory Technician (2003)
Responsibilities included observation and maintenance of aluminum production pilot test operation; analysis of product
With Lancaster Laboratories since 2003
Chemist, Metals (2003)
Senior Chemist, Metals (2006)
Responsibilities include performing setup, analysis, and review of ICP, ICP-MS runs; maintenance and troubleshooting of ICP, ICP-MS instruments; yearly, quarterly and start-up ICP instrument qualifications including IECs, IDLs, MDLs, and LDRs; maintaining adequate laboratory supply inventory; disposing of acid waste; writing SOPs

Samuel A. Huber, B.S., Manager, Physical Services/Equipment Maintenance & Repair

Education:

B.S. Biology, Lebanon Valley College (1988)
Certificate of Business Administration, Penn State University (1995)

Continuing Education:

24-hour HAZWOPER (spill response) (1995-2004)
40-hour HAZWOPER (2005-present)
DOT/IATA training (2004-present)
Incident Command System IS-00100 (2006)
National Incident Management System IS-00700 (2006)
Total Productive Maintenance (2007)
Basic Electricity for the Non-Electrician (2009)
Air Conditioning and Refrigeration (2010)

Professional Experience:

With Lancaster Laboratories since 1988
Environmental department responsibilities (1988-2007)
Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; supervising method development
Manager, Physical Services/Equipment Maintenance & Repair (2007)
Responsibilities include overseeing facilities staff and operation of physical plant and grounds; growth planning; overseeing security functions

Awards, Citations, Honorary Societies & Publications:

Dawson-Grundmann Innovation Award, Lancaster Laboratories (1999)
Design and oversee installation of bulk solvent delivery system for organic extractions; annual savings in waste reduction and labor costs of greater than $12,000
Organizing the Laboratory to Efficiently and Accurately Process Soil Samples, Pittcon poster session (2006)
NFPA Industrial Fire Protection Section Member (2009-present)

Christine M. Jampo, M.S., Senior Specialist, Environmental Business Development/Sales

Education:

B.S. Chemistry/Biology, West Chester University (1987)
M.S. Environmental Health, West Chester University (1996)

Professional Experience:

ERM, QA/Chemist/Consultant (1987-1997)
Responsibilities included QA chemistry, client/lab/field liaison, data validation/technical review, project management
Self Employed/Consultant, Environmental Consultant (1997-2001)
Responsibilities included data interpretation and analysis; QA/QC of field and laboratory data
Prudential Fox & Roach Realtors, Realtor/Sales Professional (2004-2010)
Responsibilities included residential real estate sales including buyer, seller and relocation services
With Lancaster Laboratories since 2010
Senior Specialist, Environmental Business Development/Sales (2010)
Responsibilities include developing new business revenue for LL by performing account management duties for existing accounts and prospects in the commercial and DOD markets; identifying and securing sales opportunities through phone calls, sales visits, presentations, team selling, quotes, and proposals; generating new business opportunities consistent with our operational capabilities and capacity

Sara E. Johnson, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Chemistry, Biochemistry option, Millersville University (2006)

Professional Experience:

With Lancaster Laboratories since 2006
Chemist, Flexible Staffing (2006)
Responsibilities included flexing to various departments as needed and performing analysis ranging from GC/MS to SDS-PAGE Electrophoresis with colloidal blue or silver staining
Chemist, GC/MS Volatiles (2008)
Responsibilities included performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation
Senior Chemist, GC/MS Volatiles (2010)
Responsibilities include performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation; assisting other employees with any questions that may arise and helping to train new employees

Mark Kaiser, Director; Pharmaceutical and Environmental Microbiology; Biopharmaceutical Services; Stability Services

Education:

Elizabethtown College, Biology 120 credits (1983)

Continuing Education:

Fundamentals of D, Z, and F Valves, PDA (1989)
Viable and Nonviable Environmental Monitoring, PDA (1990)
Validation in the Pharmaceutical Microbiology Laboratory, Applied Analytical Laboratories (1993)
Introduction to Capillary GC, Hewlett-Packard (1993)
HP5890 GC Troubleshooting and Maintenance, Hewlett-Packard (1993)
Design and Validation of Sterilization Processes, PDA (1998)
Introduction to Basic Laboratory Techniques in Biotechnology, PDA (1999)
Microbiology and Engineering of Sterilization Processes, PDA (2000)

Professional Experience:

With Lancaster Laboratories since 1983
Technician, Food Microbiology (1983)
Responsibilities included performing microbiological testing of food and feed products
Senior Technician, Bioassays (1984)
Responsibilities included performing antibiotic bioassays, schedule testing, supervise analysts, review and approve results, technical contact for clients
Group Leader, Bioassays, Environmental Microbiology (1986)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance of bioassays and environmental microbiology; developing new assays and services; acting as technical contact for clients
Group Leader, Pharmaceutical Microbiology and Environmental Microbiology (1989)
Responsibilities included establishing pharmaceutical microbiology services at Lancaster Laboratories; developing and validating services for sterile and non-sterile product testing as well as support for facility validation and monitoring; establish GMP and compliance systems; managing technical operations, quality, regulatory compliance, and financial performance; acting as technical contact for clients; marketing new services to prospects and clients

Manager, Pharmaceutical Microbiology and Pharmaceutical Sample Storage (1996)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical microbiology; acting as technical and marketing contact for clients and prospects; managing centralized storage systems and facilities for pharmaceutical samples
Manager, Pharmaceutical and Environmental Microbiology, Stability Services, Pharmaceutical Sample Storage (2001)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical and environmental microbiology and stability services; acting as technical and marketing contact for clients and prospects; managing centralized storage systems and facilities for pharmaceutical samples
Director (previously titled Manager), Pharmaceutical and Environmental Microbiology, Biopharmaceutical Services, Stability Services, Pharmaceutical Sample Storage (2004)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical and environmental microbiology and stability service; acting as technical and marketing contact for clients and prospects; managing centralized storage systems and facilities for pharmaceutical samples; establishing biopharmaceutical services at Lancaster Laboratories; managing the development, set up, and validation of molecular, cell, and viral service offerings for the biopharmaceutical industry; establishing GMP and compliance systems; managing technical operations, quality, regulatory compliance, and financial performance for biopharmaceuticals
Director, Pharmaceutical and Environmental Microbiology, Biopharmaceutical Services, Stability Services, Pharmaceutical Sample Storage, Pharmaceutical Sample Entry (2006)
Responsibilities include managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical and environmental microbiology and stability service; acting as technical and marketing contact for clients and prospects; managing centralized sample entry, storage systems and facilities for pharmaceutical samples; establishing biopharmaceutical services at Lancaster Laboratories; managing the development, set up, and validation of molecular, cell, viral, and mycoplasma service offerings for the biopharmaceutical industry; establishing GMP and compliance systems; managing technical operations, quality, regulatory compliance, and financial performance for biopharmaceuticals

Memberships & Appointments:

PDA, Delaware Valley Chapter, Past Vice President
PDA, Delaware Valley Chapter, Program Committee
PDA, Microbiology Interest Group
PDA, Container/Closure Task Force
Pharmaceutical Stability Discussion Group (PSDG) (2001)

Richard H. Karam, B.S., Manager, Organic Extraction/Leachate Preparation/GC/MS Volatiles/GC/MS Semivolatiles

Education:

B.S. Environmental Studies, Green Mountain College (2000)

Professional Experience:

Severn Trent Laboratories (2000-2006)
Project Manager (2005-2006)
Responsibilities included managing environmental projects; writing case narratives; project set up
Analytical Chemist (2000-2005)
Responsibilities included analyzing environmental samples for various general chemistry parameters, metals by ICP/ICPMS, pesticides/PCBs/herbicides by GC, and semivolatiles by GC/MS
With Lancaster Laboratories since 2006
Group Leader, GC/MS Semivolatiles (2006)
Responsibilities included coordinating production in GC/MS Semivolatiles; reviewing and signing reports
Manager, GC/MS Semivolatiles (2007)
Responsibilities included ensuring the accuracy and acceptability of all data generated by the GC/MS Semivolatiles group; coordinating daily prioritization of workload and monitoring the holding time and turnaround time status of samples; responding to client questions regarding GC/MS Semivolatiles data and methods and communicating technical issues or concerns about samples to project managers for clarification or resolution with the client
Manager, Organic Extraction/Leachate Preparation/GC/MS Volatiles/GC/MS Semivolatiles (2008)
Responsibilities include ensuring the accuracy and acceptability of all data generated by the groups; coordinating daily prioritization of workload and monitoring the holding time and turnaround time status of samples; responding to client questions regarding data and methods and communicating technical issues or concerns about samples to project managers for clarification or resolution with the client

Dana M. Kauffman, Manager, Sample Support and Data Deliverables

Continuing Education:

Introduction to Electronics, Lancaster County Career & Technology Center, Brownstown (1994)
AC/DC Electronics, Lancaster County Career & Technology Center (1995)
Gas Chromatography: Principles and Practices, Lancaster Labs University (2003)

Professional Experience:

With Lancaster Laboratories since 1994
- Lab Technician (1995)
- Senior Technician (1996)
- Sample Support Coordinator (1997)
- Group Leader, Sample Support (1999); Group Leader, Volatiles by GC (2002)
  - Responsibilities included supervising personnel; managing laboratory operations; project management; sample preparation; developing and evaluating new methods; reagent preparation; revising and updating SOPs; ordering supplies; training other analysts; running the automated storage and retrieval system; lab cleaning and maintenance; monitoring laboratory activities; performing internal audits; enforcing regulatory compliance requirements; maintaining required certifications; communicating client requirements to lab areas
- Manager, Sample Support and Data Deliverables (2005)
  - Responsibilities include overseeing all upfront sample handling requirements including storage, preservation, homogenization, moisture determination, volatile prescreen, and volatile soil prep; supervising group leader personnel; project management; revising and updating SOPs; performing internal audits; enforcing regulatory compliance requirements; maintaining required certifications; communicating client requirements to lab areas; data package and EDD TAT monitoring; overseeing all data package processes including data assembly, review, and processing; Practical Process Improvement (PPI) process manager responsible for facilitating PPI project team training and PPI efforts within LL

Nicole M. Kepley, B.S., Senior Chemist Group Leader, Instrumental Water Quality

Education:

AA Psychology, Harrisburg Area Community College (1997)
B.S. Psychobiology, Lebanon Valley College (2000)

Professional Experience:

With Lancaster Laboratories since 2000
- Senior Technician, Instrumental Water Quality (2000)
  - Responsibilities included various prep analyses, data entry, TOC and TOX analyses.
- Chemist, Instrumental Water Quality (2003)
  - Responsibilities included performing various analyses, verification, and review and revise SOPs.
- Senior Chemist, Instrumental Water Quality (2006)
  - Responsibilities include performing various analyses, method development, verification, and review and revise SOPs.
- Senior Chemist Group Leader, Instrumental Water Quality (2009)
  - Responsibilities include performing various analyses, method development, verification, and review and revise SOPs; acting as a technical resource, trainer, and troubleshooter; making recommendations for operational and/or technical improvements; coaching and developing direct reports; planning and monitoring workflow.

Awards, Citations, Honorary Societies, and Publications:

Phi Theta Kappa National Honor Society (Alpha Nu Omega) (1996-2000)

Katherine A. Klinefelter, M.S., Principal Specialist, Environmental Client Services

Education:

B.S. Chemistry, Rutgers University (1983)
M.S. Physiology, Rutgers University (1985)

Continuing Education:

Additional graduate work in Physiology, Rutgers University (1985-1989)
Practical Process Improvement (Team Member Training), Lancaster Labs University (2009)

Professional Experience:

Rutgers University, Research and Teaching Assistant (1984-1989)
M. S. Hershey Medical Center of Penn State University, Senior Research Technician (1990-1993)
With Lancaster Laboratories since 1993
- Environmental Project Management
- Senior Specialist, Environmental Client Services (1993)
- Senior Specialist/Coordinator, Environmental Client Services (1996)
- Senior Specialist, Environmental Client Services (2000)
- Principal Specialist, Environmental Client Services (2007)
  - Responsibilities include project management; training new client service representatives; auditing sample entry; answering client questions; communicating client requirements to lab areas

Awards, Citations, Honorary Societies & Publications:

Dean's Graduate Student Dissertation Research Award, Rutgers University
Dean's Graduate Student Travel Award, Rutgers University
Steinetz Memorial Fund Award, Department of Biological Sciences, Rutgers University
10 abstracts and 3 scientific papers on membrane transport physiology
4 presentations on membrane transport physiology
Quarterly Impact Award for Practical Process Improvement (2009)

Wendy A. Kozma, B.S., Principal Specialist Group Leader, Environmental Client Services

Education:

B.S. Environmental Science, Allegheny College (1991)

Professional Experience:

Roy F. Weston, Inc. (1992-1993)
With Lancaster Laboratories since 1993
Senior Specialist, Environmental Client Services (1996)
Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
Principal Specialist, Environmental Client Services (2004)
Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
Principal Specialist Group Leader, Environmental Client Services (2006)
Responsibilities include performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers

Rachel L. Kreamer, B.S., Manager, Environmental Client Services

Education:

B.S. Biology, Eastern Mennonite College (1980)

Continuing Education:

Financial Accounting, Penn State (2005)
Behavioral Science in Business, Penn State (2006)
Price and Markets, Penn State (2006)

Professional Experience:

With Lancaster Laboratories since 1987
Client Services Specialist, Environmental Client Services (1990)
Environmental Project Manager, Environmental Client Services (1994)
Coordinator, Environmental Client Services (1996)
Group Leader, Environmental Client Services (1996)
Responsibilities included: supervise personnel; training; revise and update SOPs; and monitoring turnaround time.
Manager, Environmental Client Services (2005)
Responsibilities included: supervise personnel; training; revise and update SOPs; and monitoring turnaround time.
Manager, Pharmaceutical Client Services (2005)
Responsibilities included: supervise personnel; revise and update SOPs; training.
Director, Professional Scientific Staffing – VA (2007)
Responsibilities included: managing all aspects of the PSS group in VA.
Director, Bay Area Service Center (2008)
Responsibilities included: managing all aspects of the bay area service center.
Manager, Environmental Client Services (2009)
Responsibilities include: managing all aspects of the environmental client services group.

Awards, Citations, Honorary Societies & Publications:

Senior Leadership Group Achievement Award (1996)

M. Susan Kreider, Senior Specialist, Data Deliverables

Continuing Education:

Chemistry and Psychology courses, F&M College

Professional Experience:

General Cigar Co., R&D Center, Laboratory Technician (1963-1966)
Responsibilities included testing tobacco products; smoke analysis; nicotine and tar analysis; preparing samples for gas chromatography
Company F. Weaver, Inc., Laboratory Technician (1966-1967)
Responsibilities included performing microbiological testing of food products, both raw materials and finished products; training factory employees in sterile food handling
Microbiological Associates, Inc., Stock Line/Sterile Technician (1968-1969)
Responsibilities included performing cancer research; dissection of animal and human tissue for cell line production; freezing of live cells; all phases of sterile lab work
Warner Lambert Co., Assistant Microbiologist/Organic Chemistry Technician (1970-1975)
Responsibilities included performing microbiological and chemical testing of raw material and finished products
Julia Winifred & Co. (Jacks III), Sales Clerk (1982-1983)
Responsibilities included retail sales; preparing windows and displays in store
With Lancaster Laboratories since 1983
Laboratory Technician, ExpressLAB (1983)
Responsibilities included performing sample prep and analyses
Senior Technician, ExpressLAB (1986)
Responsibilities included performing sample prep and analyses
Chemist, ExpressLAB (1988)
Responsibilities included performing sample prep and analyses
Specialist, Pesticide Residue Analysis (1998)
Responsibilities included performing sample prep and analyses
Specialist, EPH/Misc. GC (2003)
Responsibilities included performing sample prep and analyses
Specialist, Data Deliverables (2005)
Responsibilities included validating and sending data deliverables
Senior Specialist, Data Deliverables (2006)
Responsibilities include validating and sending data deliverables

Robert M. Large, B.S., Director, Environmental Client Services/Inside Business Development/Sample Administration/Data Deliverables/Sample Support/Bay Area Service Center

Education:

B.S. Zoology, Pennsylvania State University (1973)

Continuing Education:

Chromatography/Mass Spectral Interpretation, Finnigan MAT Institute (1981)
Foundations of Management, Gilbert Associates (1982)
M.B.A. Program, St. Joseph's University (1984-1987)
How to Market Professional Services, ACIL (1990)

Professional Experience:

Gilbert Associates, Inc., Program Manager (1977-1984)
Spotts, Stevens, & McCoy, Director of Client Services (1984-1990)
With Lancaster Laboratories since 1990
Marketing Specialist, Environmental Client Services (1990)
Group Leader, Environmental Client Services (1994)
Manager, Environmental Client Services (1995)
Responsibilities included: supervise personnel; project management; various office tasks; interpret QC implications to data quality; and advise clients on testing. Set up and managed the Bay Area Service Center in Richmond, CA (2001). Manage Environmental Sample Administration (2002). Manage Inside Business Development (2003).
Director, Environmental Client Services/Business Development/Sample Administration/Bay Area Service Center (2005)
Responsibilities include: supervise personnel; project management; various office tasks; interpret QC implications to data quality; and advise clients on testing. Set up and managed the Bay Area Service Center in Richmond, CA (2001). Manage Environmental Sample Administration (2002). Manage Inside Business Development (2003). Assisted setting up Professional Scientific Staffing (PSS) for a major biotech client (2004). Manage Data Deliverables and Sample Support (2010).

Elizabeth Leonhardt, M.E.M., Senior Specialist Group Leader, Bay Area Service Center

Education:

A.S. Biology, Santa Rosa Junior College (2000)
B.S. Animal Physiology & Neuroscience, University of California, San Diego (2002)
M.E.M. Natural Resource Management, University of Queensland, St. Lucia (2004)

Continuing Education:

DOT/IATA certified (2002)
Japanese Language, Diablo Valley College (2009)

Professional Experience:

MEC Analytical, Benthic Laboratory Technician (2002–2003)
Responsibilities included benthic invertebrate assessment; water quality monitoring; field sampling; stormwater monitoring; rapid stream bioassessment; freshwater crustacean taxonomy; provided assistance in microbiology and bioassay laboratories
With Lancaster Laboratories since 2005
Project Manager, Bay Area Service Center (2005)
Responsibilities included working as a liaison between the client and laboratory, as well as within the laboratory's departments, to ensure that projects are completed in a timely fashion and that the proper analyses are performed; provides technical and regulatory assistance to clients as needed; provides verbal and written quotations to clients; coordinates the efforts of assigned employees to provide coverage for all areas of responsibility; assists in packing and shipping as needed
Senior Specialist Group Leader, Bay Area Service Center (2006)
Responsibilities include working as a liaison between the client and laboratory, as well as within the laboratory's departments, to ensure that projects are completed in a timely fashion and that the proper analyses are performed; providing technical and regulatory assistance to clients as needed; providing verbal and written quotations to clients; coordinating the efforts of assigned employees to provide coverage for all areas of responsibility; assisting in packing and shipping as needed; assisting in EnCore preparation as needed; managing the bottle order operation for the Bay Area Service Center

Parker D. Lindstrom, B.S., Senior Chemist, Metals

Education:

B.S. Chemical Oceanography, Millersville University (2002)

Continuing Education:

Comprehensive Gas Chromatography Seminar, RESTEK (2002)
Comprehensive GC/MS Seminar, RESTEK (2002)
Statistics at Lancaster Laboratories, LLU (2005)
24-hour HAZWOPER, LLU (2006)

Professional Experience:

Fred Fiorentino, Assistant Laborer (1997-2002
Responsibilities included roofing, painting, general construction, clean-up, installation of windows, doors, stairs, decking
Dr. Kerper, Office Assistant (2000-2002)
Responsibilities included filing, cataloging children's books
Millersville University IMC/IMS, Media/Education Assistant (2000-2002)
Responsibilities included assisting teachers in creating media for the classroom, editing video and audio projects
With Lancaster Laboratories since 2002
Associate Chemist/Senior Chemist, GC/MS Volatiles (2002)
Responsibilities included running purge and trap and GC/MS to analyze samples and QC for VOCs; performing purge and trap and GC/MS maintenance
Senior Chemist, Metals (2006)
Responsibilities included running ICP/MS; verifying samples; performing maintenance; prepping samples; general troubleshooting for metals department; installation, maintenance and operation of CVAF low level Mercury; providing general computer help to Computer Services department
Senior Chemist Metrology, Metals (2009)
Responsibilities include helping the instrument (Metrology) group maintain and qualify HPLCs, GCs, and other pharmaceutical instruments; helping with other qualifications as needed (hoods, storage units, etc); for a short time in 2009 verifying data in Water Quality department

Memberships and Appointments:

Emergency Response Team (Spill Team), Lancaster Laboratories (2006)

Kathleen M. Loewen, B.S., Director, Quality Assurance

Education:

B.S. Biology, West Virginia Wesleyan College (1969)

Continuing Education:

Environmental Analytical Quality, Hewlett Packard (1988)
Environmental Analytical Laboratory Services, NUS (1989)
Symposium on Waste Testing and Quality Assurance, USEPA (1990-1996 annual attendance)
RCRA Quality Assurance Workshop, USEPA (1990)
Quality Assurance Workshop, USEPA (1991)
Environmental Seminar Series on SPE, GPC, and HPLC, Millipore (1992)
Conference on Quality Assurance in Environmental Monitoring (1993)
Solid Phase Micro Extraction, Supelco (1994)
Analytical Strategy for the RCRA Program, USEPA (1995)
Guidance Course on SW-846 Chapter One, IAETL (1995)
The Environmental Regulation Course, Executive Enterprises (1996)
GMPs Today & Tomorrow, University of Rhode Island (1997)
Complying with Laboratory cGMP Requirements, American Society for Quality (1997)
The Management of Change, Society of Quality Assurance (1997)
Leadership Conference, James Madison University (1998)
Training the Trainer, Society of Quality Assurance (1998)
Advanced QA Techniques for Facility Inspections, Society of Quality Assurance (1998)
Auditing Computer Validation, Society of Quality Assurance (1999)
Required Quality Records (Under Critical Elements & NELAC) PAAEL (2000)
Advanced 'concepts in Computer Validation – "Maintaining the Validated State" SQACVC (2000)
ISO 17025: The New Standard for Laboratory Quality A2LA (2000)
Measurement Uncertainty A2LA (2000)
Application of ISO/IEC 17025: Uncertainty & Traceability, ILAC (2000)
Assuring Ethical Practices in the Laboratory, ACIL (2001)
Computer Validation, Part 11, Stelex University (2001)
Part 11 Meets CROMERRR, SQA (2001)
GAMP Computer Validation Initiative, SQA (2001)
Laboratory cGMP Compliance, FDA/PQI (2001)
Good Clinical Practices, SQA (2002)
Digging Deeper into Validation, SQA (2002)
Managing Process Deviation and Failure Investigations, CPT (2002)
Quality Responsibilities of Management, SQA (2003)
New Horizons in the Life of a GLP Auditor, SQA (2003)
FDA Inspection Etiquette, FDI (2004)
Biotechnology (Intro, Auditing Techniques, Data Review SQA (2004)
Change Control revisited, PDA (2005)
Analytical Instrument Qualification USP <1058>, LabCompliance (2005)
FDA/EU Compliance for Analytical Laboratories, LabCompliance (2005)
GMP Regulations for GLP Auditors, SQA (2006)
Preparing your Organization for the 'New' part 11, LabCompliance (2006)
FDA's Expectations for cGMPs for QC Laboratories, Analysts/Process Chemists, Compliance Solutions, LLC (2006)
Value Added Auditing, SQA (2007)
Bioanalytical-PK, Biomarkers, Method Validation; Valve-added Auditing, SQA (2007)
Investigating OOS Test Results for Pharmaceutical Production, Ben Astrum (2007)
Advanced Good Laboratory Practice, SQA (2008)
Environmental QA/QC Requirements, Association of Public Health Laboratories (2008)
Successfully Using the One-Page Manager, QA Edge (2008)
The New TNI Lab Accreditation Standard, NY/PAAAEL (2010)
Disney Customer Service: Improve Your Quality & Raise Expectations, Progressive Business (2011)
Internal Audits: Meeting FDA Expectations, FOI (2011)
10 Essential Audit Questions, Paton (2011)

Professional Experience:

Microbiological Associates, Biology Laboratory Technician (1969-1970)
Schuyler Laboratories, Laboratory Technician (1970-1971)
Victor F. Weaver, Inc., Labeling Specifications Supervisor/Liaison with USDA (1985-1988)

With Lancaster Laboratories since 1988
Quality Assurance Specialist (1988)
Quality Assurance Senior Specialist/Coordinator (1991)
Quality Assurance Director, previously titled Officer (1996)
Responsibilities include supervising the Quality Assurance Unit which includes monitoring of current GLP and GMP activities, review of procedures and analytical data, work with client and agency audits and correspondence, enforcement of regulatory compliance requirements, regulatory and client document review, quality improvement, QA policy development and maintenance, and prompt follow-up of any quality or corrective action issues

Memberships & Appointments:

American Society of Quality (ASQ)
Institute of Validation Technology (IVT)
Mid-Atlantic Region Society of Quality Assurance (MARSQA)
Computer Validation Committee
PDA
Society of Quality Assurance (SQA)

Jason M. Long, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Chemistry, Shippensburg University (2004)

Professional Experience:

EA Engineering Science & Technology, Lab Tech (2004)
Responsibilities included setting up and running tests in toxicology lab; cleaning glassware used in performing tests; titrating for alkalinity and pH of water samples
With Lancaster Laboratories since 2004
Chemist, GC/MS Volatiles (2004)
Responsibilities included analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers
Senior Chemist, GC/MS Volatiles (2007)
Responsibilities include analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; troubleshooting problems on GC/MS, purge and traps, and autosamplers

Marla S. Lord, B.S., Senior Specialist, GC/MS Volatiles

Education:

B.S. Industrial Hygiene, Purdue University (2000)

Continuing Education:

OSHA 8-Hour (2000)
Comprehensive GC/MS Seminar, Restek (2002)
Practical Process Improvement Facilitator Training (2010)

Professional Experience:

ALCOA, Industrial Hygiene Intern (1999)
Responsibilities included performing air sampling for a variety of substances; conducting noise survey including area and personal sampling; testing plant environment for heat stress and evaluated reports; assisting in formulation of written program
BP-Amoco Refinery/Orr Professional Services, Industrial Hygiene Technician (2000)
Responsibilities included performing air sampling to reevaluate Benzene Exposure Surveillance Program; conducting noise surveys including area and personal monitoring to reevaluate Hearing Conservation Program
With Lancaster Laboratories since 2000
Senior Technician, Volatiles by GC (2000)
Responsibilities included performing prescreen analysis, sample prep, GC maintenance, and data review
Chemist, GC/MS Volatiles (2001)
Responsibilities included analyzing samples and QC by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers
Senior Specialist, GC/MS Volatiles (2006)
Responsibilities include performing GC/MS volatile data interpretation; reviewing and approving data; signing reports; analyzing samples; generating raw data; sample verification; SOP revisions and updates

Dorothy M. Love, B.S., Principal Specialist Group Leader, Quality Assurance

Education:

B.S. Environmental Health, Indiana University of Pennsylvania (1981)

Professional Experience:

Sun Transport, Inc., Safety Assistant (1980-1981)
Texas A & M University, Research Assistant (1982-1984)
Texas Water Commission, Chemist (1984-1986)
GHR Analytical, Chemist (1986-1987)
Clean Harbors, Inc., Senior Chemist (1987-1989)
With Lancaster Laboratories since 1989
- Senior Specialist (1989)
- Senior QA Specialist (1998) Coordinator (2000)
- Principal Specialist/Coordinator, Quality Assurance (2003)
  - Responsibilities included supervise personnel; train other QA staff; revise and update analytical methods; monitor laboratory activities and corrective action for quality issues; perform internal audits; work with external auditors; review lab data and procedures; enforce regulatory compliance requirements; and review/write client/lab Quality Assurance Project Plans (QAPP).
- Principal Specialist Group Leader, Quality Assurance (2005)
  - Responsibilities include supervise personnel; train other QA staff; revise and update analytical methods; monitor laboratory activities and corrective action for quality issues; perform internal audits; work with external auditors; review lab data and procedures; enforce regulatory compliance requirements; and review/write client/lab Quality Assurance Project Plans (QAPP).

Duane A. Luckenbill, B.S., Director, Environmental Sciences

Education:

B.S. Chemistry, Clarion University of PA (1989)

Continuing Education:

Introduction to Mass Spectral Interpretation, Hewlett-Packard (1995)
Technical Training, OI Analytical (1995)

Professional Experience:

ATEC Associates, Inc., GC/MS Analyst (1989)
With Lancaster Laboratories since 1989
- Chemist (1991)
- Chemist/Coordinator (1993)
- Group Leader (1997)
- Manager (2001)
  - Responsible for client satisfaction, safety and quality systems administration, and all aspects of financial, personnel, and operations management of the GC/MS Volatiles and GC/MS Semivolatiles groups.
- Director (2005)
  - Responsible for client satisfaction, safety and quality systems administration, and all aspects of financial, personnel, and operations management of the GC/MS Volatiles, GC/MS Semivolatiles, Volatiles in Air, Organic Extraction, Leachate Preparation, Field Sampling, Pesticide Residue Analysis, Volatiles by GC, and EPH/Miscellaneous GC groups.

Awards, Citations, Honorary Societies & Publications:

Undergraduate Award in Analytical Chemistry, American Chemical Society (1988)
Department of Chemistry Competitive Award, Clarion University (1988 – 1989)
Outstanding Senior Chemistry Award, American Institute of Chemists Foundation (1989)
Senior College Award for Chemistry, Society for Analytical Chemists of Pittsburgh (1989)
1 publication on mass spectrometry

Nicole L. Maljovec, M.S., Senior Specialist Group Leader, Environmental Client Services

Education:

B.S. Chemistry, St. Bonaventure University (2004)
M.S. Adolescence Education, D'Youville College (2005)

Professional Experience:

CYTEC Industries, Industrial Hygiene Internship (2003-2004)
- Responsibilities included performing air monitoring and sampling; complying with OSHA standards; assisting R/D lab with the identification of unknown chemicals and wastes

Niagara Wheatfield, Environmental Science Teacher (2005-2006)
Responsibilities included teaching chemistry, chemistry lab, and environmental science; developing special education plans to assist students with learning disabilities
With Lancaster Laboratories since 2006
Specialist, Environmental Client Services (2006)
Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
Senior Specialist Group Leader, Environmental Client Services (2007)
Responsibilities include performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers; managing a team of client service representatives and administrative assistants, training of new employees, setting up and delegating new projects, serving as primary project manager for several large clients and consultants

Melissa McDermott, B.A., Senior Chemist, EPH/Misc. GC

Education:

B.A. Biology, Millersville University (1992)
Elementary Education Certification, PA (May 2009)
Middle School Science Certification, PA (July 2009)

Continuing Education:

Gas Chromatography Principles and Practices (1995)
Conflict Resolution and Confrontation Skills Seminar (1996)
Coaching Skills for Supervisors Seminar (1996)
Waste Testing and Quality Assurance Symposium (1996)
Entry Level Management (1997)
How to Deliver Exceptional Customer Service Seminar (1997)
Statistics at Lancaster Laboratories (2006)

Professional Experience:

With Lancaster Laboratories since 1992
Chemist, EPH/Misc. GC (1993)
Responsibilities included performing analysis of environmental samples for metals by AA flame and cold vapor generation; assembling client data packages
Chemist Coordinator, EPH/Misc. GC (1996)
Responsibilities included coordinating rush work; communicating with client service representatives regarding sample status; answering client questions; generating employee job plans; conducting employee evaluations
Senior Chemist, EPH/Misc. GC (1997)
Responsibilities included performing analysis of environmental samples for DRO and interpretive TPH analyses; verifying analyses performed by other analysts; preparing standards; revising departmental SOPs; method development; reviewing data packages
Senior Specialist, Environmental Client Services (1997)
Responsibilities included auditing sample entry; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions and providing sampling containers
Senior Chemist, EPH/Misc. GC (2002)
Responsibilities included reviewing and approving data; writing departmental methods; reviewing and approving data packages; acting as technical resource within department; answering client questions; monitoring and performing QA metrics
Senior Specialist, Environmental Client Services (2007)
Responsibilities included acting as technical resource between client services and laboratories; scheduling sample submissions and providing sampling containers; communicating client requirements to lab areas
Senior Chemist, EPH/Misc. GC (2009)
Responsibilities include reviewing and approving data; writing departmental methods; reviewing and approving data packages; acting as technical resource within department; answering client questions; monitoring and performing QA metrics

Roy R. Mellott Jr., B.S., Senior Chemist Group Leader, GC/MS Volatiles

Education:

B.S. Biology, Millersville University (1993)

Continuing Education:

Hazardous Waste Disposal, LLU (1996)
GC: Principles & Practices, LLU (1997)
GC/MS: Applications/Troubleshooting Seminar, ECS/MDL Systems, Inc. (1999)
GLP Training, LLU (1999)
Introduction to Interpretation of Mass Spectra, LLU (2005)
Interpretation of Mass Spectra, Intermediate, LLU (2005)

Professional Experience:

With Lancaster Laboratories since 1995
Senior Lab Tech I, GC/MS Volatiles (1995)
Responsibilities included requisitioning samples; performing sample storage, prescreening, discard, hazardous waste disposal; tracking down missing samples by various means
Chemist/Auditor, GC/MS Volatiles (1996)
Responsibilities included performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; calibrating and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data
Senior Chemist, GC/MS Volatiles (2002)
Responsibilities included performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; setting up, calibrating, and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data; updating/correcting SOPs and laboratory and analytical procedures; preparation, tracking and documentation of analytical standards used in the laboratory; training of new employees to the department
Senior Chemist Group Leader, GC/MS Volatiles (2005)
Responsibilities include performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; setting up, calibrating, and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data; updating/correcting SOPs and laboratory and analytical procedures; preparation, tracking and documentation of analytical standards used in the laboratory; training of new employees to the department

Memberships & Appointments:

Nature Conservancy (1998-present)
Lancaster Laboratories Ethics Committee (1999-2003)
Lancaster Herpetological Society, President (2005-present)

Betsy S. Menefee, B.S., Senior Specialist, Data Deliverables

Education:

B.S. Chemistry (cum laude), Salem College (1958)

Continuing Education:

Service Operations Process Optimization, Penn State University (1993)
Group Discussions (Management Course), Penn State University (1994)

Professional Experience:

Duke University, Research Assistant (1958-1959)
With Lancaster Laboratories since 1980
Senior Chemist, Metals (1985)
Senior Specialist, Metals (1999)
Responsibilities included reviewing data packages for accuracy, preparing inorganic data packages, and assisting with electronic deliverables
Senior Specialist, Data Deliverables (2006)
Responsibilities include reviewing data packages for accuracy, preparing inorganic data packages, and assisting with electronic deliverables

Awards, Citations, Honorary Societies & Publications:

2 scientific publications in analytical chemistry

Megan A. Moeller, B.S., Senior Specialist, Environmental Client Services

Education:

B.S. Environmental Science, University of Delaware (1999)

Professional Experience:

With Lancaster Laboratories since 1999
- Sample Administration/Client Service Specialist, Environmental Client Services (2003)
  - Responsibilities included Interpretation and entry of incoming samples. Route samples to the correct locations. Assist Client Service representatives with auditing, reviewing reports, and reviewing invoices.
- Specialist, Environmental Client Services (2004-2006)
  - Responsibilities included managing projects, prepare quotations, audit sample entries, answer client questions, communicate client requirements to lab areas, schedule sample submissions, and provide sample containers.
- Senior Specialist, Environmental Client Services (2006)
  - Responsibilities include managing projects, prepare quotations, audit sample entries, answer client questions, communicate client requirements to lab areas, schedule sample submissions, and provide sample containers.

Chad A. Moline, B.S., Senior Chemist Group Leader, GC/MS Semivolatiles

Education:

B.S. Environmental Studies, Slippery Rock University (1998)
Teaching Certification, Secondary Education, Millersville University (2003)

Professional Experience:

- Centre Analytical Laboratories, Lab Technician (1999-2000)
  - Responsibilities included running various wet chemistry analyses
- Lancaster Laboratories, Chemist/Senior Chemist (2000-2005)
  - Responsibilities included maintaining GC/MS instrumentation
- Warwick School District, Science Teacher (2005-2006)
  - Responsibilities included teaching chemistry and physics to 8th grade students
- Conestoga Valley School District, Science Teacher (2006-2007)
  - Responsibilities included teaching chemistry and earth science to 8th grade students
- With Lancaster Laboratories since 2007
  - Senior Chemist Group Leader, GC/MS Semivolatiles (2007)
    - Responsibilities include monitoring workflow; meeting client turnaround times

Kevin T. Moran, M.B.A., Senior Specialist, Environmental Business Development/Sales

Education:

B.S. Marine Engineering, U.S. Merchant Marine Academy (1972)
M.B.A. Marketing, Babson College (1981)

Professional Experience:

- SAIC, Regional Sales Manager (1994-1999)
  - Responsibilities included selling process treatment equipment for groundwater remediation to environmental consulting companies and industrial end users; managing a staff of seven engineers and technicians engaged in operating and constructing groundwater treatment systems.
- Mantech Environmental, Marketing Manager (1999-2000)
  - Responsibilities included developing strategy to target industrial customers with multiple sites for an innovative groundwater remediation technology.
- Hazleton Environmental, Marketing Manager (2000-2003)
  - Responsibilities included developing marketing strategy for sales of process treatment equipment to industrial and municipal users; aiding company in breaking into DOD market for treatment equipment.
- With Lancaster Laboratories since 2003
  - Senior Specialist, Environmental Business Development/Sales (2003)
    - Responsibilities include managing and growing revenue at assigned industrial accounts; using selling skills to add new industrial and environmental consulting firms for analytical services in New York, New Jersey, and New England.

Jeffrey S. Moyer, B.S., Senior Specialist Group Leader, Sample Bottles

Education:

B.S. Environmental Resource Management, Penn State University (1977)

Professional Experience:

Joseph A. Kodak, Carpenter's Helper (1977-1978)
Responsibilities included performing construction
BP Oil, Inc., Operations Supervisor (1978-1979)
Responsibilities included working on special projects in the regional operations office
Koch Hydrocarbon Company, Terminal Manager (1979-1997)
Responsibilities included managing the operation of a 24 hr/day, 365 day/year propane storage facility; coordinating inventory storage, product quality control, maintenance, safety, and personnel staffing and training; additional responsibilities included facility upgrades and expansion projects
With Lancaster Laboratories since 1997
Specialist, Environmental Sample Administration (1997)
Responsibilities included entering environmental samples for analysis; coordinating projects with client services; updating standard forms; filing client bottle orders; tracking change forms and forwarding updated info to SA department; tracking short hold/rush list; processing gold forms
Specialist, Environmental Client Services (1999)
Responsibilities included acting as technical resource for clients and SA entry; preparing quotes for clients; preparing bottle orders; scheduling sample pickups; auditing acknowledgements and client paperwork; troubleshooting client problems; updating standard forms; processing bottle orders, lab reports, acknowledgements, and COCs; handling reprint requests; preparing SDG reports
Senior Specialist Group Leader, Sample Bottles (2004)
Responsibilities include managing bottles department; coordinating projects with client services; updating bottle code and preservation sheets; updating SOPs; working with purchasing to ensure inventory levels are adequate; backing up transportation coordination

Jennifer L. Moyer, B.S., Senior Specialist, Metals

Education:

B.S. Chemistry, Lock Haven University (2000)

Professional Experience:

Lock Haven University, Lab Tech (1996-1998)
Responsibilities included setting up labs; stocking and setting up stock rooms; helping professors with projects
Croda Inc., Process Development Chemist (1998-2000)
Responsibilities included developing and improving procedures on existing products
With Lancaster Laboratories since 2000
Chemist, Metals (2000)
Responsibilities included running and maintaining ICP instruments
Chemist, Metals (2002)
Responsibilities included running and maintaining Graphite Furnace Atomic Absorption instruments
Group Leader/Specialist, Metals (2003)
Responsibilities included overseeing Graphite Furnace Atomic Absorption and Mercury analysts
Senior Specialist, Metals (2007)
Responsibilities include verifying ICP, GFAA, Mercury, and ICP-MS

Charles J. Neslund, B.S., Manager, Volatiles in Air and Specialty Services Group

Education:

B.S. Chemistry, University of Pittsburgh (1982)

Continuing Education:

Graduate studies in organic chemistry, University of Pittsburgh (1983)

Professional Experience:

- Lancaster Laboratories (1984-1996)
  - Chemist (1986)
  - Group Leader (1987)
  - Chemist (1991)
- OI Analytical, Sales Representative (1996)
- With Lancaster Laboratories since 1997
  - Group Leader, GC/MS Semivolatiles (1997)
    - Responsibilities included: supervise personnel; schedule lab work; manage laboratory operations and financial resources; project management; data interpretation; review and approve data; developing and evaluating new methods; consult with clients regarding testing needs; and revise and update SOPs and analytical methods.
  - Manager, GC/MS Semivolatiles and Volatiles in Air (2005)
    - Responsibilities included: supervise personnel; schedule lab work; manage laboratory operations and financial resources; project management; data interpretation; review and approve data; developing and evaluating new methods; consult with clients regarding testing needs; and revise and update SOPs and analytical methods.
  - Manager, Volatiles in Air and Specialty Services Group (2007)
    - Responsibilities include: supervise personnel; schedule lab work; manage laboratory operations and financial resources; project management; data interpretation; review and approve data; developing and evaluating new methods; consult with clients regarding testing needs; and revise and update SOPs and analytical methods; market specialty services capabilities, technical presentations

Awards, Citations, Honorary Societies & Publications:

- Dawson-Grundmann Innovation Award (1995)

Memberships & Appointments:

- American Chemical Society (ACS)
- Chromatography Forum of the Delaware Valley (CFDV)
  - Past member of Executive Committee of the Chromatography Forum of the Delaware Valley
- Air & Waste Management Association (A&WMA)
- Society of Environmental Toxicology and Chemistry (SETAC)
- Sediment Management Workgroup (SMWG)

Deborah A. Neslund, Senior Specialist Group Leader, Environmental Sample Administration

Professional Experience:

- Lancaster General Hospital, Phlebotomist (1976-1977)
- Fairfax Hospital, LPN (1978)
- Lancaster General Hospital, Phlebotomist/EKG Technician (1980-1986)
- With Lancaster Laboratories since 1986
  - Senior Specialist Coordinator
    - Responsibilities included: Supervise personnel; direct flow of samples to include prioritization to meet hold times and standards set for rush and other samples; develop and improve systems for efficiency within SA; represent SA in communications with Technical Groups, Client Services, and other support areas; log-in samples.
  - Senior Specialist Group Leader (2005)
    - Responsibilities include: Supervise personnel; direct flow of samples to include prioritization to meet hold times and standards set for rush and other samples; develop and improve systems for efficiency within SA; represent SA in communications with Technical Groups, Client Services, and other support areas; log-in samples.

Ryan V. Nolt, B.S., Principal Chemist Group Leader, GC/MS Volatiles

Education:

- B.S. Chemistry, Millersville University (1997)

Professional Experience:

- With Lancaster Laboratories since 1996
  - Clerk II, Sample Support (1996)
    - Responsibilities included performing ASRS operations, preserving incoming samples, homogenizing samples, packing bottle orders, and performing sample discard.
  - Senior Technician, ExpressLAB (1997)
    - Responsibilities included performing sample dilutions, preparing standards, prepping samples, and setting up new instruments.
  - Chemist, GC/MS Volatiles (1998)
    - Responsibilities included performing purge and trap and GC/MS maintenance; tuning and calibrating GC/MS system; analyzing samples; reviewing, working up, and assembling all supporting data; and preparing new standards.

Senior Chemist Coordinator, GC/MS Volatiles (2000)
Responsibilities included performing routine and non-routine laboratory analysis; diagnosing and solving technical problems; implementing improvements to maximize quality; maintaining and troubleshooting instruments; writing and revising standard operating procedures; validating new methods and equipment; assigning new work to instrument groups and monitoring productivity; and training new analysts.
Principal Chemist Group Leader, GC/MS Volatiles (2005)
Responsibilities include performing routine and non-routine laboratory analysis; diagnosing and solving technical problems; implementing improvements to maximize quality; maintaining and troubleshooting instruments; writing and revising standard operating procedures; validating new methods and equipment; assigning new work to instrument groups and monitoring productivity; and training new analysts.

Timothy Oostdyk, Ph.D., President, Lancaster Laboratories

Education:

B.A. Chemistry (cum laude), Franklin and Marshall College (1985)
Ph.D. Analytical Chemistry, Villanova University (1993)

Continuing Education:

ICP Seminar (1985)
ASMS Interpretation of Mass Spectra (1989)
Service Operations Process Optimization, Pennsylvania State University (1992)
Global Leadership Program, Thermo Fisher Scientific (2008)

Professional Experience:

Nabisco Brands Technology Center, Technician (Summer 1983)
With Lancaster Laboratories since 1985
Chemist/Coordinator (1986)
Group Leader (1988)
Manager (1990)
Director (1995)
Executive Vice President, COO (2000)
Responsibilities included supervising personnel and managing laboratory operations and financial resources
President (2011)
Responsibilities include presiding over all support and technical operations of Lancaster Laboratories; managing resources; establishing priorities to ensure the continued success of LL

Awards, Citations, Honorary Societies, and Publications:

Spirit of LL Award (1989)
Phi Beta Kappa, Franklin and Marshall College
Sigma Xi
10 scientific publications in analytical chemistry

Heidi L. Ortenzi, B.S., Senior Chemist, Organic Extraction

Education:

B.S. Environmental Science/Biology, Kutztown University (1996)

Continuing Education:

P.E. Spectroscopy Seminar, Perkin Elmer (1998)
Statistics, LLU (1999)
Pharm. Calc. Class, LLU (1999)
LLI Leadership Training (2000)
Practical Process Improvement Team Member Training (2008)
Practical Process Improvement Facilitator Training (2010)

Professional Experience:

M.J. Reider Associates, Lab Technician (1996-1997)
Responsibilities included organics prep/method development for HEM/various wet chemistry analyses.
With Lancaster Laboratories since 1997
Chemist, Metals (1998)
Responsibilities included performing metals analyses, maintenance of instruments, verification of analyses, analyzed GMP samples, administered quad studies, MDL studies, IDL studies.

Coordinator, Metals (1999)
Responsibilities included coordination of GFAA/FAA/Hg group, verification of analyses, instrument maintenance and operation, updating of SOPs, training records, quad studies, MDLs, and IDLs, performed GMP analyses.
Coordinator/Specialist, Environmental Client Services (2001)
Responsibilities included supervising Commercial Account Team and administrators, handle miscellaneous and homeowner calls, prepare bottle orders, audit sample paperwork, monitor sample progress, and handle client concerns.
Group Leader/Senior Specialist, Environmental Client Services (2005)
Responsibilities included supervising Account Management Team and administrator, work with team members on continual process improvement, manage several large client accounts, prepare bottle orders, audit sample paperwork, monitor sample progress, and handle client concerns.
Senior Chemist, Organic Extraction (2007)
Responsibilities include performing non-routine extractions, scheduling prep work, verification of prepped batches, processing MOS reports, managing projects for tobacco analyses, point person for project rollouts.

Awards, Citations, Honorary Societies, and Publications:

Senior Leadership Group Award, Lancaster Laboratories (2001, 2005, 2007)
Superlative Service Award, Lancaster Laboratories (2004, 2010)

Memberships and Appointments:

Ethics Committee, Lancaster Laboratories (1998)
MOS Process Improvement Team, Lancaster Laboratories (2005)

Anneliese H. Owen, M.B.A., Manager, Environmental Sample Administration

Education:

B.S. Molecular and Cell Biology, Pennsylvania State University (1986)
M.B.A. Pennsylvania State University (1993)

Professional Experience:

With Lancaster Laboratories since 1986
Coordinator (1987)
Client Services Specialist (1988)
Business Development Specialist (1990)
Group Leader, Environmental Sample Administration (1992)
Responsibilities included: supervise personnel; manage laboratory operations and financial resources; sample interpretation and entry; and monitor corrective action for quality issues.
Manager, Environmental Sample Administration (2005)
Responsibilities include: supervise personnel; manage laboratory operations and financial resources; sample interpretation and entry; and monitor corrective action for quality issues.

Linda C. Pape, B.A., Senior Chemist, GC/MS Volatiles

Education:

B.A. Business Administration, Millsaps College (1985)

Professional Experience:

Rite Aid Pharmacy, Store Manager (1985-1989)
Responsibilities included being responsible for overall maintenance and security of merchandise, store, and property; ordering and display of all merchandise; auditing daily cash and inventory reports; scheduling employees; payroll accounting; training of new and prospective personnel
With Lancaster Laboratories since 1993
Chemist, Volatiles by GC (1993)
Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality
Chemist, Water Quality (2000)
In addition to responsibilities listed above performed CN distillation, PO_4 digestion, and phenol distillation during a 3-month time frame

Senior Chemist, Volatiles by GC (2007)
Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees in Volatiles by GC soils

Senior Chemist, Volatiles by GC/MS (2008)
Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography/mass spectrometry; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees

Senior Chemist, GC/MS Volatiles (2009)
Responsibilities include analyzing client-submitted samples and their associated quality control samples; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees

Jill M. Parker, B.S., Senior Specialist, Environmental Client Services

Information not available at time of printing.

James H. Place, B.S., Senior Chemist, Pesticide Residue Analysis

Education:

B.S. Physical Science, York College of Pennsylvania (1997)

Professional Experience:

AMZ Corporation, Laboratory Technician (1998-2000)
Responsibilities included performing analysis and maintenance of chemical compositions pertaining to electroplating baths

Nichia America Co., Laboratory Technician (2000-2001)
Responsibilities included performing analysis of phosphorus for composition of pigments; performing sample screening and AA analysis

AMZ Corporation, Laboratory Technician (2001-2003)
Responsibilities included performing analysis and maintenance of chemical compositions pertaining to electroplating baths; conducting inventory and ordering chemicals

With Lancaster Laboratories since 2003

Chemist, Pesticide Residue Analysis (2003)
Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and SOPs; achieving quality results within the time-frame expected by our clients with minimal daily supervision; maintaining the GCs or HPLCs used for routine analyses; identifying and correcting common instrument or QC problems

Senior Chemist, Pesticide Residue Analysis (2008)
Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and SOPs; assisting in implementing special client requests; identifying and offering solutions to correct instrument problems and causes of QC problems; reviewing data for accuracy and completeness (for both routine and non-routine analyses, reports, or data packages); serving as a technical resource for the department

Christine M. Ratcliff, B.S., Principal Specialist, Volatiles in Air

Education:

B.S. Chemistry, Shippensburg University (1988)

Continuing Education:

Mass Spectral Interpretation, Finnigan MAT Institute (1990)

Professional Experience:

With Lancaster Laboratories since 1988
- Chemist (1991)
- Coordinator (1994)
- Group Leader (1996)
- Senior Chemist/Coordinator (1997)
- Senior Chemist (2002)
  - Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data
- Senior Specialist, GC/MS Semivolatiles (2005)
  - Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data
- Principal Specialist, GC/MS Semivolatiles (2009)
  - Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of GC/MS semivolatiles data in a timely manner
- Principal Specialist, Volatiles in Air (2009)
  - Responsibilities include reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of Volatiles in Air, GC/MS semivolatiles, and GC/MS volatiles data in a timely manner
- Principal Specialist, Volatiles in Air (2009)
  - Responsibilities include reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of Volatiles in Air, GC/MS semivolatiles, GC/MS volatiles, and dioxans and furans data in a timely manner

Mark A. Ratcliff, B.A., Senior Specialist, GC/MS Semivolatiles

Education:

B.A. Physics, Franklin & Marshall College (1988)

Continuing Education:

Finnegan Mass Spectral Interpretation Course (1991)

Professional Experience:

With Lancaster Laboratories since 1989
- Chemist (1992)
- Senior Chemist (1996)
  - Responsibilities included: perform GC/MS semivolatiles testing; operate GC/MS instruments; data interpretation; calibrating and repairing instruments; prepare standards; revise and update SOPs; and train other analysts.
- Senior Specialist, GC/MS Semivolatiles (2005)
  - Responsibilities include: perform GC/MS semivolatiles testing; operate GC/MS instruments; data interpretation; calibrating and repairing instruments; prepare standards; revise and update SOPs; and train other analysts.

Barbara F. Reedy, B.S., Senior Specialist, Quality Assurance

Education:

B.S. Environmental Biology, Millersville University (1993)

Continuing Education:

Environmental GC Analysis Seminar, Restek (2001)
The Internet Audit A Quality Tool, PaAAEL (2001)
Advanced Gas Chromatography Mass Spectroscopy Seminar, PaAAEL (2002)
LC/MS/MS System Seminar, Applied Biosystems (2006)
Introduction to Root Cause Analysis, Patton Professional (2007)
When to Initiate Corrective Action, Patton Professional (2007)
Practical Process Improvement Training in the role of Team Member (2008)
GC Pesticide/PCB's Analysis Training Seminar (2008)
NY/PAAAEL Annual Meeting - Internal & Electronic Audits: Satisfying Regulatory Requirements, Corrective and Preventive Actions, Ethics and Data Integrity Training (2009)

Professional Experience:

Department of Environmental Resources, Division of Rivers and Wetlands, Scientific Intern (1993)
- Responsibilities included reviewing wetland permits applications; inspecting and photographing wetland mitigation sites; determining hydrology, soil type, and the consistency of the mitigation with the approved project plans; researching records of the sites

With Lancaster Laboratories since 1993
Associate Chemist/Chemist, Volatiles by GC (1993)
Responsibilities included calibrating Capillary, VOA, BTEX, and FID instruments; performing routine maintenance; interpreting, reviewing, and uploading data
Senior Chemist, Volatiles by GC (1999)
Responsibilities included being primary verifier for the majority of data for Volatiles by GC for the ELCD/PID and FID for both waters and soils; signing of analytical reports; generating statistically determined QC windows; training new analysts to review and upload data into the LIMS
Senior Specialist, Quality Assurance (2001)
Responsibilities include ensuring quality of data being produced in the laboratories by performing data review, auditing laboratories, and reviewing written procedures; ensuring laboratory adherence to government regulations and client requirements; reviewing client and government documents for requirements outside our usual laboratory practices; setup and testing new analysis in the laboratory sample management system as required by the departments

Nelson H. Risser, M.B.A., Principal Chemist, Specialty Services Group

Education:

B.A., Chemistry, Shippensburg University (1977)
M.B.A., Pennsylvania State University (1995)

Continuing Education:

Quality Management College, Philip Crosby Associates (1989)
Validation of Computerized Systems for the Pharmaceutical Industry, PDA (1995)
Lab Equipment Qualification and Validation, Barnett International Conference Group (1999)
PreCovery Disaster Recovery Software, SunGard (1999)
Practical Process Improvement – Team Member Training (2009)
TSQ Quantum Vantage Operations, Thermo Scientific Training Institute (2009)
DFS High Resolution Magnetic Sector Mass Spectrometer Operations, Thermo Scientific (2009)

Professional Experience:

Frederick Cancer Research Center, Analytical Chemist (1977-1979)
Responsibilities included developing analytical methods to support cancer research efforts
Lancaster Laboratories, Technical Associate-Director (1979-2007)
Responsibilities included performing a broad scope of analytical tests utilizing manual wet chemistry, atomic absorption, purge and trap concentration, gas chromatography, ion chromatography, mass spectrometry, and other instrumental analyzers; managing staff chemists in the Environmental Services Division in analyzing water and soil for volatile organics using gas chromatography/mass spectrometry; supervising laboratory and support operations; supervising Computer Services staff performing software development and systems support; overseeing corporate computer operations in utilizing System Development Life Cycle processes to ensure validated computer systems are implemented and that a state of validation is maintained
With Lancaster Laboratories since 2008
Principal Chemist, Environmental Sciences (2008)
Responsibilities included performing sample analyses utilizing high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS)
Principal Chemist, Specialty Services Group, Environmental Sciences (2010)
Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Awards, Citations, Honorary Societies & Publications:

7 scientific papers on chemical analysis of carcinogens, solvent recovery, workforce scheduling

Robin C. Runkle, B.S., Senior Specialist, GC/MS Volatiles

Education:

B.S. Chemistry, State University of New York at Oneonta (1988)

Continuing Education:

Introduction to Mass Spectral Interpretation, Finnigan Mat (1991)
Gas Chromatography: Practical Theory and Applications for LL (1993)
HP5890 GC Troubleshooting and Maintenance, Hewlett-Packard (1993)
Technical Training, OI Analytical (1995)

Professional Experience:

With Lancaster Laboratories since 1989
Senior Chemist (1993)
Responsibilities included: sample preparation; perform GC/MS volatile testing; operate GC/MS instruments; data interpretation; review and approve data; developing and evaluating new methods; calibrating and repairing instruments; prepare standards; reagent preparation; revise and update SOPs and analytical methods; order supplies; train other analysts; and prepare and test trip blank water.
Senior Specialist, GC/MS Volatiles (2005)
Responsibilities include: data review and verification, review and sign reports, respond to and work on client inquiries and ATF requests.

Stephanie A. Selis, B.S.E., Senior Chemist, GC/MS Volatiles

Education:

B.S.E. Biology, Chemistry Minor, Millersville University (1996)

Professional Experience:

Access I, Access II, PC Focus (1997)
Emergency Evacuation Coordinator (1998)
Gas Chromatography Principles and Practices, Lancaster Laboratories University (1998)
GC/MS Theories and Applications, MDL Systems (1999)
Statistics, Lancaster Laboratories University (2000)

Professional Experience:

With Lancaster Laboratories since 1996
Chemist (1996)
Senior Chemist, Volatiles by GC (2000)
Responsibilities included: Sample analysis, troubleshooting and maintenance, system calibration, establish QC windows for soil analysis, write SOPs, data entry, prepare standards, sample verification, analyst training.
Senior Chemist, GC/MS Volatiles (2005)
Responsibilities include: Sample analysis, troubleshooting and maintenance, system calibration, establish QC windows for soil analysis, write SOPs, data entry, prepare standards, sample verification, analyst training.

Richard A. Shober, B.S., Principal Chemist, Pesticide Residue Analysis

Education:

B.S. Chemistry, Muhlenberg College (1984)

Continuing Education:

Inductively Coupled Plasma Spectroscopy, Allied Analytical (1985)
ACS Short Course, Analytical Chemistry of Contaminants in Surface and Groundwater (1986)
Gas Chromatography: Practical Theory & Application, Lancaster Laboratories (1994)
Mass Spectral Interpretation, Hewlett-Packard (1995)
Comprehensive HPLC, RESTEK (2010)

Professional Experience:

With Lancaster Laboratories since 1984
Principal Chemist, Pesticide Residue Analysis (1999)
Responsibilities include performing pesticide residue testing; operating gas chromatography instruments; interpreting data; repairing instruments; developing new methods for and operating LC/MS/MS; developing and maintaining computer systems/programs for lab use

Awards, Citations, Honorary Societies & Publications:

Poster paper on computer applications for analytical chemistry
Poster paper on tobacco specific nitrosamine analysis

Biographical Listings:

Who's Who in Environmental Science

Michele J. Smith, B.S., Senior Specialist, Specialty Services Group

Education:

B.S. Chemistry, St. Mary's College, Notre Dame, Indiana (1998)
22 credits master's study with Penn State University (2000-2002)

Continuing Education:

Gas Chromatography Principles and Practices, Lancaster Laboratories University (1999)
Statistics, Lancaster Laboratories University (2000)

Professional Experience:

St. Mary's College, Laboratory Teaching Assistant (1996-1998)
Responsibilities included: assisted professor in the laboratory—responsible for experiment demonstrations, answered student's questions, and graded lab reports.
With Lancaster Laboratories since 1998
Chemist (1998)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, review daily QC outliers.
Senior Chemist (2001)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, track samples to meet turn around time.
Senior Chemist Coordinator (2004)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, track samples to meet turn around time.
Senior Specialist Group Leader, GC/MS Semivolatiles (2005)
Responsibilities included: review and assemble GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, schedule and track samples to meet turn around time.
Senior Specialist, Environmental Client Services (2008)
Responsibilities included auditing sample paperwork; setting up standard forms; generating bottle orders; preparing quotes
Senior Specialist, Specialty Services Group (2011)
Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

Memberships and Appointments:

American Chemical Society (1998-2002)

Max E. Snavely, B.S., Senior Specialist, Metals

Education:

B.S. Chemistry, Lebanon Valley College (1977)

Continuing Education:

Inductively Coupled Plasma Spectroscopy, Thermo Jarrell Ash (1991)

Professional Experience:

Sterling Drug, Inc., Quality Control Chemist (1977-1980)
Andrew S. McCreath & Sons, Inc., Analytical Chemist (1980-1987)
With Lancaster Laboratories since 1987
Senior Chemist (1990)
Responsibilities included: operate ICP instruments; data interpretation; review and approve data; train other analysts; and coordinate performance evaluation samples.
Senior Specialist, Metals (2005)
Responsibilities include: operate ICP instruments; data interpretation; review and approve data; train other analysts; and coordinate performance evaluation samples.

Sarah M. Snyder, B.S., Senior Specialist, Pesticide Residue Analysis

Education:

B.S. Chemistry, Alvernia College (2004)
B.S. Forensic Science, Alvernia College (2004)

Professional Experience:

With Lancaster Laboratories since 2003
- Laboratory Technician, Organic Extraction (2003)
  - Responsibilities included prepping organic soil extractions of PCBs and tobaccos; washing glassware; running the Automated Solvent Extractor and nitrite instrument; prepping micro-extractions
- Chemist, EPH/Misc. GC (2005)
  - Responsibilities included maintaining and operating 5890 and 6890 FID-GC instrumentation; prepping standards; reading Diesel Range Organics and state specific samples; performing computer work
- Chemist, Pesticide Residue Analysis (2007)
  - Responsibilities included maintaining and operating 5890 and 6890 ECD-GC instrumentation; prepping standards; reading Herbicide and Organophosphate samples; performing computer work
- Specialist, Pesticide Residue Analysis (2007)
  - Responsibilities included reviewing data from all analyses; keeping track of department samples; signing reports; working with data package
- Senior Specialist, Pesticide Residue Analysis (2010)
  - Responsibilities include mentoring newer analysts; reviewing data from all analyses; keeping track of department samples; signing/reviewing reports; helping data packages with questions; helping with projects

Tara M. Spaide, Senior Specialist, Environmental Client Services

Continuing Education:

Algebra and Analytical Geometry, Pennsylvania State University (1993)
Chemistry, Pennsylvania State University (1993)

Professional Experience:

With Lancaster Laboratories since 1986
- Senior Specialist Coordinator, Organic Extraction (1997)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Chemist Coordinator, Organic Extraction (2003)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Chemist Group Leader, Organic Extraction (2005)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Specialist, Environmental Client Services (2007)
  - Responsibilities include auditing sample paperwork; setting up standard forms; generating bottle orders; preparing quotes

Dale R. Stoneroad, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Science, Chowan University (1998)

Professional Experience:

Analytical Laboratory Services, Inc., Chemical Specialist (1998-2010)
- Responsibilities included analyzing 525, 527 529 8270, 625 EPA methods; training fellow employees how to use new instrumentation; operating HP 5971, HP5972, HP5973, and HP5975 instruments; being responsible for standard prep and inventory; assisting in sample collection and sample preparation; serving as a data reviewer for the GC/MS volatile group; organizing workloads by due dates and reporting data into a company LIMS to be released to clients; performing minor and major maintenance of all GC/MS equipment

With Lancaster Laboratories since 2010
- Senior Chemist, GC/MS Semivolatiles (2010)
  - Responsibilities include operating, maintaining, and troubleshooting GC/MS instrumentation; operating HP5890/6890 GCs, 5971, 5972, 5973, 5975 Mass Spec. Thermo DSQII MS/Trace GCs; reviewing and interpreting data of various analyses including but not limited to 8270C, Appendix IX, 625, CLP 3/90, and 2/88; preparing standards for various methods; interpreting data and assembling data packages of batch data; evaluating and reviewing system procedures; performing GC/MS analysis

Awards, Citations, Honorary Societies, and Publications:

Resident Assistant of the Year (1996)
Employee of the Quarter (2002)
Employee of the Year (2007)

Andrew J. Strebel, Principal Chemist, GC/MS Semivolatiles

Continuing Education:

Advanced Aquarius Programmers Course, Hewlett-Packard (1989)
Environmental Applications of GC/MS, Indiana University (1989)
Environmental GC-MS (DOS) Operation, Hewlett-Packard (1995)
Unix Module 1, Albright College (1995)
Unix Module 2, Albright College (1995)
Unix Shell Scripts, Albright College (1995)
Unix AWK Programming, Albright College (1995)
Target Training, Thru-Put Systems, Inc. (1995)
Report Writer Training, Thru-Put Systems, Inc. (1998)
HP-UX System Administration for HP 9000s, Hewlett Packard (1998)
HP-UX Troubleshooting for HP 9000s, Hewlett Packard (1998)
GC/MS Training Course, MDL Systems (1999)
LC/MS/MS 101 Training Course, Basic Mass Spec Solutions, Inc. (2001)

Professional Experience:

With Lancaster Laboratories since 1986
Technical Specialist (1991)
Chemist (1994)
Senior Chemist (1997)
Principal Chemist, GC/MS Semivolatiles (2001)
Responsibilities include: perform routine semivolatile testing; operate GC/MS semivolatile instruments; data interpretation; review and approve data; developing and evaluating new methods; calibrating and repairing instruments; prepare standards; revise and update SOPs and analytical methods; train other analysts; develop and maintain computer systems/programs for lab use; and computer validation testing.

Robert Strocko, Jr., B.S., Manager, Metals

Education:

B.S. Biology, York College of Pennsylvania (1988)

Continuing Education:

Thermo Jarrel l ASA ICP Course, Thermo Jarrell ASA (1993)

Professional Experience:

Springettsbury Waste Water Treatment Facility, Chemistry Technician (1986-1988)
Responsibilities included running NPDES tests on wastewater, % solids, NH4, pH, BOD, suspended solids, coliform, dissolved solids, temperature, and Hexa-Chrome testing
Penn Dairies, Laboratory Technician (1988-1989)
Responsibilities included testing raw milk for coliform bacteria for acceptance; performing milk-fat percent solids on milk products; calculating sugar content in sweetened milk
Pennsylvania Department of Environmental Resources, Chemistry Technician (1989-1992)
Responsibilities included receiving samples; logging data for analysis to computer; handling field sampling questions; operating flame AA; shipping cooler to field samples
With Lancaster Laboratories since 1992
Chemist, Metals (1992)
Responsibilities included setting up, pouring, and running samples on ICP; reviewing and verifying ICP data; performing instrument maintenance; calculating IDLs, MDLs, and linear ranges; writing SOPs
Chemist/Coordinator, Metals (1996)
Responsibilities included overseeing prep room personnel and work flow; scheduling work flow through prep room; writing job plans and job reviews; ordering standards and reagents; overchecking notebooks
Manager, Metals (1998)
Responsibilities include overseeing technical areas in ICP, low-level mercury, ICP-MS, and mercury; writing SOPs, ICARs, etc.; writing job plans and job reviews; handling technical questions for clients/client services; verifying ICP data; signing reports

Christiane S. Sweigart, B.S., Senior Specialist, Electronic Data Deliverables

Education:

B.S. Science, Elizabethtown College (1985)
Medical/Technology Degree, St. Joseph School of Medical Technology (1985)

Continuing Education:

The Principals of Gas Chromatography (1993)
Statistics Course (1993)
Creative Training Techniques Conference (1997)

Professional Experience:

With Lancaster Laboratories since 1985
Chemist, GC/MS (1985)
Responsibilities included GC/MS operation targeting both VOA and BNA compounds, instrument maintenance, sample handling, and data handling (interpretation and documentation)
Chemist, GC/VOA (1986)
Responsibilities included GC operation targeting both aromatic and halogenated compounds, FID operation, instrument maintenance, sample handling, and data handling (interpretation and documentation). Training of others on FID methods, development of training/reference manual for FID, development of internal Operating Manual, standard documentation, definition and maintenance of Statistically defined windows, and temporary coordinator in Department 25.
Chemist Coordinator, GC/VOA (1993)
Responsibilities included coordination of sample analysis and data management; job plans and feedback for several personnel; communication both internal and external, and data handling (interpretation and documentation; and combination of existing department with another (personnel, instrumentation, sample volume).
Senior Specialist, Human Resources (1997)
Responsibilities included recruiting, training, and professional development.
Senior Specialist, Electronic Data Deliverables (2001)
Responsibilities include EDD generation, EDD content review, and communication (internal and external).

Awards, Citations, Honorary Societies & Publications:

Recognition for the implementation of a revamped New Hire Orientation (1999)
Recognition for the development and presentation of the Ethic's Refresher (2001)

Memberships & Appointments:

LCAHRM (1997-2001)

Lawrence M. Taylor, B.S., Senior Specialist, GC/MS Volatiles

Education:

B.S. Chemistry, Shippensburg University (1989)

Continuing Education:

QA Report Operator Training Course, Finnigan Mat Institute (1990)
Technical Training, OI Analytical (1995)
Mass Spectral Interpretation Course, Hewlett-Packard (1995)
Archon Training Course, PTS (1997)

Professional Experience:

With Lancaster Laboratories since 1989
Senior Chemist (1992)
Responsibilities included GC/MS volatile data interpretation; review and approve data; verify sample results, and sign reports.
Senior Specialist, GC/MS Volatiles (2005)
Responsibilities include GC/MS volatile data interpretation; review and approve data; verify sample results, and sign reports.

Lauren C. Temple, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Chemistry, Shippensburg University (2003)

Continuing Education:

Intro to Interpretation of Mass Spectra, Lancaster Laboratories University (2005)

Professional Experience:

With Lancaster Laboratories since 2003
Chemist, GC/MS Volatiles (2003)
Responsibilities included analyzing water and soil samples using purge and trap GC/MS; prepping samples and performing data review; performing maintenance as needed on purge and traps, GC/MS, and autosamplers
Senior Chemist, GC/MS Volatiles (2006)
Responsibilities include analyzing water and soil samples using purge and trap GC/MS; prepping samples and performing data review; performing maintenance as needed on purge and traps, GC/MS, and autosamplers; performing basic data review and audit; assisting in training new hires as needed

Valerie L. Tomayko, B.S., Senior Specialist Group Leader, Volatiles by GC

Education:

A.S. Chemical Engineering Technology, Pennsylvania State University (1977)
B.S. Human Resource Management, Geneva College (1993)

Professional Experience:

Hercules Inc., Laboratory Technician (1977-1983)
Antech Ltd., Associate Chemist, (1985-1989)
Quanterra (formerly Wadsworth/Alert), Chemist, (1989-1997)
UEC (United States Steel Engineering Consultants), Chemist (1997)
With Lancaster Laboratories since 1997
Senior Chemist, Pesticide Residue Analysis (1997)
Responsibilities included: data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Chemist Coordinator, Pesticide Residue Analysis (2001)
Responsibilities included: Monitor turnaround time and status of samples and packages; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Specialist Group Leader, Pesticide Residue Analysis (2005)
Responsibilities included: Monitor turnaround time and status of samples and packages; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Specialist Group Leader, Volatiles by GC (2006)
Responsibilities include: Monitor turnaround time and status of samples; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for GC Volatile analysis.

Luz C. Torres, B.S., Senior Specialist Group Leader, Data Deliverables

Education:

B.S. Secretarial Sciences, Catholic University of Puerto Rico (1982)

Continuing Education:

English as a Second Language, Spanish American Civic Association (1988)
Computer Literacy, Spanish American Civic Association (1989)

Professional Experience:

Dr. Jose Moro, Pediatrician, Administrative Secretary (1976-1986)
Responsibilities included customer service, answering phone, collecting payment, billing medical insurance, dictation, transcription, writing letters, filing, archiving, account receivables, ordering supplies.
With Lancaster Laboratories since 1988
Laboratory Assistant, Water Quality (1988)
Responsibilities included washing glassware, assisting technical staff by performing Odor and TDS analyses.
Clerk II, Data Deliverables (1991)
Responsibilities included data package assembly, tracking/preparing/sending QC summary reports, processing and sending data packages, generating and sending Lotus Text file disks, and DP content review.

Administrator I, II, III, Data Deliverables (1992)
Responsibilities included DP assembly, DP content review, review of analytical data, DP processing and sending, training new hires and current staff learning new tasks, DP corrections follow up.
Specialist Coordinator, Data Deliverables (1996)
Responsibilities included technical data review, package correction and problems investigation, Package TAT monitoring, oversee data package assembly, content review, and data package processing, documentation of departmental procedures, maintenance of database, interviewing, supervision of personnel
Senior Specialist Coordinator, Data Deliverables (2003)
Responsibilities included QA review, interviewing, supervision of personnel including writing job plan and performance evaluation, package correction and problems investigation, package TAT monitoring, documentation of departmental procedures, training new hires and cross-training employee from other areas, maintenance of method summary database, oversee data package assembly, content review, and data package processing.
Senior Specialist Group Leader, Data Deliverables (2005)
Responsibilities include QA review, interviewing, supervision of personnel including writing job plan and performance evaluation, package correction and problems investigation, package TAT monitoring, documentation of departmental procedures, training new hires and cross-training employee from other areas, maintenance of method summary database, oversee data package review and data package processing.

Timothy J. Trees, A.A.S., Principal Chemist, Specialty Services Group

Education:

Certificate, N.Y.S. Water/Wastewater Treatment Operations, Columbia Greene Community College (1985)
A.A.S. Environmental Control of Hazardous Waste/Water Quality, Ulster County Community College (1986)

Continuing Education:

Water Treatment Operations, NYS License Board (1984)
Wastewater Treatment Operations, NYS License Board (1986)
Varian AA Course (1992)
Service Operations Process Optimization, Pennsylvania State University (1992)
24-hour HAZWOPER (spill response) (1995)
Atomic Spectroscopy Workshop, Perkin-Elmer (1997)
Hitachi GFAA Workshop, Hitachi, CT (1994)

Professional Experience:

York Wastewater Management (1985-1986)
Rider Engineering (1986-1988)
With Lancaster Laboratories since 1988
Senior Technician, Metals (1988)
Responsibilities included: operation, maintenance, and sample preparation of mercury cold vapor and hydride generation instrumentation for the determination of mercury, arsenic, and selenium; data entry; troubleshooting instruments; repair of instrumentations' electronic system.
Chemist I, Metals (1990)
Responsibilities included: operation and maintenance of graphite furnace instrumentation; verification of mercury cold vapor and hydride generation data; coaching and training of personnel in the operation of mercury and hydride instrumentation; troubleshooting and repair of instrumentations' mechanical and electronic system.
Chemist I/Coordinator, Metals (1992)
Responsibilities included: operation and maintenance of graphite furnace instrumentation; ICP operation; verification of mercury cold vapor and hydride generation data; coaching and training of personnel in the operation of mercury, hydride, and graphite furnace instrumentation; troubleshooting and repair of instrumentations' mechanical and electronic system; systems operation optimization to increase production; scheduling of personnel for department operation; job plan and review with employees.
Chemist II/Coordinator, Metals (1993)
Responsibilities included: coaching and training of personnel in the operation of mercury, hydride, and graphite furnace instrumentation; assist clients with data interpretation and process improvement; ICP operation; verification of graphite furnace, mercury cold vapor, and hydride generation data; data package review; troubleshooting and repair of instrumentations' mechanical and electronic systems; system operations optimization to increase production; scheduling of personnel for department operation; job plan and review with employees.
Senior Chemist/Coordinator, Metals (1994)
Responsibilities included: operation, maintenance, repair, and troubleshooting of department graphite furnaces; flame atomic absorption, mercury cold vapor, hydride generation, and Inductively Coupled Plasma Instrumentation as well as computer systems used in the operation with these instruments; data qualification, interpretation, and verification of department workload; assist clients with interpretation of data, cause and effect; coaching and training of department personnel in areas of sample preparation, instrument setup, maintenance, and analysis using these instruments; job plan, review, and evaluation with employees; ordering of supplies; maintained operation of Metals Atomic Absorption for the department; method development for both environmental and pharmaceutical divisions for graphite furnace and ICP work; Set up and maintain, all SOPs and documentation for computer systems and instrumentation to comply with GMP regulations; data package review for metals analysis; review and verification of ICP data as needed.

Principal Chemist/Coordinator, Metals (1996)
Responsibilities included: operation, maintenance, repair, and troubleshooting of department graphite furnaces; flame atomic absorption, mercury cold vapor, hydride generation, and Inductively Coupled Plasma Instrumentation as well as computer systems used in the operation with these instruments; data qualification, interpretation, and verification of department workload; assist clients with interpretation of data, cause and effect; coaching and training of department personnel in areas of sample preparation, instrument setup, maintenance, and analysis using these instruments; job plan, review, and evaluation with employees; ordering of supplies; maintained operation of Metals Atomic Absorption for the department; method development for both environmental and pharmaceutical divisions for graphite furnace and ICP work; Set up and maintain, all SOPs and documentation for computer systems and instrumentation to comply with GMP regulations; data package review for metals analysis; review and verification of ICP data as needed.

Senior Chemist, GC/MS Semivolatiles (1998)
Responsibilities included: operation, maintenance, and troubleshooting of GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; review and data interpretation of various analyses including but not limited to, 8270C, Appendix IX, 625, CLP 3/90, and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures.

Principal Chemist, GC/MS Semivolatiles (2001)
Responsibilities included: operation, maintenance, and troubleshooting of GC/MS instrumentation; HP5890, 6890 GC, 5971,5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to 8270C, Appendix IX, 625, CLP 3/90 and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; analysis and troubleshooting of HPLC and analysis of PAHs; coaching and training of analysts to assist with troubleshooting; working in Pharmaceutical Method Development and Validation, operating LC/MS, LC/MS/MS, and GC/MS instrumentation, and performing instrument qualifications since June 2003.

Principal Chemist, Flexible Staffing (2006)
Responsibilities included working in GC/MS Volatiles in Air department; operation, maintenance, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to TO-15 and TO-14; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; ability to operate a variety of instrumentation and data systems.

Principal Chemist, GC/MS Semivolatiles (2007)
Responsibilities included operating, performing maintenance on, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971,5972, 5973, 5975 Mass Spec; setting up and performing method development of Thermo Fisher TRACE GC and DSQ II MS; performing method development using both EI and CI mode of analysis; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including, but not limited to, 8270C, Appendix IX, 625, CLP 3/90 and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; analysis and troubleshooting of HPLC and analysis of PAHs; coaching and training of analysts to assist with troubleshooting; Including working in GC/MS Volatiles in Air department; operation, maintenance, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to TO-15 and TO-14; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; ability to operate a variety of instrumentation and data systems.

Principal Chemist, Specialty Services Group (2011)
Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Abraham H. Uysal, M.S., Senior Data Review Specialist, GC/MS Volatiles

Education:

B.S. Chemistry, M.E. Tech. University-Turkey (1979)
M.S. Chemistry, M.E. Tech. University-Turkey (1982)

Professional Experience:

Aerotek, Senior Chemist (1997-1998)
Responsibilities included analysis of semivolatiles by GC/MS and analysis of volatile organics by GC/PID/ELCD.

Wastex Inc., Lead Supervisor (1998-1999)
Responsibilities included analysis of semivolatiles by GC/MS and analysis of pesticides/PCBs by GC/ECD.

M.J. Reider Assoc. Inc., Senior Chemist (1999-005)
Responsibilities included analysis of pesticides and PCBs by GC/ECD: Preparation, analysis, and data review.

With Lancaster Laboratories since 2005
Senior Data Review Specialist, GC/MS Volatiles (2005)
Responsibilities include auditing GC/MS volatiles data for accuracy and integrity.

Robert Todd Vincent, B.S., Principal Chemist, Organic Extraction

Education:

B.S. Chemistry, West Virginia Wesleyan College (2001)

Professional Experience:

With Lancaster Laboratories since 2001
- Chemist, EPH/Misc. GC (2001)
  - Responsibilities included analyzing samples; performing equipment repair; GC method development
- Chemist, Organic Extraction (2005)
  - Responsibilities included performing method development; equipment repair
- Senior Chemist, Organic Extraction (2007)
  - Responsibilities included performing method development; equipment repair; vendor relations; technology evaluation
- Principal Chemist, Organic Extraction (2011)
  - Responsibilities include performing high level, difficult preps (with minimal supervision or guidance) following standard operating procedures (SOPs); self train in new techniques; entering information into computer; training new or existing employees in extraction techniques or use of equipment; using knowledge to actively improve current processes; developing, enhancing, and validating new extraction methods; keeping work area clean and organized; preparing spikes; repairing equipment; updating departmental SOPs and training manual; disposing of wastes in approved manner; assisting in incident prevention and remediation when necessary

Heather E. Williams, B.S., Senior Chemist, EPH/Misc. GC

Education:

B.S. Forensic and Investigative Science, West Virginia University (2004)

Continuing Education:

Principles of Gas Chromatography, LLU (2007)

Professional Experience:

With Lancaster Laboratories since 2006
- Chemist, EPH/Misc. GC (2006)
  - Responsibilities included analyzing routine samples and their associated QC by gas chromatography for extractable petroleum products such as DRO, TPH, and other related materials; reviewing, calculating, and reporting the corresponding data and results; maintaining, optimizing, and calibrating Gas Chromatographs in an efficient and accurate manner; assisting in organization of department work, track samples, and prepare samples and standards to consistently meet turn around time requirements
- Senior Chemist, EPH/Misc. GC (2008)
  - Responsibilities include analyzing routine samples and their associated QC by gas chromatography for extractable petroleum products such as DRO, TPH and other related materials; reviewing, interpreting, calculating, and reporting the corresponding data and results; maintaining, optimizing, and calibrating Gas Chromatographs in an efficient and accurate manner; assisting in organization of department work, track samples, prepare samples and standards to consistently meet turn around time requirements; verify sample data

Donald E. Wyand, B.S., Director, Environmental Business Development/Sales

Education:

B.S. Chemistry, Lebanon Valley College (1989)

Continuing Education:

Graduate Chemistry, Villanova University

Professional Experience:

With Lancaster Laboratories since 1989
- Client Services Specialist (1990)
- Business Development Specialist (1993)
- Principal Specialist/Account Manager (1995)

Principal Specialist/Sales (1998) Principal Specialist/Coordinator/Sales, Environmental Sciences (2001)
Responsibilities included: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Principal Specialist/Group Leader/Sales (2005)
Responsibilities included: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Director, Environmental Business Development/Sales (2006)
Responsibilities include: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Memberships & Appointments:

American Chemical Society
Society of American Military Engineers
Society of Environmental Toxicology and Chemistry

Meng Yu, M.S., Principal Chemist, Specialty Services Group

Education:

B.E. Analytical Chemistry, Zhejiang University of Technology (1986)
Post Graduate, Biogeography and Environmental Assessment, University of Saarland (1996)
M.S. Chemistry, Catholic University of Leuven (1998)

Professional Experience:

Setsco Service Ltd, Executive Chemist (1999-2002)
Responsibilities included setting up new analyses for pharmaceutical and food testing using USP, BP, and AOAC methods; performing pesticide residue analysis using all kinds of GC

Cantest Ltd, Research Chemist (2002-2008)
Responsibilities included performing pesticide and drug residue method validation as per USDA, EPA, CFIA methods; performing bioanalytical method development and validation; UPLCMSMS, LCMSMS, LCMS and GCMS operation and maintenance

Pharmanet Inc. HSP Laboratory, Research Scientist (2008-2010)
Responsibilities included performing bioanalytical method development and validation, LCMSMS operation, tuning, and maintenance

With Lancaster Laboratories since 2010
Principal Chemist, Specialty Services Group (2010)
Responsibilities include developing and validating new testing methods; operating and maintaining LCMSMS instruments; performing sample analyses

Lancaster Laboratories

Environmental Quality Policy Manual

Appendix E
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Specialty Services	
10342	Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazine in Aqueous Samples by LC/MS/MS
10346	Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazine in Soil Samples by LC/MS/MS
10914	Separatory Funnel Extraction Procedure for the Determination of Dioxins/Furans (CDD/CDF) in a Water Matrix
10915, 11031	Determination of Tetra- Through Octa-Chlorinated Dioxins and Furans by HRGC/HRMS
10954	Determination of Selected Perfluorinated Alkyl Acids (PFAAs) in Aqueous Samples by LC/MS/MS
11016	Determination of Perfluorooctanoic Acid (PFOA) in Aqueous Samples by LC/MS/MS
11030	Dean Stark Soxhlet Extraction Procedure for the Determination of Dioxins/Furans (CDD/CDF) in a Solid Matrix
11639	Determination of Diuron, Fenuron and Monuron in Water Samples by SPE Extraction and LC/MS/MS
11663	Determination of Diuron, Fenuron and Monuron in Soil Samples by LC/MS/MS
11685	Determination of Endothall in Soil Samples by LCMSMS
MC-SP-001	DFS HRGC/HRMS Preventative and Corrective Maintenance
SOP-SP-001	Maintenance and Tuning for Thermo Scientific TSQ Quantum Access Tandem Mass Spectrometer with a Thermo Electron Accela HPLC System (LC/MS/MS)
SOP-SP-002	Fix or Adjustable Volume Handheld Pipettes
SOP-SP-003	Column Cleanup Procedure for Dioxins/Furans (CDD/CDF) Sample Extracts

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Procedure No.	Title
SOP-SP-004	Processing EPA 1613B PCDD/PCDF High Resolution Mass Spectrometry Data using TargetQuan 2.0
Tobacco Analysis	
0088	Extraction of Nicotine from Tobacco Products Using the Centers for Disease Control Protocol
0091	CDC Tobacco Moisture
0097	Analysis of Nicotine in Tobacco by GC/FID for Smokeless Tobacco Products Using the CDC Method
11067	Drying and Grinding for Cyclopamine
2745	Extraction of Nicotine and Minor Alkaloid from Tobacco
2264	Nitrite in Tobacco Prep
2266	Nitrite Nitrogen Analysis in Tobacco
2326LC	Extraction of Tobacco Specific N-Nitrosamines in Tobacco Filler
2610	Nitrate in Tobacco Prep
2608	Nitrate Nitrogen in Tobacco (Colorimetric, Automated Cadmium Reduction)
4998	Tobacco Drying and Grinding
5102	Analysis of Tobacco Specific Nitrosamines (TSNA) in Tobacco Leaf by LC/MS/MS
6870	Extraction of Nicotine from Tobacco and Tobacco Products
6878	Analysis of Nicotine in Tobacco by GC/FID Following Coresta 62
6883	Extraction of Tobacco for Benzo[a]Pyrene
6962	Column Cleanup of Tobacco for TSNAs
Transportation	
SOP-TR-001	Collecting Water Samples for Regulatory Purposes
SOP-TR-003	Sampling Swimming Pool Water
SOP-TR-010	What to Do in Case of Vehicular Accident or Breakdown
SOP-TR-018	Sample Pick-Up, Transportation, and Delivery
SOP-TR-019	Performing Free Chlorine Residual Readings
Volatiles by GC	
10902, 8419, 8432, 8416, 8418	Purgeable Halocarbons/Aromatics/Miscellaneous Organics in Water and Solid Samples
1635, 1636, 1728, 1729, 2762, 2763, 8229, 8268, 10598	Gasoline Range Organics (GRO) in Water Samples Using Purge and Trap Gas Chromatography
1637, 1638, 1700, 1725, 1726, 2765, 2766, 5550, 5551, 10599	Gasoline Range Organics (GRO) in Soils using Purge and Trap Gas Chromatography
2005, 2006, 8273, 8274	Determination of Volatile Gasoline Range Organics in Soil and Water - Northwest GX Method
2102, 8464, 8806	Purgeable Aromatics in Water Samples
8179	Purgeable Aromatics in High-Level Soils
8230	Tertiary Butylamine in Water Samples
8241	Purgeable Aromatics in Water Samples by Method 602
8465, 8466, 8467, 8470, 8476, 8478, 8482, 8484, 8893	Purgeable Halocarbons/Aromatics in Water Samples by EPA 601 and EPA 602
SOP-OR-020	Statistical Calculations Used in the Analysis of Samples by EPA Methodology
SOP-OR-065	Checking and Documenting of pH for Volatile Organic Samples
SOP-OR-070	Glassware Cleaning

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Procedure No.	Title
SOP-OR-075	Calibrating the 1-uL Standard Delivery Groove on the Archon Model 5100A and O.I. 4660 Autosampler Systems
SOP-OR-077	GC Routine and Nonroutine Maintenance
SOP-OR-080	Use of 40-mL Vials for Volatile Organic Analyses
SOP-OR-081 (Client-Specific)	Client-Specific PE Sample Preparation
SOP-OR-082	Using "Range Compound Analysis" Software for Range Data Acquisition
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0034	Oxygen and Carbon Dioxide in Air
10341	Helium as a Tracer Gas
10734	The Automated Determination of Volatile Organic Compounds in Air Collected in Specially Treated Canisters Using Cryogenic Preconcentration and Gas Chromatography with Mass Selective Detection Using NJDEP Modified Low Level Method TO-15
5265, 5298, 0015, 0037, 7199, 7869	The Automated Determination of Volatile Organic Compounds in Air Collected in Specially Treated Canisters or Tedlar Bags Using Cryogenic Preconcentration and Gas Chromatography with Mass Selective Detection Using EPA Method TO-14 or TO-15
6820	Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photoionization Detector for Louisiana RECAP Vapor Evaluation
7090	Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photoionization Detector
7345	SIM Analysis of Low-Level Volatile Organic Compounds in Air Collected in Specially Treated Canisters or Tedlar Bags Using Cryogenic Preconcentration and Gas Chromatography with SIM Mass Selective Detection Using EPA Method TO-15
MC-AL-002	Calibration of Pressure Gauges
MC-AL-003	Routine Instrument Maintenance for Volatiles in Air by GC and GC/MS
SOP-AL-001	Cleaning and Handling of Summa Canisters
SOP-AL-002	Cleaning and Handling of Flow Controllers
SOP-AL-003	Volatiles in Air Audit Process
SOP-AL-004	Procedure for Compositing Samples from a Tedlar Bag
SOP-AL-005	Preparing Summa Can Order
Water Quality	
0200, 10331	pH (WW) (electrometric)
0201, 0202	Analysis #0201 Alkalinity to pH 8.3 (titrimetric) Analysis #0202 Alkalinity to pH 4.5 (titrimetric)
0203	Total Solids in Waters (Gravimetric)
0204, 0205	Total Fixed Solids (Gravimetric) (#0204) Total Volatile Solids (Gravimetric) (#205)
0206	Total Suspended Solids in Waters (Gravimetric)
0207, 0208	Fixed Suspended Solids (Gravimetric) (#207) Volatile Suspended Solids (Gravimetric) (#208)
0209	Total Dissolved Solids (Calculation)
0210	Fixed Dissolved Solids (Calculation)
0211	Volatile Dissolved Solids (Calculation)
0212	Total Dissolved Solids in Waters (Gravimetric)
0215	Settleable Solids
0216	Total Hardness (Titrimetric Determination)
0221	Ammonia-Nitrogen for Waters (Titrimetric Distillation Procedure)
0225	Methylene-Blue-Active Substances (MBAS)
0226	Orthophosphate
0229	Sulfite
0230, 10293, 10499	Colorimetric Sulfide in Waters (#0230) Sulfide as H2S (#10293 calculation) Dissolved Sulfide in Waters (#10499)

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Procedure No.	Title
0234	Chemical Oxygen Demand (COD) (Dichromate Reflux Method) (Titrimetric, Mid-Level)
0235	Biochemical Oxygen Demand Determination in Waters by Incubation
0238	Free Carbon Dioxide (Calculation)
0240	Chlorine Residual
0263, 2200	(#0263) Fluoride by Ion Selective Electrode (ISE) (#2200) Distilled Fluoride by Ion Selective Electrode (ISE)
0276, 10330	Hexavalent Chromium (colorimetric)
0277	Color
0279	Turbidity (Nephelometric)
0280	Specific Conductance
0394, 0496	pH (SW) (Electrometric)
0425, 7825, 2432	Hexavalent Chromium in Solids (Alkaline Digestion and Analysis Methods)
0428	Dissolved Oxygen (Membrane Electrode)
0430	Determination of Flash Point for Liquids and Solids
0475, 0476	Acidity to pH 3.7 and pH 8.3 (titrimetric)
0521	Total Residue
0522, 1029	Volatile Residue (#0522) Total Fixed Residue/Ash (#1029)
0541	Soluble Biochemical Oxygen Demand Determination in Waters by Incubation
0542	Ignitability of Solids
0559	Dissolved Silica (Colorimetric)
0573	Ammonia-Nitrogen for Soils (Titrimetric distillation procedure)
10222, 10696	Ammonia Nitrogen by Ion-selective Electrode Method (ISE) in Solids
10695	Ammonia - Nitrogen in Water by Ion-Selective Electrode Method (ISE)
11145	Hexavalent Chromium (Colorimetric) in Waters by MCP
11146	Hexavalent Chromium in Solids by MCP (Alkaline Digestion and Analysis Methods)
1121	Reactivity
1122	Reactive Sulfide
1124	Chloride (Titrimetric Determination)
1125	Sulfate (turbidimetric) in Waters
1215	Specific Conductance (Solids)
1333	Sulfide Titration for Water
1364	Carbonaceous Biochemical Oxygen Demand Determination in Waters by Incubation
1441	pH (CLP) (Electrometric)
1443, 6569	#1443 Specific Gravity #6569 Bulk Density
1446	Low-Level Hexavalent Chromium (colorimetric)
1448	Bellack Distillation for Fluoride in Waters and Solids
1454, 1455, 1456	Bicarbonate (#1454), Carbonate (#1455), Hydroxide (#1456) Alkalinity (Calculation)
1459	Chemical Oxygen Demand (COD) in Waters (Dichromate Reflux Method) (Titrimetric, Low-Level)
1630	Acid Volatile Sulfide in Solids
1820	Paint Filter Liquids Test (Free Liquids Test)
1821	Oxidation-Reduction Potential
1962, 7825	Hexavalent Chromium in Solids by CTRCP (Alkaline Digestion and Analysis Methods)
1968	Hexavalent Chromium (Colorimetric) in Waters by CTRCP

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Procedure No.	Title
2365	Percent Solids for GC/MS
2562, 6598	n-Hexane Extractable Material (HEM) in Solids and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM)
4001	Chemical Oxygen Demand (COD) (Dichromatic Reflux Method) (Colorimetric)
4530	Total Acidity for Wastewater
6649	Total Dissolved Solids (Gravimetric) in Waters
6858	Moisture (Gravimetric)
6914, 4219, 2593	(#6914) Ammonia – Nitrogen by Ion-Selective Electrode Method (ISE) (#4219) Ammonia Distillation (#2593) Un-Ionized Ammonia
7103, 11601, 11604	Particle Size Distribution of Soils and Solids/Grain Size Classification
7120	UV254
8079, 8078, 0612	Hexane Extractable Material (HEM) and Silica Gel Treated Hexane Extractable Materials (SGT-HEM) in Waters by EPA Method 1664A
8344, 10328	Ferrous Iron
MC-WQ-002	Spectronic Genesys 2 Spectrophotometer
MC-WQ-004	Accumet Model AB30 pH/Ion/Conductivity Meter
MC-WQ-006	Equipment Incubators and Refrigerators
MC-WQ-007	pH Probes and Meters
MC-WQ-009	Equipment Muffle Furnaces and Ovens
MC-WQ-010	Calibration of Hach 2100AN Turbidimeter
MC-WQ-012	Maintenance of Desiccators
MC-WQ-013	Fixed Volume Hand-Held Pipettes
MC-WQ-014	Adjustable Volume Handheld Pipettes
MC-WQ-017	Hach DR 2800 Spectrophotometer
MC-WQ-022	Orion 960 Autotitration System
MC-WQ-023	YSI Model 5100 Dissolved Oxygen Meter
MC-WQ-024	Maintenance of Hot Plates
SOP-WQ-002	Standardization of 0.02 and 0.1 Normal Sulfuric Acid
SOP-WQ-005	Standardization of 0.02 Normal Sodium Hydroxide
SOP-WQ-006	Water Quality Washroom Procedures
SOP-WQ-014	Instructions for Collecting Data on the LLENS System
SOP-WQ-016	Chemical Review
SOP-WQ-017	Quality Control Data for Wet Chemistry

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Appendix F
Instrument and Equipment List

Current as of October 05, 2011
4 Total Pages (including this coversheet)

NOTE: Current lists available from technical departments.

Instrument	# of Units	Manufacturer/Model #
Liquid Chromatography/Gas Chromatography/Mass Spectrometry (LC/GC/MS)		
LC/MS/MS	3	Waters 2795 LC with Micromass Quattro micro MS/MS and Waters 2996 Photodiode Array UV-Vis Detector
LC/MS/MS	1	Thermo Scientific TSQ Quantum Access with Acella LC
LC/MS/MS	1	Agilent 1200 LC with Agilent 6410 MS/MS
GC/MS	1	Agilent 5971
GC/MS	6	Thermo Scientific DSQII
GC/MS	1	Agilent 5972
GC/MS	6	Agilent 5973
GC/MS	3	Agilent 5975
GC/MS	1	Thermo Scientific ISQ
GC/MS/MS	1	Thermo Scientific TSQ with Ultra Trace GC
HRGC/HRMS	3	Thermo Scientific DFS
Gas Chromatograph	23	Agilent 5890
Gas Chromatograph	19	Agilent 6890
Gas Chromatograph	5	Agilent 7890
Gas Chromatograph	4	Thermo Scientific
Gas Chromatograph	1	Varian 3400
Auxiliary Equipment for Gas Chromatographs		
Most of the GC/MS and GC systems include autosamplers and approximately half are fitted with purge and trap concentrators for analysis of volatiles.		
Purge/Trap Concentrators	13	OI 4560/4660
Autosamplers	2	Archon 5100/5100A
Autosamplers	44	Agilent 7683
Autosamplers	14	Agilent 7693
Autosamplers	6	OI 4551/4552
Autosamplers	11	EST Centruion
Autosamplers	7	Thermo Scientific AS TriPlus
Autosamplers	2	CTC Combipal Headspace
Automated Sampling System (Tedlar Bags)	1	Tekmar 2016/2032/LSC2000
Automated Sampling System (Summa Canisters)	3	Entech 7016CR Autosamplers
Automated Sampling System (Tedlar Bags/Summa Canisters)	1	Entech 7032A
Automated Concentrator	3	Entech 7100
Detectors available for GC: Electron Capture, Flame Ionization, Pthoionization, Hall Electrolytic Conductivity, Nitrogen/Phosphorus, and Thermal Conductivity. All of the chromatographs are connected to electronic integration systems.		
High Performance Liquid Chromatography		
High Performance Liquid Chromatograph	1	Agilent 1100 LC
High Performance Liquid Chromatograph	1	Agilent 1200 HPLC
High Performance Liquid Chromatograph	1	Hitachi L7000
High Performance Liquid Chromatograph	1	Shimadzu LC-10
High Performance Liquid Chromatograph	1	Shimadzu LC-6A or 6B
Gel Permeation Chromatography		
Gel Permeation Chromatograph	3	J2Scientific AccuPrep
Ion Chromatography		
Ion Chromatograph	1	Dionex DX320
Ion Chromatograph	1	Dionex ICS1000
Ion Chromatograph	1	Dionex ICS3000

Instrument	# of Units	Manufacturer/Model #
Ion Chromatograph	1	Dionex ICS2000
Ion Chromatograph	2	Dionex ICS1100
Atomic Absorption/Emission Spectrophotometry		
ICAP™ 6000 Duo ICP Analyzer	4	Thermo
ICP/MS	1	P/E Sciex Elan 9000
ICP/MS	1	Agilent 7500CC
Mercury Analyzer	1	Leeman Labs PS 200II
Mercury Analyzer	1	Leeman Labs Hydra II
Mercury Analyzer	1	Leeman Labs HYDRA AF_{GOLD+}
Mercury Prep Station	1	Thomas Cain DEENA 60
UV Vis/IR Spectrophotometry:		
UV-Vis Spectrophotometer	2	Spectronic Genesys
UV-Vis Spectrophotomenter	1	Hach DR2800
Miscellaneous Chemistry Instrumentation		
Block Digestion Systems	8	Environmental Express SC150
Block Digestion Systems	6	Environmental Express SC154
Centrifuge	6	Various
Chilled water recirculators	14	Various
Closed Cup Flashpoint Apparatus, Pensky-Martin	1	Fisher Scientific TA6
Cyanide Midi Distillation Kits	4	Various
Discrete Analyzer	1	Seal AQ2
Dissolved Oxygen Meter	1	YSI Model 59
Flow Solution Autoanalyzer	2	Alpkem
Glassware washer - automated	4	Miele – (2) PG8257 (1) G7827 (1) G7704
Kjehldal Distillation Apparatus	1	Fisher
Microwave Extractors	3	CEM MarsXpress
pH meters	8	Various
Phenol Midi Distillation	2	Andrews Glass
Pressurized Solvent Extractor	2	Dionex ASE200
Sonicators	9	Various
Total Organic Carbon Analyzer	2	O.I. Corp. 1030
Total Organic Carbon Combustion Analyzer	2	O.I. Corp. 1010
Turbidimeter	1	Hach 2100AN
Zero Headspace Extractor	74	Various Models
Microbiology Equipment		
Autoclave	2	Steris – Amsco,
Balance	5	Mettler, PB 3002
Balance	1	Mettler-Toledo, AT200
Balance	2	Mettler-Toledo, PR2002
Balance	1	Sartorius BP4100
Biological Safety Cabinet	4	NuAire NU-425-600 Type A/B 3
Biological Safety Cabinet	1	NuAire NU-435-600 Type B2 Fume Hood
Colony Counter	3	Quebec Dark Field
Incubator	1	PGC 9311-1127
Incubator	1	PS WFY20SAWI
Microscope	1	Stereoscope with Zoom, AO Model 570
Microscope	1	Zeiss
pH Meter	2	Orion Model 410A
Quanti-Tray Sealer	1	IDEXX Model 2X
Water Bath	1	Boekel Grant with Removal Heater Circulator

Instrument	# of Units	Manufacturer/Model #
Water Bath	1	Thermo Electron Corp.
Water Bath	1	Precision Coliform Incubator Bath
Water Bath	1	VWR 1275PC
UV Light	2	Spectronics
UV Sterilizer	1	Millipore

Computer Equipment

Our laboratories make extensive use of computers for business applications, technical operations (e.g., our sample management system), and QA Program (see section on Quality Assurance). The following is a list of the major components of our computer systems.

Numerous physical and virtual servers used to support the systems

Oracle systems run on IBM UNIX servers:

Five IBM P5-510 Servers running AIX UNIX 5.3L with 2-way 1.90GHz CPUs

One IBM P5-520 Server running AIX UNIX 5.3L with 4-way 1.90GHz CPUs

- 16-24 GB RAM in IBM servers
- 6.7+ Terra Bytes of disk storage and several SAN devices including DS4300, DS4100, and Clariion CX3-40
- Various tape backup systems
- On-line fail over databases are available for all corporate production Oracle databases.

Networks/Telecommunication:

- TCP/IP based network
- Ten Gigabit switch to accommodate company server farm
- Dual Cisco 6506E network cores

Personal Computers/Servers:

- 3 T1s for Internet access through Cisco ASDM firewall
- ArcServe backup server
- Microsoft Exchange server
- Dell PowerEdge file and print servers
- More than 30 Network File Servers
- More than 1000 Personal Computers

Power Systems:

- 3 Phase Uninterrupted Power System

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Appendix G
Preventative Maintenance Schedules

Current as of October 05, 2011
3 Total Pages (including this coversheet)

NOTE: Current schedules available in technical departments.

Preventive Maintenance Schedule

Instrument	Preventive Maintenance	Frequency
GC/MS	Change septum	AN* : Min. weekly
	Clean/replace injection port seal & liner	AN
	Check fans	Monthly
	Check cool flow	Monthly
	Clean source	Bimonthly or AN
	Change oil in diffusion pump	Annually
	Change oil in rough pump	Annually
GC Volatiles	Check propanol level in ELCD reservoir	AN: Min. semiweekly
	Check all liquid and gas flows	Prior to calib. or AN
	Clean ELCD cell, change reaction tube	AN
	Change ELCD Teflon line, resin tube	AN
	Replace adsorbent trap in concentrators	AN
	Change PID lamp	AN
	Precalibration instrument settings check	Prior to each calibration
GC	Septum change	Each run
	Column/injection port maintenance	AN
	Clean detector	AN
	Leak check ECDs	Semiannually
GC/HRMS	System bakeout	AN
	Replacing the Secondary Electron Multiplier (SEM)	AN
	Adjusting potentials on ion source	Daily
	Check sensitivity and resolution on ion source	Weekly
	Cleaning ion source	AN
	Replace filament on ion source	AN
	Cleaning reference inlet	AN
	Check oil level on forepumps	monthly
	Change oil on forepumps	Yearly or if oil is cloudy or discolored
	Exchange lubricant reservoir on turbopumps	Yearly or after 5000 hours of operation
	Replace injection port liner	AN
	Clip injection port end of column	AN
	Replace septum	AN
LC/MS/MS	Change rough pump (vacuum) oil	Semiannually
	Clean cones and spray chamber	As needed, before each calibration
	Clean source and ion lenses	Annually
	Check electrospray capillary	AN
	Empty waste liquid reservoir	AN
	Tune and calibrate MS	AN

Instrument	Preventive Maintenance	Frequency
HPLC	Pump lubrication	Annually
	Check pump seals	Annually
	Check-valves cleaned or rebuilt	AN
	Replace and/or adjust detector bulb	AN
	Clean detector flow cell	AN
	Replace Teflon lines	AN
	Autosampler septa replacement	AN
	In-line filter sonication/cleaning	AN
	System passivation	AN
	PCRS pump lubrication	AN
	Empty waste liquid reservoir	Daily
Cold Vapor AA and Cold Vapor AF	Replace pump tubing	AN
	Lubricate pump head & autosampler	AN
	Clean optical cells and windows	AN
ICP	Replace pump winding	AN
	Lubricate autosampler	AN
	Vacuum instrument airfilters and air intakes	AN
	Clean optics and lenses	AN
	Clean Torch and injector tip	AN
	Clean nebulizer and spray chamber	AN
ICP/MS	Change interface rough pump oil	Quarterly
	Change MS rough pump oil	Semiannually
	Clean cones and ion lenses	AN
	Clean Torch, injector tip, nebulizer and spray chamber	AN
	Change peristaltic tubing	AN
	Vacuum instrument airfilters and air intakes	AN
	Empty waste liquid reservoir	AN
Total Organic Carbon Analyzer	Check for leaks	AN
	Inspect rotary valve	AN
	Clean gas permeation tube	AN
	Check halide scrubber	AN
	Check dessicant tube	AN
	Dust back and clean circuit boards	AN
Autoanalyzer spectrophotometer	Clean sample probe	AN
	Clean proportioning pump	AN
	Inspect pump tubing, replace if worn	AN
	Clean wash receptacles	AN

*AN = as needed. These actions may be performed more frequently as required by the instrument's operational response.

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Appendix H
Calibration Schedules

Current as of October 05, 2011
14 Total Pages (including this coversheet)

NOTE: Current schedules available in technical departments.

Calibration Summary for SW-846 Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles*	After C-cal fails	6	RF for SPCCs >0.300 for chlorobenzene and 1,1,2,2-tetrachloroethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane %RSD CCCs <30%	Every 12 hours	1	RF for SPCCs >0.300 for chlorobenzene and 1,1,2,2-tetrachloro-ethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane %Drift for CCCs <20
GC/MS Semivolatiles (8270C)*	After C-cal fails	6	RF for SPCCs >0.050 Max %RSD for CCCs <30%	Every 12 hours	1	RF for SPCCs 0.050 %Drift for CCCs <20
GC/MS Semivolatiles (8270D)*	After C-cal fails	6	% RSD ≤ 20% for each compound, (no more than 10% of the compounds can exceed 20% RSD); alternate fit must be used for any analyte with RSD >20% (use linear fit if correlation coefficient is 0.990 or greater; if correlation coefficient is < 0.990 then quadratic fit can be used, but the coefficient of determination must be 0.990 or greater). If linear fit is used, it must pass a linear regression check (the low standard must be within 30% of its true concentration)	Every 12 hours	1	%Drift ± 20%; (no more than 20% of the compounds can exceed 20% drift, and all compounds that exceed 20% drift must be ≤ 50% drift)
GC/MS Semi-volatiles SIM	After C-cal Fails	6	% RSD for all compounds ≤20%	Every 12 hours	1	%Drift ± 20%
GC VOA	After C-cal fails	At least 5	% RSD ≤20% for individual compounds. Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20% then the average RF can be used for all compounds.	Every 10 samples	1	%Drift ± 15% for individual compounds or average % drift for all compounds in the standard ± 15%

Calibration Summary for SW-846 Methods

	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC Pesticides	After C-cal fails	5	20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, endrin 15% Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds.	Every 10 samples Every 20 samples or 12 hours for Method 8081A, 8082	1	≤15% drift from initial response for quantitation C-cal - A CCV is also compliant if the average % difference is ≤15% for all compounds in the CCV standard. DDT/Endrin breakdown check 15% every 12 hours or 20 injections (8081A)
Dioxins by HRGC/HRMS	After C-cal fails	6	If %RSD for native compounds <20% and for labeled compounds <35%, otherwise a calibration curve is used	Every 12 hours	1	<15% valley peak resolution for 2378-TCDD All native and labeled compounds meet method defined recovery limits RTs within ±15 secs of RT in ICAL
HPLC	Each new run or after C-cal fails	5	20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds.	Every 10 samples	1	≤15% drift from initial response for quantitation C-cal - A CCV is also compliant if the average % difference is ≤15% for all compounds in the CCV standard.
GC TPH-GRO	After C-cal fails	At least 5	% RSD of <20% to use the average CF, otherwise use calibration curve	Every 12 hours	1	%Drift ±15%
GC TPH-DRO	After C-cal fails	5	20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit.	Every 12 hours	1	% Drift ±15%
ICP/MS	Each new run	1	Independent calibration verification (ICV) within ±10%	Every 10 samples	1	±10% of true value
ICP	Each new run	1	Independent calibration verification within ±10%, standards <5%RSD	Every 10 samples	1	Same as initial

Calibration Summary for SW-846 Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
CVAA	Each new run	5	Independent calibration verification within ±10% Correlation coefficient >0.995	Every 10 samples	1	±20% of true value
Autoanalyzer	Daily	6	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
TOC Analyzer	Monthly	Water – 6 Soil -4	Corr. Coeff. > 0.995	Every 10 samples	1	±10% of true value
Balance	Daily	4	Top-loading ±.5%, Analytical ± .1% for weights >.1 g 50 mg ± .5%, 20 mg ± 1.0% 10 mg and 5 mg ± 2.0%	N/A	N/A	N/A

*All compounds with %RSD >15 must use first or second order regression fit of the six calibration points. Alternatively, if average of the %RSD of all compounds in calibration standard is ≤15%, the AVG RF can be used for all compounds.

Abbreviations
Std Conc - The number of standard concentrations used
%RSD - Percent Relative Standard Deviation CF – Calibration Factor
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds C-cal - Continuing Calibration
RF - Response factor
CVAA - Cold Vapor Atomic Absorption
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
ICP - Inductively Coupled Plasma spectrophotometer; ICP run also includes inter-element correction check standard (at beginning and end of run)

Calibration Summary for CLP Methods

	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles	After C-cal fails	5	Specified compounds must meet contract minimum RRF criteria and max %RSD of ≤20.5%	Every 12 hours	1	Specified compounds must meet contract minimum RRF criteria and max %D of ≤25%
GC/MS Semivolatiles	After C-cal fails	5	Specified compounds must meet contract minimum RRF criteria and max %RSD of ≤25%. Up to 4 compounds may fail, but must be <40%.	Every 12 hours	1	Specified compounds must meet contract minimum RRF criteria max %D of ≤ 25%. Up to four compounds may fail, but must be <40%.
GC Pesticides	After C-cal fails	3	%RSD for compounds ≤20% (alpha-BHC and delta-BHC ≤25%) %RSD for surrogates ≤30%	Every 12 hours	1	IND A & B/PEM alternate every 12 hours with %D ≤25. Degradation for DDT, endrin ≤20%, combined ≤30% IBLK every 12 hours with CCV
Cold Vapor AA	Each new run	5	Independent calibration verification within ±20%	Every 10 samples	1	Same as initial
ICP	Each new run	1	Independent calibration verification within ±10%	Every 10 samples	1	Same as initial
ICP-MS	Each new run	1	Independent calibration verification within ±10%	Every 10 samples	1	Same as initial
Autoanalyzer (cyanide)	Daily	5	Correlation coefficient >0.995	Every 10 samples	1	±10% of original response
Balance	Daily	4	±0.5%	N/A	N/A	N/A

Abbreviations

RRF – Relative Response Factor
%RSD – Percent Relative Standard Deviation
%D – Percent difference IND – Individual standard mix
RPD – Relative Percent Difference PEM – Performance Evaluation Mix
C-cal – Continuing Calibration
ICP – Inductively Coupled Plasma spectrophotometer
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
IBLK – Instrument Blank

For volatiles, up to two compounds may be outside criteria providing the RRF is ≥0.010 and %RSD ≤40%.
For semivolatiles, up to four compounds may be outside criteria providing the RRF is ≥0.010 and %RSD ≤40%.
For both volatile and semivolatile compounds with no established RRF criteria, the minimum RRF is ≥0.010.
For pesticides, up to two target compounds may have %RSD >20% but ≤ 30%.

GC/MS Tuning Criteria			
BFB Key Ions and Ion Abundance Criteria:			
Mass	**CLP Methods**	**Method 8260B**	**Method 524.2**
50	8% to 40% of mass 95	15% to 40% of mass 95	15% to 40% of mass 95
75	30% to 66% of mass 95	30% to 60% of mass 95	30% to 80% of mass 95
95	Base peak = 100%	Base peak = 100%	Base peak = 100%
96	5% to 9% of mass 95	5% to 9% of mass 95	5% to 9% of mass 95
173	<2% of mass 174	<2% of mass 174	<2% of mass 174
174	50% to 120% of mass 95	>50% of mass 95	>50% of mass 95
175	4% to 9% of mass 174	5% to 9% of mass 174	5% to 9% of mass 174
176	93% to 101% of mass 174	>95% but <101% of mass 174	>95% but <101% of mass 174
177	5% to 9% of mass 176	5% to 9% of mass 176	5% to 9% of mass 176
DFTPP Key Ions and Ion Abundance Critieria:			
Mass	**Methods** 8270D & CLP	**Method 8270C**	**Method 525.2**
51	30 % to 80 % of mass 198	30 % to 60 % of mass 198	10 % to 80 % of base peak
68	<2% of mass 69	<2% of mass 69	<2% of mass 69
69	mass 69 relative abundance	mass 69 relative abundance	mass 69 relative abundance
70	<2% of mass 69	<2% of mass 69	<2% of mass 69
127	25 % to 75 % of mass 198	40% to 60 % of mass 198	10% to 80 % of base peak
197	<1% of mass 198	<1% of mass 198	<2% of mass 198
198	Base Peak = 100%	Base Peak = 100%	Base peak or >50 % of mass 442
199	5% to 9% of mass 198	5% to 9% of mass 198	5% to 9% of mass 198
275	10% to 30% of mass 198	10% to 30% of mass 198	10% to 60% of base peak
365	>0.75% of mass 198	>1% of mass 198	>1% of base peak
441	8270D: Present but < 24% mass 442 CLP: Present but < mass 443	Present but < mass 443	Present but < mass 443
442	8270D: >50% of mass 198 CLP: 40% to 110% of mass 198	>40% of mass 198	Base peak or >50% of mass 198
443	15% to 24% of mass 442	17% to 23% of mass 442	15% to 24% of mass 442

Calibration Summary for Drinking Water Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS 525.2	After C-cal fails	6	The RSD for each analyte mean RF must be ≤30%. Or a linear regression calibration curve may be used.	Every 12 hours	1	%D for RF must be ≤30%. If curve used, the point must fall on curve from I-cal.
GC 504.1	Every new run	5	% RSD <20% to use Average RF, otherwise use calibration curve.	Every 10 samples or each batch if <10 samples	1	70% to 130% of expected value
GC/MS 524.2	After C-cal fails	4	% RSD <20% otherwise use calibration curve	Every 12 hours	1	%D for RF must be ≤30%. If curved used, the % recovery based on the concentration spiked must be 70% to 130% of expected value.
GC 507 508 515.1	Each new run, or after C-cal fails	3	≤20% RSD of RFs of Initial Calibration to use avg. RF, otherwise use curve fit. (Degradation for DDT, Endrin ≤20% initially - Method 508.)	Every 10 samples	1	≤20% drift from initial response for both quantitation and confirmation.
HPLC 531.1	Each new run, or after C-cal fails	3	≤20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit	Every 10 samples and/or blanks	1	≤20% drift from initial response.
Mercury auto-analyzer	Each new run	5	Initial calibration verification with ±5%	Every 10 samples	1	±10% of true value
Auto-analyzer	Daily	6	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
Balance	Daily	4	See SOP	N/A	N/A	N/A
ICP	Each new run	1	Initial calibration verification ±5%	Every 10 samples	1	±10% of true value
ICP-MS	Each new run	1	Independent calibration verification within ±10%	Every 10 samples	1	±15% of true value

Calibration Summary for Drinking Water Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
pH meter	Daily	3	See SOP	Every 10 samples	1	Statistical limits
IC	Monthly	5	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
ISE	Every 3 months	5	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value

Abbreviations

Std Conc - The number of standard concentrations used
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds
RF - Response Factor
%RSD - Percent Relative Standard Deviation
%D - Percent Difference
C-cal - Continuing Calibration
CVAF – Cold Vapor Atomic Fluorescence
HPLC - High Performance Liquid Chromatography
GC - Gas Chromatograph
GC/MS - Gas Chromatography/Mass Spectrometry
ICP - Inductively Coupled Plasma spectrophotometer
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
IC - Ion Chromatograph
ISE - Ion Specific Electrode

Method 507 Laboratory Performance Check Solution (analyzed prior to system calibration)			
Test	Analyte	Conc. µg/mL	Requirements
Sensitivity	Vernolate	0.05	Detection of analyte; S/N > 3
Chromatographic performance	Bromacil	5.0	0.80 < PGF[a] <1.20
Column performance	Prometon Atrazine	0.30 0.15	Resolution[b] > 0.7

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at 10% peak height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Method 508 Laboratory Performance Check Solution (analyzed prior to system calibration)			
Test	Analyte	Conc. µg/mL	Requirements
Sensitivity	Chlorpyrifos	0.0020	Detection of analyte; S/N > 3
Chromatographic performance	DCPA	0.0500	0.80 < PGF[a] < 1.15
Column performance	Chlorothalonil HCH-delta	0.0500 0.0400	Resolution[b] > 0.50

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at 10% peak height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Method 515 Laboratory Performance Check Solution (analyzed prior to system calibration)			
Test	Analyte	Conc. µg/mL	Requirements
Sensitivity	Dinoseb	0.004	Detection of analyte; S/N >3
Chromatographic performance	4-Nitrophenol	1.6	0.70 < PGF[a] < 1.05
Column performance	3,5-Dichlorobenzoic acid 4-Nitrophenol	0.6 1.6	Resolution[b] >0.40

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at tenth height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Calibration Summary for EPA 100, 200, 300, 600 & 1600 Series Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles*	After C-cal fails	5	RSD ≤35% for all compounds*, or a linear regression may be used	Every 24 hours	1	All compounds must meet the QC acceptance criteria as stated in the method. Compounds not stated must meet a 65% -135% recovery criteria.
GC/MS Semivolatiles**	After C-cal fails	5	RSD ≤35% for all compounds**, or a linear regression may be used Tailing factors: Benzidine < 3 Pentachlorophenol < 5	Every 24 hours	1	All compounds calibrating for <20
GC Pesticides & PCBs (Method 608)	After C-cal fails	5	10% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, Endrin 15%	Every 10 samples	1	≤15% drift from initial response for quantitation
GC VOA Halocarbons and/or Aromatics	After C-cal fails	At least 5	%RSD of ≤10% for individual compounds to use average RFs. If %RSD >10%, a quadratic fit type is used if correlation coefficient is >0.995.	Every 12 hours, or every 10 samples	1	Method defined limits
HPLC	Each new run or after C-cal fails	5	10% RSD of RFs of initial calibration to use average RF, otherwise use curve fit	Every 10 samples	1	≤15% difference from initial response for quantitation
ICP/MS	Each new run	1	Independent calibration verification (ICV) within ±10%	Every 10 samples	1	±15% of true value
ICP	Each new run	1	Independent calibration verification within ±5%, standards <5%RSD	Every 10 samples	1	±10% of true value

Calibration Summary for EPA 100, 200, 300, 600 & 1600 Series Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
CVAA	Each new run	5	Independent calibration verification within ±5% Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
CVAF	Each new run	5	The RSD ≤ 15%, and the low standard recovers 75-125% of the true value	After the calibration and at the end of the analytical batch	1	±23% of the true value
Auto-analyzer	Daily	6	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
TOC	Monthly	6 5	Corr. Coeff. > 0.995 Corr. Coeff. > 0.995	Every 10 samples	1	±10% of true value
Balance	Daily	4	Top-loading ±0.5%, Analytical ± 0.1% for weights >0.1 g 50 mg ± 0.5%, 20 mg ± 1.0% 10 mg and 5 mg ± 2.0%	N/A	N/A	N/A

*All compounds with %RSD >35 must use first or second order regression fit of the five calibration points. The first order regression may only be used if the correlation coefficient r ≥0.990. The second order regression may only be used if the coefficient of determination r^2 ≥0.990.

* * All compounds with % RSD >35 must use first order regression fit of the five calibration points. The first order regression may only be used if the correlation coefficient r ≥0.990.

Abbreviations
Std Conc - The number of standard concentrations used
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds
RF - Response Factor
%RSD - Percent Relative Standard Deviation
C-cal - Continuing Calibration
CVAA - Cold Vapor Atomic Absorption spectrophotometer
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma spectrophotometer; ICP run also includes inter-element correction check standard (beginning and end of run)
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry

Calibration Summary for EPA TO Series Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles TO-15	After C-cal fails	5	RSD ≤30% for all compounds, 2 allowed to be >30% as long as <40%.	Every 24 hours	1	All compounds ≤30 difference, 2 compounds allowed to be >30% as long as ≤40%.
GC/MS Volatiles TO-14A	After C-cal fails	3	RSD ≤30% for all compounds, 2 allowed to be >30% as long as <40%.	Every 24 hours	1	All compounds ≤30 difference, 2 compounds allowed to be >30% as long as ≤40%.

Lancaster Laboratories

Environmental Quality Policy Manual

Appendix I
NELAP Scope of Testing

Current as of October 05, 2011
61 Total Pages (including this coversheet)

NOTE: Current certificates maintained by QA Department.

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Page 1 of 51

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 110.2	Color	NELAP	PA	4/4/2005
EPA 150.1	pH	NELAP	PA	2/28/2002
EPA 1613	Dioxin	NELAP	PA	10/5/2010
EPA 1664 Rev A	Oil and grease	NELAP	PA	5/24/2011
EPA 180.1	Turbidity	NELAP	PA	4/4/2005
EPA 200.7	Aluminum	NELAP	PA	4/4/2005
EPA 200.7	Barium	NELAP	PA	1/22/2001
EPA 200.7	Beryllium	NELAP	PA	6/2/2004
EPA 200.7	Cadmium	NELAP	PA	1/22/2001
EPA 200.7	Calcium	NELAP	PA	11/28/2001
EPA 200.7	Chromium	NELAP	PA	1/22/2001
EPA 200.7	Cobalt	NELAP	PA	10/16/2008
EPA 200.7	Copper	NELAP	PA	1/22/2001
EPA 200.7	Iron	NELAP	PA	4/4/2005
EPA 200.7	Magnesium	NELAP	PA	12/4/2007
EPA 200.7	Manganese	NELAP	PA	4/4/2005
EPA 200.7	Nickel	NELAP	PA	1/22/2001
EPA 200.7	Potassium	NELAP	PA	5/24/2011
EPA 200.7	Silver	NELAP	PA	1/26/2001
EPA 200.7	Sodium	NELAP	PA	1/22/2001
EPA 200.7	Strontium	NELAP	PA	5/24/2011
EPA 200.7	Tin	NELAP	PA	11/3/2008
EPA 200.7	Vanadium	NELAP	PA	10/16/2008
EPA 200.7	Zinc	NELAP	PA	4/4/2005
EPA 200.8	Antimony	NELAP	PA	2/10/2005
EPA 200.8	Arsenic	NELAP	PA	2/10/2005
EPA 200.8	Beryllium	NELAP	PA	2/10/2005
EPA 200.8	Cadmium	NELAP	PA	2/10/2005
EPA 200.8	Chromium	NELAP	PA	2/10/2005
EPA 200.8	Copper	NELAP	PA	3/9/2007
EPA 200.8	Lead	NELAP	PA	2/10/2005
EPA 200.8	Nickel	NELAP	PA	2/10/2005
EPA 200.8	Selenium	NELAP	PA	2/10/2005
EPA 200.8	Thallium	NELAP	PA	2/10/2005
EPA 245.1	Mercury	NELAP	PA	8/29/2001
EPA 300.0	Chloride	NELAP	PA	5/17/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

www.dep.state.pa.us Issue Date: 05/25/2011

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Page 2 of 51

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 300.0	Fluoride	NELAP	PA	1/22/2004
EPA 300.0	Nitrate	NELAP	PA	10/31/2002
EPA 300.0	Nitrite	NELAP	PA	10/31/2002
EPA 300.0	Sulfate	NELAP	PA	7/7/2003
EPA 314.0	Perchlorate	NELAP	PA	5/24/2007
EPA 335.4	Cyanide	NELAP	PA	7/11/2006
EPA 353.2	Nitrate as N	NELAP	PA	2/28/2002
EPA 353.2	Nitrite	NELAP	PA	2/28/2002
EPA 353.2	Total nitrate-nitrite	NELAP	PA	5/24/2011
EPA 504.1	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	5/17/2005
EPA 504.1	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	2/28/2002
EPA 504.1	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	1/26/2001
EPA 507	Alachlor (Lasso)	NELAP	PA	2/28/2002
EPA 507	Atrazine	NELAP	PA	2/28/2002
EPA 507	Simazine	NELAP	PA	2/28/2002
EPA 508	Aldrin (HHDN)	NELAP	PA	5/18/2005
EPA 508	Aroclor-1016 (PCB-1016)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1221 (PCB-1221)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1232 (PCB-1232)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1242 (PCB-1242)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1248 (PCB-1248)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1254 (PCB-1254)	NELAP	PA	4/24/2007
EPA 508	Aroclor-1260 (PCB-1260)	NELAP	PA	4/24/2007
EPA 508	Chlordane (tech.)	NELAP	PA	2/28/2002
EPA 508	Dieldrin	NELAP	PA	1/3/2002
EPA 508	Endrin	NELAP	PA	2/28/2002
EPA 508	Heptachlor	NELAP	PA	2/28/2002
EPA 508	Heptachlor epoxide	NELAP	PA	2/28/2002
EPA 508	Hexachlorobenzene	NELAP	PA	2/28/2002
EPA 508	Hexachlorocyclopentadiene	NELAP	PA	2/28/2002
EPA 508	Methoxychlor	NELAP	PA	2/28/2002
EPA 508	Toxaphene (Chlorinated camphene)	NELAP	PA	5/25/2007
EPA 508	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	2/28/2002
EPA 515.1	2,4,5-TP (Silvex)	NELAP	PA	1/24/2001
EPA 515.1	2,4-D	NELAP	PA	1/24/2001

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Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 515.1	Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	1/24/2001
EPA 515.1	Dicamba	NELAP	PA	1/24/2001
EPA 515.1	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	1/24/2001
EPA 515.1	Pentachlorophenol (PCP)	NELAP	PA	1/24/2001
EPA 515.1	Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid)	NELAP	PA	1/24/2001
EPA 524.2	1,1,1,2-Tetrachloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,1,1-Trichloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,1,2,2-Tetrachloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,1,2-Trichloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,1-Dichloro-2-propanone (1,1-Dichloropropanone)	NELAP	PA	5/17/2005
EPA 524.2	1,1-Dichloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	10/31/2002
EPA 524.2	1,1-Dichloropropene	NELAP	PA	10/31/2002
EPA 524.2	1,2,3-Trichlorobenzene	NELAP	PA	4/4/2005
EPA 524.2	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	10/31/2002
EPA 524.2	1,2,4-Trichlorobenzene	NELAP	PA	10/31/2002
EPA 524.2	1,2,4-Trimethylbenzene	NELAP	PA	4/4/2005
EPA 524.2	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	5/24/2007
EPA 524.2	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	5/24/2007
EPA 524.2	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	10/31/2002
EPA 524.2	1,2-Dichloroethane	NELAP	PA	10/31/2002
EPA 524.2	1,2-Dichloropropane	NELAP	PA	10/31/2002
EPA 524.2	1,3,5-Trimethylbenzene	NELAP	PA	5/17/2005
EPA 524.2	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	10/31/2002
EPA 524.2	1,3-Dichloropropane	NELAP	PA	10/31/2002
EPA 524.2	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	10/31/2002
EPA 524.2	1-Chlorobutane	NELAP	PA	5/24/2007
EPA 524.2	2,2-Dichloropropane	NELAP	PA	10/31/2002
EPA 524.2	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	5/24/2007
EPA 524.2	2-Chlorotoluene	NELAP	PA	10/31/2002
EPA 524.2	2-Hexanone	NELAP	PA	5/24/2007
EPA 524.2	2-Nitropropane	NELAP	PA	5/24/2007
EPA 524.2	4-Chlorotoluene	NELAP	PA	10/31/2002
EPA 524.2	4-Isopropyltoluene (p-Isopropyltoluene)	NELAP	PA	5/17/2005
EPA 524.2	4-Methyl-2-pentanone (MIBK)	NELAP	PA	5/24/2007

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us **Issue Date: 05/25/2011**

Pennsylvania Department of Environmental Protection

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 524.2	Acetone	NELAP	PA	5/24/2007
EPA 524.2	Acrylonitrile	NELAP	PA	5/24/2007
EPA 524.2	Allyl chloride (3-Chloropropene)	NELAP	PA	5/24/2007
EPA 524.2	Benzene	NELAP	PA	10/31/2002
EPA 524.2	Bromobenzene	NELAP	PA	10/31/2002
EPA 524.2	Bromochloromethane	NELAP	PA	4/4/2005
EPA 524.2	Bromodichloromethane	NELAP	PA	10/31/2002
EPA 524.2	Bromoform	NELAP	PA	10/31/2002
EPA 524.2	Carbon disulfide	NELAP	PA	5/24/2007
EPA 524.2	Carbon tetrachloride	NELAP	PA	10/31/2002
EPA 524.2	Chloroacetonitrile	NELAP	PA	5/24/2007
EPA 524.2	Chlorobenzene	NELAP	PA	10/31/2002
EPA 524.2	Chloroethane	NELAP	PA	10/31/2002
EPA 524.2	Chloroform	NELAP	PA	10/31/2002
EPA 524.2	Dibromochloromethane	NELAP	PA	10/31/2002
EPA 524.2	Dibromomethane	NELAP	PA	10/31/2002
EPA 524.2	Dichlorodifluoromethane (Freon 12)	NELAP	PA	4/4/2005
EPA 524.2	Dichloromethane (DCM; Methylene chloride)	NELAP	PA	10/31/2002
EPA 524.2	Diethyl ether (Ethyl ether)	NELAP	PA	5/24/2007
EPA 524.2	Ethyl methacrylate	NELAP	PA	5/24/2007
EPA 524.2	Ethylbenzene	NELAP	PA	10/31/2002
EPA 524.2	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/4/2005
EPA 524.2	Hexachloroethane	NELAP	PA	5/24/2007
EPA 524.2	Isopropylbenzene (Cumene)	NELAP	PA	4/4/2005
EPA 524.2	Methacrylonitrile	NELAP	PA	5/24/2007
EPA 524.2	Methyl bromide (Bromomethane)	NELAP	PA	10/31/2002
EPA 524.2	Methyl chloride (Chloromethane)	NELAP	PA	10/31/2002
EPA 524.2	Methyl iodide (Iodomethane)	NELAP	PA	5/24/2007
EPA 524.2	Methyl tert-butyl ether (MTBE)	NELAP	PA	4/4/2005
EPA 524.2	Methylacrylate	NELAP	PA	5/24/2007
EPA 524.2	Methylmethacrylate	NELAP	PA	5/24/2007
EPA 524.2	Naphthalene	NELAP	PA	5/17/2005
EPA 524.2	Nitrobenzene	NELAP	PA	5/17/2005
EPA 524.2	Pentachloroethane	NELAP	PA	5/24/2007
EPA 524.2	Propionitrile (Ethyl cyanide)	NELAP	PA	5/24/2007
EPA 524.2	Styrene	NELAP	PA	10/31/2002

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www.dep.state.pa.us Issue Date: 05/25/2011

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 524.2	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	10/31/2002
EPA 524.2	Tetrahydrofuran (THF)	NELAP	PA	5/24/2007
EPA 524.2	Toluene	NELAP	PA	10/31/2002
EPA 524.2	Total trihalomethanes (TTHMs)	NELAP	PA	10/31/2002
EPA 524.2	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	10/31/2002
EPA 524.2	Trichlorofluoromethane (Freon 11)	NELAP	PA	4/4/2005
EPA 524.2	Vinyl chloride (Chloroethene)	NELAP	PA	10/31/2002
EPA 524.2	Xylenes, total	NELAP	PA	10/31/2002
EPA 524.2	cis-1,2-Dichloroethene	NELAP	PA	10/31/2002
EPA 524.2	cis-1,3-Dichloropropene	NELAP	PA	10/31/2002
EPA 524.2	n-Butylbenzene	NELAP	PA	4/4/2005
EPA 524.2	n-Propylbenzene	NELAP	PA	5/17/2005
EPA 524.2	sec-Butylbenzene	NELAP	PA	4/4/2005
EPA 524.2	tert-Butylbenzene	NELAP	PA	4/4/2005
EPA 524.2	trans-1,2-Dichloroethene	NELAP	PA	10/31/2002
EPA 524.2	trans-1,3-Dichloropropene	NELAP	PA	10/31/2002
EPA 524.2	trans-1,4-Dichloro-2-butene	NELAP	PA	5/24/2007
EPA 524.2-Extended	Allyl chloride (3-Chloropropene)	NELAP	PA	7/3/2007
EPA 524.2-Extended	Diisopropyl ether (DIPE)	NELAP	PA	1/7/2010
EPA 524.2-Extended	Ethyl tert-butyl ether (ETBE)	NELAP	PA	1/24/2007
EPA 524.2-Extended	tert-Amyl methyl ether (TAME)	NELAP	PA	1/24/2007
EPA 524.2-Extended	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	5/24/2007
EPA 525.2	2,3-Dichlorobiphenyl (BZ 5)	NELAP	PA	5/17/2005
EPA 525.2	Acenaphthylene	NELAP	PA	4/28/2010
EPA 525.2	Alachlor (Lasso)	NELAP	PA	2/28/2002
EPA 525.2	Anthracene	NELAP	PA	5/25/2007
EPA 525.2	Atrazine	NELAP	PA	1/3/2002
EPA 525.2	Benzo[a]anthracene	NELAP	PA	5/25/2007
EPA 525.2	Benzo[a]pyrene	NELAP	PA	1/24/2001
EPA 525.2	Benzo[b]fluoranthene	NELAP	PA	6/4/2007
EPA 525.2	Benzo[ghi]perylene	NELAP	PA	7/3/2007
EPA 525.2	Benzo[k]fluoranthene	NELAP	PA	6/4/2007
EPA 525.2	Benzyl butyl phthalate (Butyl benzyl phthalate)	NELAP	PA	5/25/2007
EPA 525.2	Butachlor	NELAP	PA	12/19/2002
EPA 525.2	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	5/25/2007
EPA 525.2	Di-n-butyl phthalate	NELAP	PA	5/25/2007

Pennsylvania Department of Environmental Protection

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 525.2	Dibenzo[a,h]anthracene	NELAP	PA	5/25/2007
EPA 525.2	Dieldrin	NELAP	PA	5/17/2005
EPA 525.2	Diethyl phthalate	NELAP	PA	5/25/2007
EPA 525.2	Dimethyl phthalate	NELAP	PA	5/25/2007
EPA 525.2	Endrin	NELAP	PA	5/17/2005
EPA 525.2	Heptachlor	NELAP	PA	5/17/2005
EPA 525.2	Heptachlor epoxide	NELAP	PA	5/17/2005
EPA 525.2	Hexachlorobenzene	NELAP	PA	2/11/2005
EPA 525.2	Hexachlorocyclopentadiene	NELAP	PA	1/24/2001
EPA 525.2	Methoxychlor	NELAP	PA	1/24/2001
EPA 525.2	Metolachlor	NELAP	PA	12/19/2002
EPA 525.2	Metribuzin	NELAP	PA	12/19/2002
EPA 525.2	Phenanthrene	NELAP	PA	5/25/2007
EPA 525.2	Propachlor (Ramrod)	NELAP	PA	1/24/2001
EPA 525.2	Pyrene	NELAP	PA	5/25/2007
EPA 525.2	Simazine	NELAP	PA	1/3/2002
EPA 525.2	bis(2-Ethylhexyl) adipate (di(2-Ethylhexyl) adipate)	NELAP	PA	1/24/2001
EPA 525.2	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	1/24/2001
EPA 525.2	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	1/24/2001
EPA 525.2-Extended	Acenaphthene	NELAP	PA	5/25/2007
EPA 531.1	3-Hydroxycarbofuran	NELAP	PA	11/7/2006
EPA 531.1	Aldicarb (Temik)	NELAP	PA	1/24/2001
EPA 531.1	Aldicarb sulfone	NELAP	PA	1/24/2001
EPA 531.1	Aldicarb sulfoxide	NELAP	PA	1/24/2001
EPA 531.1	Carbaryl (Sevin)	NELAP	PA	10/9/2002
EPA 531.1	Carbofuran (Furadan)	NELAP	PA	1/24/2001
EPA 531.1	Methomyl (Lannate)	NELAP	PA	1/24/2001
EPA 531.1	Oxamyl (Vydate)	NELAP	PA	1/24/2001
EPA 8015-Extended	Ethane	NELAP	PA	5/24/2011
EPA 8015-Extended	Methane	NELAP	PA	5/24/2011
SM 2120 B	Color	NELAP	PA	5/25/2005
SM 2130 B	Turbidity	NELAP	PA	5/17/2005
SM 2320 B	Alkalinity as CaCO3	NELAP	PA	1/24/2001
SM 2340 B	Total hardness as CaCO3	NELAP	PA	4/4/2005
SM 2340 C	Total hardness as CaCO3	NELAP	PA	5/24/2011
SM 2510 B	Conductivity	NELAP	PA	5/17/2005

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Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

Lancaster Laboratories, Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Drinking Water

Method	Analyte	Accreditation Type	Primary	Effective Date
SM 2540 C	Total dissolved solids (TDS)	NELAP	PA	6/2/2004
SM 2540 D	Residue, nonfilterable (TSS)	NELAP	PA	5/24/2011
SM 2550 B	Temperature, deg. C	NELAP	PA	4/4/2005
SM 4500-CN- E	Free cyanide	NELAP	PA	5/24/2011
SM 4500-Cl F	Total residual chlorine	NELAP	PA	5/24/2011
SM 4500-Cl G	Residual free chlorine	NELAP	PA	1/7/2010
SM 4500-F- C	Fluoride	NELAP	PA	10/15/2003
SM 4500-H+ B	pH	NELAP	PA	5/16/2007
SM 4500-P E	Orthophosphate as P	NELAP	PA	6/12/2007
SM 4500-SiO2 C (20th ed.)	Silica, dissolved	NELAP	PA	5/24/2007
SM 5540 C	Surfactants as MBAS	NELAP	PA	5/24/2007
SM 9215 B	Heterotrophic bacteria (Enumeration)	NELAP	PA	2/5/2003
SM 9223 B	Total coliform & E. coli	NELAP	PA	1/26/2001

Pennsylvania Department of Environmental Protection

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
AK-101	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
AK-102	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
EPA 1010	Ignitability	NELAP	PA	12/12/2005
EPA 130.2	Hardness	NELAP	PA	1/19/2005
EPA 1311	Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	12/12/2005
EPA 1312	Synthetic precipitation leaching procedure (SPLP)	NELAP	PA	12/12/2005
EPA 160.1	Residue, filterable (TDS)	NELAP	PA	1/19/2005
EPA 160.4	Residue, volatile	NELAP	PA	1/19/2005
EPA 1613	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 1613	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 1613	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 1613	2,3,7,8-TCDD (Dioxin)	NELAP	PA	6/30/2010
EPA 1613	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	NELAP	PA	6/30/2010
EPA 1613	Total heptachlorodibenzo-p-dioxin (HpCDD)	NELAP	PA	8/6/2010
EPA 1613	Total heptachlorodibenzofuran (HpCDF)	NELAP	PA	8/6/2010
EPA 1613	Total hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	8/6/2010
EPA 1613	Total hexachlorodibenzofuran (HxCDF)	NELAP	PA	8/6/2010
EPA 1613	Total pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	8/6/2010
EPA 1613	Total pentachlorodibenzofuran (PeCDF)	NELAP	PA	8/6/2010
EPA 1613	Total tetrachlorodibenzo-p-dioxin (TCDD)	NELAP	PA	8/6/2010
EPA 1613	Total tetrachlorodibenzofuran (TCDF)	NELAP	PA	8/6/2010
EPA 1625 Rev C	N-Nitrosodimethylamine	NELAP	PA	11/23/2010
EPA 1631	Mercury	NELAP	PA	6/11/2007

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 1664 Rev A	Non-polar material	NELAP	PA	11/17/2006
EPA 1664 Rev A	Oil and grease	NELAP	PA	1/19/2005
EPA 1666 Rev A	2-Propanol (Isopropyl alcohol)	NELAP	PA	12/2/2009
EPA 1666 Rev A	4-Methyl-2-pentanone (MIBK)	NELAP	PA	12/12/2005
EPA 1666 Rev A	Ethyl acetate	NELAP	PA	1/19/2005
EPA 1666 Rev A	Isobutyraldehyde	NELAP	PA	1/19/2005
EPA 1666 Rev A	Isopropyl acetate	NELAP	PA	1/19/2005
EPA 1666 Rev A	Isopropyl ether	NELAP	PA	1/19/2005
EPA 1666 Rev A	Methyl formate	NELAP	PA	1/19/2005
EPA 1666 Rev A	Tetrahydrofuran (THF)	NELAP	PA	1/19/2005
EPA 1666 Rev A	Xylenes, total	NELAP	PA	1/19/2005
EPA 1666 Rev A	n-Amyl acetate (n-Pentyl acetate)	NELAP	PA	4/4/2005
EPA 1666 Rev A	n-Amyl alcohol (1-Pentanol)	NELAP	PA	4/4/2005
EPA 1666 Rev A	n-Butyl acetate	NELAP	PA	4/4/2005
EPA 1666 Rev A	n-Heptane	NELAP	PA	1/19/2005
EPA 1666 Rev A	n-Hexane	NELAP	PA	1/19/2005
EPA 1666 Rev A	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	4/4/2005
EPA 1671 Rev A	Acetonitrile	NELAP	PA	1/19/2005
EPA 1671 Rev A	Diethylamine	NELAP	PA	1/19/2005
EPA 1671 Rev A	Dimethyl sulfoxide	NELAP	PA	1/19/2005
EPA 1671 Rev A	Ethanol	NELAP	PA	1/19/2005
EPA 1671 Rev A	Methanol	NELAP	PA	1/19/2005
EPA 1671 Rev A	Methyl cellosolve (2-Methoxyethanol)	NELAP	PA	1/19/2005
EPA 1671 Rev A	Triethylamine	NELAP	PA	1/19/2005
EPA 1671 Rev A	n-Propanol (1-Propanol)	NELAP	PA	1/19/2005
EPA 170.1	Temperature, deg. C	NELAP	PA	4/4/2005
EPA 180.1	Turbidity	NELAP	PA	1/19/2005
EPA 200.2	Metals sample preparation	NELAP	PA	1/24/2007
EPA 200.7	Aluminum	NELAP	PA	1/19/2005
EPA 200.7	Antimony	NELAP	PA	1/19/2005
EPA 200.7	Arsenic	NELAP	PA	1/19/2005
EPA 200.7	Barium	NELAP	PA	1/19/2005
EPA 200.7	Beryllium	NELAP	PA	1/19/2005
EPA 200.7	Boron	NELAP	PA	1/19/2005
EPA 200.7	Cadmium	NELAP	PA	1/19/2005
EPA 200.7	Calcium	NELAP	PA	1/19/2005

Pennsylvania Department of Environmental Protection

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 200.7	Chromium	NELAP	PA	1/19/2005
EPA 200.7	Cobalt	NELAP	PA	1/19/2005
EPA 200.7	Copper	NELAP	PA	1/19/2005
EPA 200.7	Iron	NELAP	PA	1/19/2005
EPA 200.7	Lead	NELAP	PA	1/19/2005
EPA 200.7	Magnesium	NELAP	PA	1/19/2005
EPA 200.7	Manganese	NELAP	PA	1/19/2005
EPA 200.7	Molybdenum	NELAP	PA	1/19/2005
EPA 200.7	Nickel	NELAP	PA	1/19/2005
EPA 200.7	Potassium	NELAP	PA	1/19/2005
EPA 200.7	Selenium	NELAP	PA	1/19/2005
EPA 200.7	Silver	NELAP	PA	4/4/2005
EPA 200.7	Sodium	NELAP	PA	1/19/2005
EPA 200.7	Strontium	NELAP	PA	5/24/2011
EPA 200.7	Thallium	NELAP	PA	1/19/2005
EPA 200.7	Tin	NELAP	PA	1/19/2005
EPA 200.7	Titanium	NELAP	PA	1/19/2005
EPA 200.7	Vanadium	NELAP	PA	1/19/2005
EPA 200.7	Zinc	NELAP	PA	1/19/2005
EPA 200.8	Aluminum	NELAP	PA	1/7/2010
EPA 200.8	Antimony	NELAP	PA	4/4/2005
EPA 200.8	Arsenic	NELAP	PA	4/4/2005
EPA 200.8	Barium	NELAP	PA	4/4/2005
EPA 200.8	Beryllium	NELAP	PA	4/4/2005
EPA 200.8	Cadmium	NELAP	PA	4/4/2005
EPA 200.8	Chromium	NELAP	PA	4/4/2005
EPA 200.8	Cobalt	NELAP	PA	11/23/2010
EPA 200.8	Copper	NELAP	PA	4/4/2005
EPA 200.8	Lead	NELAP	PA	4/4/2005
EPA 200.8	Manganese	NELAP	PA	11/23/2010
EPA 200.8	Molybdenum	NELAP	PA	1/7/2010
EPA 200.8	Nickel	NELAP	PA	4/4/2005
EPA 200.8	Selenium	NELAP	PA	12/12/2005
EPA 200.8	Silver	NELAP	PA	1/2/2007
EPA 200.8	Thallium	NELAP	PA	5/31/2006
EPA 200.8	Vanadium	NELAP	PA	1/7/2010

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www.dep.state.pa.us Issue Date: 05/25/2011

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717)-656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 200.8	Zinc	NELAP	PA	1/18/2011
EPA 200.8-Extended	Boron	NELAP	PA	1/7/2010
EPA 200.8-Extended	Calcium	NELAP	PA	1/7/2010
EPA 200.8-Extended	Iron	NELAP	PA	11/23/2010
EPA 200.8-Extended	Magnesium	NELAP	PA	1/7/2010
EPA 200.8-Extended	Potassium	NELAP	PA	1/7/2010
EPA 200.8-Extended	Sodium	NELAP	PA	1/7/2010
EPA 200.8-Extended	Strontium	NELAP	PA	1/7/2010
EPA 200.8-Extended	Tin	NELAP	PA	1/7/2010
EPA 200.8-Extended	Titanium	NELAP	PA	1/7/2010
EPA 218.6	Chromium VI	NELAP	PA	4/4/2005
EPA 245.1	Mercury	NELAP	PA	1/19/2005
EPA 300.0	Bromide	NELAP	PA	4/4/2005
EPA 300.0	Chloride	NELAP	PA	1/19/2005
EPA 300.0	Fluoride	NELAP	PA	5/25/2005
EPA 300.0	Nitrate as N	NELAP	PA	1/19/2005
EPA 300.0	Nitrite as N	NELAP	PA	1/19/2005
EPA 300.0	Orthophosphate as P	NELAP	PA	11/23/2010
EPA 300.0	Sulfate	NELAP	PA	1/19/2005
EPA 3005A	Preconcentration under acid	NELAP	PA	12/12/2005
EPA 3010A	Hot plate acid digestion (HNO_3 + HCl)	NELAP	PA	12/12/2005
EPA 3020A	Hot plate acid digestion (HNO_3 only)	NELAP	PA	12/12/2005
EPA 305.2	Acidity as $CaCO_3$	NELAP	PA	1/24/2007
EPA 3060A	Alkaline digestion of Cr(VI)	NELAP	PA	1/24/2007
EPA 314.0	Perchlorate	NELAP	PA	11/23/2009
EPA 335.4	Total cyanide	NELAP	PA	1/19/2005
EPA 351.2	Kjeldahl nitrogen, total (TKN)	NELAP	PA	1/19/2005
EPA 3510C	Separatory funnel liquid-liquid extraction	NELAP	PA	12/12/2005
EPA 3520C	Continuous liquid-liquid extraction	NELAP	PA	12/12/2005
EPA 353.2	Nitrate as N	NELAP	PA	1/19/2005
EPA 353.2	Nitrite as N	NELAP	PA	1/19/2005
EPA 353.2	Total nitrate-nitrite	NELAP	PA	4/4/2005
EPA 3620B	Florisil cleanup	NELAP	PA	12/12/2005
EPA 3630C	Silica gel cleanup	NELAP	PA	12/12/2005
EPA 3640A	Gel permeation cleanup (GPC)	NELAP	PA	12/12/2005
EPA 365.1	Phosphorus, total	NELAP	PA	4/4/2005

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Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 365.3	Orthophosphate as P	NELAP	PA	1/19/2005
EPA 3660B	Sulfur cleanup	NELAP	PA	12/12/2005
EPA 375.4	Sulfate	NELAP	PA	4/4/2005
EPA 410.1	Chemical oxygen demand (COD)	NELAP	PA	12/11/2006
EPA 410.4	Chemical oxygen demand (COD)	NELAP	PA	4/4/2005
EPA 415.1	Total organic carbon (TOC)	NELAP	PA	1/19/2005
EPA 420.4	Total phenolics	NELAP	PA	4/17/2007
EPA 425.1	Surfactants as MBAS	NELAP	PA	1/19/2005
EPA 5030B	Aqueous-phase purge-and-trap	NELAP	PA	12/12/2005
EPA 524.2	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/18/2011
EPA 524.2	1,2-Dichloroethane	NELAP	PA	1/18/2011
EPA 524.2	4-Methyl-2-pentanone (MIBK)	NELAP	PA	5/24/2011
EPA 524.2	Acetone	NELAP	PA	1/18/2011
EPA 524.2	Benzene	NELAP	PA	1/18/2011
EPA 524.2	Chlorobenzene	NELAP	PA	1/18/2011
EPA 524.2	Chloroform	NELAP	PA	1/18/2011
EPA 524.2	Dichloromethane (DCM, Methylene chloride)	NELAP	PA	5/24/2011
EPA 524.2	Tetrahydrofuran (THF)	NELAP	PA	5/24/2011
EPA 524.2	Toluene	NELAP	PA	1/18/2011
EPA 524.2	o-Xylene	NELAP	PA	5/24/2011
EPA 6010	Aluminum	NELAP	PA	12/12/2005
EPA 6010	Antimony	NELAP	PA	12/12/2005
EPA 6010	Arsenic	NELAP	PA	12/12/2005
EPA 6010	Barium	NELAP	PA	12/12/2005
EPA 6010	Beryllium	NELAP	PA	12/12/2005
EPA 6010	Boron	NELAP	PA	12/12/2005
EPA 6010	Cadmium	NELAP	PA	12/12/2005
EPA 6010	Calcium	NELAP	PA	12/12/2005
EPA 6010	Chromium	NELAP	PA	12/12/2005
EPA 6010	Cobalt	NELAP	PA	12/12/2005
EPA 6010	Copper	NELAP	PA	12/12/2005
EPA 6010	Iron	NELAP	PA	12/12/2005
EPA 6010	Lead	NELAP	PA	12/12/2005
EPA 6010	Lithium	NELAP	PA	1/18/2011
EPA 6010	Magnesium	NELAP	PA	12/12/2005
EPA 6010	Manganese	NELAP	PA	12/12/2005

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Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6010	Molybdenum	NELAP	PA	12/12/2005
EPA 6010	Nickel	NELAP	PA	12/12/2005
EPA 6010	Potassium	NELAP	PA	12/12/2005
EPA 6010	Selenium	NELAP	PA	12/12/2005
EPA 6010	Silver	NELAP	PA	12/12/2005
EPA 6010	Sodium	NELAP	PA	12/12/2005
EPA 6010	Strontium	NELAP	PA	12/12/2005
EPA 6010	Thallium	NELAP	PA	12/12/2005
EPA 6010	Tin	NELAP	PA	12/12/2005
EPA 6010	Titanium	NELAP	PA	12/12/2005
EPA 6010	Vanadium	NELAP	PA	12/12/2005
EPA 6010	Zinc	NELAP	PA	12/12/2005
EPA 602	Benzene	NELAP	PA	1/19/2005
EPA 602	Ethylbenzene	NELAP	PA	1/19/2005
EPA 602	Methyl tert-butyl ether (MTBE)	NELAP	PA	1/19/2005
EPA 602	Toluene	NELAP	PA	1/19/2005
EPA 602	Xylenes, total	NELAP	PA	1/19/2005
EPA 602-Extended	Naphthalene	NELAP	PA	1/18/2011
EPA 602-Extended	Styrene	NELAP	PA	6/24/2008
EPA 602-Extended	m+p-Xylene	NELAP	PA	1/18/2011
EPA 602-Extended	o-Xylene	NELAP	PA	1/18/2011
EPA 6020	Aluminum	NELAP	PA	1/7/2010
EPA 6020	Antimony	NELAP	PA	12/12/2005
EPA 6020	Arsenic	NELAP	PA	12/12/2005
EPA 6020	Barium	NELAP	PA	12/12/2005
EPA 6020	Beryllium	NELAP	PA	12/12/2005
EPA 6020	Cadmium	NELAP	PA	12/12/2005
EPA 6020	Calcium	NELAP	PA	1/7/2010
EPA 6020	Chromium	NELAP	PA	12/12/2005
EPA 6020	Cobalt	NELAP	PA	11/23/2010
EPA 6020	Copper	NELAP	PA	12/12/2005
EPA 6020	Iron	NELAP	PA	11/23/2010
EPA 6020	Lead	NELAP	PA	12/12/2005
EPA 6020	Magnesium	NELAP	PA	1/7/2010
EPA 6020	Manganese	NELAP	PA	11/23/2010
EPA 6020	Molybdenum	NELAP	PA	1/7/2010

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Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories, Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6020	Nickel	NELAP	PA	7/23/2008
EPA 6020	Potassium	NELAP	PA	1/7/2010
EPA 6020	Selenium	NELAP	PA	12/12/2005
EPA 6020	Silver	NELAP	PA	1/12/2007
EPA 6020	Sodium	NELAP	PA	1/7/2010
EPA 6020	Thallium	NELAP	PA	12/12/2005
EPA 6020	Vanadium	NELAP	PA	1/7/2010
EPA 6020	Zinc	NELAP	PA	1/18/2011
EPA 6020-Extended	Boron	NELAP	PA	1/7/2010
EPA 6020-Extended	Strontium	NELAP	PA	1/7/2010
EPA 6020-Extended	Tin	NELAP	PA	1/7/2010
EPA 6020-Extended	Titanium	NELAP	PA	1/7/2010
EPA 608	4,4'-DDD	NELAP	PA	1/19/2005
EPA 608	4,4'-DDE	NELAP	PA	1/19/2005
EPA 608	4,4'-DDT	NELAP	PA	1/19/2005
EPA 608	Aldrin (HHDN)	NELAP	PA	1/19/2005
EPA 608	Aroclor-1016 (PCB-1016)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1221 (PCB-1221)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1232 (PCB-1232)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1242 (PCB-1242)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1248 (PCB-1248)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1254 (PCB-1254)	NELAP	PA	12/11/2006
EPA 608	Aroclor-1260 (PCB-1260)	NELAP	PA	12/11/2006
EPA 608	Chlordane (tech.)	NELAP	PA	1/19/2005
EPA 608	Dieldrin	NELAP	PA	1/19/2005
EPA 608	Endosulfan I	NELAP	PA	1/19/2005
EPA 608	Endosulfan II	NELAP	PA	1/19/2005
EPA 608	Endosulfan sulfate	NELAP	PA	1/19/2005
EPA 608	Endrin	NELAP	PA	1/19/2005
EPA 608	Endrin aldehyde	NELAP	PA	1/19/2005
EPA 608	Heptachlor	NELAP	PA	1/19/2005
EPA 608	Heptachlor epoxide	NELAP	PA	1/19/2005
EPA 608	Methoxychlor	NELAP	PA	5/2/2006
EPA 608	Toxaphene (Chlorinated camphene)	NELAP	PA	1/19/2005
EPA 608	alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 608	beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005

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Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 608	delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 608	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 610	Acenaphthene	NELAP	PA	1/2/2007
EPA 610	Acenaphthylene	NELAP	PA	1/2/2007
EPA 610	Anthracene	NELAP	PA	1/2/2007
EPA 610	Benzo[a]anthracene	NELAP	PA	1/2/2007
EPA 610	Benzo[a]pyrene	NELAP	PA	1/2/2007
EPA 610	Benzo[b]fluoranthene	NELAP	PA	1/2/2007
EPA 610	Benzo[ghi]perylene	NELAP	PA	1/2/2007
EPA 610	Benzo[k]fluoranthene	NELAP	PA	1/2/2007
EPA 610	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/2/2007
EPA 610	Dibenzo[a,h]anthracene	NELAP	PA	1/2/2007
EPA 610	Fluoranthene	NELAP	PA	1/2/2007
EPA 610	Fluorene	NELAP	PA	1/2/2007
EPA 610	Indeno(1,2,3-cd)pyrene	NELAP	PA	1/2/2007
EPA 610	Naphthalene	NELAP	PA	1/2/2007
EPA 610	Phenanthrene	NELAP	PA	1/2/2007
EPA 610	Pyrene	NELAP	PA	1/2/2007
EPA 622	Azinphos-methyl (Guthion)	NELAP	PA	6/15/2009
EPA 622	Bolstar (Sulprofos)	NELAP	PA	6/15/2009
EPA 622	Chlorpyrifos	NELAP	PA	6/15/2009
EPA 622	Coumaphos	NELAP	PA	6/15/2009
EPA 622	Demeton-O	NELAP	PA	6/15/2009
EPA 622	Demeton-S	NELAP	PA	6/15/2009
EPA 622	Diazinon (Spectracide)	NELAP	PA	6/15/2009
EPA 622	Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	6/15/2009
EPA 622	Disulfoton	NELAP	PA	6/15/2009
EPA 622	Ethoprop (Prophos)	NELAP	PA	6/15/2009
EPA 622	Fensulfothion	NELAP	PA	6/15/2009
EPA 622	Fenthion	NELAP	PA	6/15/2009
EPA 622	Merphos	NELAP	PA	6/15/2009
EPA 622	Methyl parathion (Parathion, methyl)	NELAP	PA	6/15/2009
EPA 622	Mevinphos	NELAP	PA	6/15/2009
EPA 622	Naled	NELAP	PA	6/15/2009
EPA 622	Phorate (Thimet)	NELAP	PA	6/15/2009
EPA 622	Ronnel	NELAP	PA	6/15/2009

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 622	Stirophos (Tetrachlorovinphos)	NELAP	PA	6/15/2009
EPA 622	Tokuthion (Prothiophos)	NELAP	PA	6/15/2009
EPA 622	Trichloronate	NELAP	PA	6/15/2009
EPA 622-Extended	Carbophenothion (Trithion)	NELAP	PA	4/28/2010
EPA 622-Extended	EPN (Santox)	NELAP	PA	6/15/2009
EPA 622-Extended	Ethion	NELAP	PA	6/15/2009
EPA 622-Extended	Famphur	NELAP	PA	6/15/2009
EPA 622-Extended	Malathion	NELAP	PA	6/15/2009
EPA 622-Extended	Parathion (Ethyl parathion)	NELAP	PA	6/15/2009
EPA 624	1,1,1,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 624	1,1,1-Trichloroethane	NELAP	PA	1/19/2005
EPA 624	1,1,2,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 624	1,1,2-Trichloroethane	NELAP	PA	1/19/2005
EPA 624	1,1-Dichloroethane	NELAP	PA	1/19/2005
EPA 624	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	1/19/2005
EPA 624	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 624	1,2-Dichloroethane	NELAP	PA	1/19/2005
EPA 624	1,2-Dichloropropane	NELAP	PA	1/19/2005
EPA 624	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 624	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 624	2-Chloroethyl vinyl ether	NELAP	PA	1/19/2005
EPA 624	Acrolein (Propenal)	NELAP	PA	1/19/2005
EPA 624	Acrylonitrile	NELAP	PA	1/19/2005
EPA 624	Benzene	NELAP	PA	1/19/2005
EPA 624	Bromodichloromethane	NELAP	PA	1/19/2005
EPA 624	Bromoform	NELAP	PA	1/19/2005
EPA 624	Carbon tetrachloride	NELAP	PA	1/19/2005
EPA 624	Chlorobenzene	NELAP	PA	1/19/2005
EPA 624	Chloroethane	NELAP	PA	1/19/2005
EPA 624	Chloroform	NELAP	PA	1/19/2005
EPA 624	Dibromochloromethane	NELAP	PA	4/4/2005
EPA 624	Ethylbenzene	NELAP	PA	1/19/2005
EPA 624	Methyl bromide (Bromomethane)	NELAP	PA	1/19/2005
EPA 624	Methyl chloride (Chloromethane)	NELAP	PA	1/19/2005
EPA 624	Methylene chloride (Dichloromethane)	NELAP	PA	1/19/2005
EPA 624	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	1/19/2005

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Pennsylvania Department of Environmental Protection

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Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 624	Toluene	NELAP	PA	1/19/2005
EPA 624	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	1/19/2005
EPA 624	Trichlorofluoromethane (Freon 11)	NELAP	PA	1/19/2005
EPA 624	Vinyl chloride (Chloroethene)	NELAP	PA	1/19/2005
EPA 624	Xylenes, total	NELAP	PA	1/19/2005
EPA 624	cis-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 624	trans-1,2-Dichloroethene	NELAP	PA	1/19/2005
EPA 624	trans-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 624-Extended	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	7/3/2007
EPA 624-Extended	1,1-Dichloropropene	NELAP	PA	7/3/2007
EPA 624-Extended	1,2,3-Trichlorobenzene	NELAP	PA	7/3/2007
EPA 624-Extended	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	7/3/2007
EPA 624-Extended	1,2,3-Trimethylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	1,2,4-Trichlorobenzene	NELAP	PA	7/3/2007
EPA 624-Extended	1,2,4-Trimethylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	7/3/2007
EPA 624-Extended	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	7/3/2007
EPA 624-Extended	1,3,5-Trimethylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	1,3-Dichloropropane	NELAP	PA	7/3/2007
EPA 624-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	7/3/2007
EPA 624-Extended	2,2-Dichloropropane	NELAP	PA	7/3/2007
EPA 624-Extended	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	7/3/2007
EPA 624-Extended	2-Chlorotoluene	NELAP	PA	7/3/2007
EPA 624-Extended	2-Hexanone	NELAP	PA	7/3/2007
EPA 624-Extended	4-Chloro-2-nitrophenol	NELAP	PA	7/3/2007
EPA 624-Extended	4-Chlorotoluene	NELAP	PA	7/3/2007
EPA 624-Extended	4-Isopropyltoluene (p-Isopropyltoluene)	NELAP	PA	7/3/2007
EPA 624-Extended	Acetone	NELAP	PA	7/3/2007
EPA 624-Extended	Acetonitrile	NELAP	PA	7/3/2007
EPA 624-Extended	Allyl chloride (3-Chloropropene)	NELAP	PA	7/3/2007
EPA 624-Extended	Bromobenzene	NELAP	PA	7/3/2007
EPA 624-Extended	Bromochloromethane	NELAP	PA	5/2/2006
EPA 624-Extended	Carbon disulfide	NELAP	PA	7/3/2007
EPA 624-Extended	Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	6/12/2009
EPA 624-Extended	Cyclohexane	NELAP	PA	7/3/2007
EPA 624-Extended	Dibromomethane	NELAP	PA	7/3/2007

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Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 624-Extended	Dichlorodifluoromethane (Freon 12)	NELAP	PA	7/3/2007
EPA 624-Extended	Diisopropyl ether (DIPE)	NELAP	PA	5/2/2006
EPA 624-Extended	Ethyl methacrylate	NELAP	PA	7/3/2007
EPA 624-Extended	Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	NELAP	PA	2/1/2011
EPA 624-Extended	Freon-123A	NELAP	PA	2/1/2011
EPA 624-Extended	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	7/3/2007
EPA 624-Extended	Isopropylbenzene (Cumene)	NELAP	PA	5/2/2006
EPA 624-Extended	Methacrylonitrile	NELAP	PA	7/3/2007
EPA 624-Extended	Methyl iodide (Iodomethane)	NELAP	PA	7/3/2007
EPA 624-Extended	Methyl isobutyl ketone (MIBK, 4-Methyl-2-pentanone)	NELAP	PA	5/2/2006
EPA 624-Extended	Methyl tert-butyl ether (MTBE)	NELAP	PA	12/12/2005
EPA 624-Extended	Methylmethacrylate	NELAP	PA	7/3/2007
EPA 624-Extended	Naphthalene	NELAP	PA	7/3/2007
EPA 624-Extended	Pentachloroethane	NELAP	PA	7/3/2007
EPA 624-Extended	Propionitrile (Ethyl cyanide)	NELAP	PA	7/3/2007
EPA 624-Extended	Styrene	NELAP	PA	5/2/2006
EPA 624-Extended	Tetrahydrofuran (THF)	NELAP	PA	7/3/2007
EPA 624-Extended	Vinyl acetate	NELAP	PA	7/3/2007
EPA 624-Extended	cis-1,2-Dichloroethene	NELAP	PA	6/12/2009
EPA 624-Extended	n-Butylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	n-Heptane	NELAP	PA	7/3/2007
EPA 624-Extended	n-Hexane	NELAP	PA	7/3/2007
EPA 624-Extended	n-Propylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	sec-Butylbenzene	NELAP	PA	7/3/2007
EPA 624-Extended	tert-Amyl methyl ether (TAME)	NELAP	PA	5/2/2006
EPA 624-Extended	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	5/2/2006
EPA 624-Extended	tert-Butyl ethyl ether	NELAP	PA	5/2/2006
EPA 624-Extended	tert-Butylbenzene	NELAP	PA	7/3/2007
EPA 625	1,2,4-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 625	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 625	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 625	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 625	2,4,5-Trichlorophenol	NELAP	PA	7/3/2007
EPA 625	2,4,6-Trichlorophenol	NELAP	PA	1/19/2005
EPA 625	2,4-Dichlorophenol	NELAP	PA	1/19/2005
EPA 625	2,4-Dimethylphenol	NELAP	PA	1/19/2005

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 625	2,4-Dinitrophenol	NELAP	PA	1/19/2005
EPA 625	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	1/19/2005
EPA 625	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	1/19/2005
EPA 625	2-Chloronaphthalene	NELAP	PA	1/19/2005
EPA 625	2-Chlorophenol	NELAP	PA	1/19/2005
EPA 625	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	1/19/2005
EPA 625	2-Methylphenol (o-Cresol)	NELAP	PA	7/3/2007
EPA 625	2-Nitrophenol	NELAP	PA	1/19/2005
EPA 625	3,3'-Dichlorobenzidine	NELAP	PA	1/19/2005
EPA 625	4-Bromophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 625	4-Chloro-3-methylphenol	NELAP	PA	1/19/2005
EPA 625	4-Chlorophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 625	4-Nitrophenol	NELAP	PA	1/19/2005
EPA 625	Acenaphthene	NELAP	PA	1/19/2005
EPA 625	Acenaphthylene	NELAP	PA	1/19/2005
EPA 625	Acetophenone	NELAP	PA	5/2/2006
EPA 625	Aniline	NELAP	PA	5/2/2006
EPA 625	Anthracene	NELAP	PA	4/4/2005
EPA 625	Benzidine	NELAP	PA	1/19/2005
EPA 625	Benzo[a]anthracene	NELAP	PA	1/19/2005
EPA 625	Benzo[a]pyrene	NELAP	PA	1/19/2005
EPA 625	Benzo[b]fluoranthene	NELAP	PA	1/19/2005
EPA 625	Benzo[ghi]perylene	NELAP	PA	1/19/2005
EPA 625	Benzo[k]fluoranthene	NELAP	PA	1/19/2005
EPA 625	Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	1/19/2005
EPA 625	Carbazole	NELAP	PA	5/2/2006
EPA 625	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/19/2005
EPA 625	Di-n-butyl phthalate	NELAP	PA	1/19/2005
EPA 625	Di-n-octyl phthalate	NELAP	PA	1/19/2005
EPA 625	Dibenzo[a,h]anthracene	NELAP	PA	1/19/2005
EPA 625	Diethyl phthalate	NELAP	PA	1/19/2005
EPA 625	Dimethyl phthalate	NELAP	PA	1/19/2005
EPA 625	Fluoranthene	NELAP	PA	1/19/2005
EPA 625	Fluorene	NELAP	PA	1/19/2005
EPA 625	Hexachlorobenzene	NELAP	PA	1/19/2005
EPA 625	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	1/19/2005

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.

www.dep.state.pa.us Issue Date: 05/25/2011

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 625	Hexachlorocyclopentadiene	NELAP	PA	1/19/2005
EPA 625	Hexachloroethane	NELAP	PA	1/19/2005
EPA 625	Indeno(1,2,3-cd)pyrene	NELAP	PA	1/19/2005
EPA 625	Isophorone	NELAP	PA	1/19/2005
EPA 625	N-Nitrosodi-n-propylamine	NELAP	PA	1/19/2005
EPA 625	N-Nitrosodimethylamine	NELAP	PA	1/19/2005
EPA 625	N-Nitrosodiphenylamine	NELAP	PA	1/19/2005
EPA 625	Naphthalene	NELAP	PA	1/19/2005
EPA 625	Nitrobenzene	NELAP	PA	1/19/2005
EPA 625	Pentachlorophenol (PCP)	NELAP	PA	1/19/2005
EPA 625	Phenanthrene	NELAP	PA	1/19/2005
EPA 625	Phenol	NELAP	PA	1/19/2005
EPA 625	Pyrene	NELAP	PA	1/19/2005
EPA 625	Pyridine	NELAP	PA	5/2/2006
EPA 625	bis(2-Chloroethoxy)methane	NELAP	PA	1/19/2005
EPA 625	bis(2-Chloroethyl) ether	NELAP	PA	1/19/2005
EPA 625	bis(2-Chloroisopropyl) ether	NELAP	PA	1/19/2005
EPA 625	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	1/19/2005
EPA 625-Extended	1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	7/3/2007
EPA 625-Extended	1,2,4,5-Tetrachlorobenzene	NELAP	PA	5/2/2006
EPA 625-Extended	1,2-Diphenylhydrazine	NELAP	PA	5/2/2006
EPA 625-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	7/3/2007
EPA 625-Extended	1-Methylphenanthrene	NELAP	PA	5/2/2006
EPA 625-Extended	2,3,4,6-Tetrachlorophenol	NELAP	PA	7/3/2007
EPA 625-Extended	2,3-Dichloroaniline	NELAP	PA	5/2/2006
EPA 625-Extended	2,3-Dinitrotoluene	NELAP	PA	7/3/2007
EPA 625-Extended	2,4,5-Trichlorophenol	NELAP	PA	7/3/2007
EPA 625-Extended	2,6-Dichlorophenol	NELAP	PA	7/3/2007
EPA 625-Extended	2-Methylnaphthalene	NELAP	PA	7/3/2007
EPA 625-Extended	2-Methylphenol (o-Cresol)	NELAP	PA	7/3/2007
EPA 625-Extended	2-Nitroaniline	NELAP	PA	7/3/2007
EPA 625-Extended	3-Methylphenol (m-Cresol)	NELAP	PA	7/3/2007
EPA 625-Extended	3-Nitroaniline	NELAP	PA	7/3/2007
EPA 625-Extended	4-Chloroaniline	NELAP	PA	7/3/2007
EPA 625-Extended	4-Methylphenol (p-Cresol)	NELAP	PA	7/3/2007
EPA 625-Extended	4-Nitroaniline	NELAP	PA	7/3/2007

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories, Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 625-Extended	Benzoic acid	NELAP	PA	5/2/2006
EPA 625-Extended	Benzyl alcohol	NELAP	PA	7/3/2007
EPA 625-Extended	Dibenzofuran	NELAP	PA	7/3/2007
EPA 625-Extended	Diphenyl ether	NELAP	PA	7/3/2007
EPA 625-Extended	N-Nitrosodi-n-butylamine	NELAP	PA	5/2/2006
EPA 625-Extended	N-Nitrosodiethylamine	NELAP	PA	5/2/2006
EPA 625-Extended	N-Nitrosopyrrolidine	NELAP	PA	5/2/2006
EPA 625-Extended	Pentachlorobenzene	NELAP	PA	7/3/2007
EPA 625-Extended	alpha-Terpineol	NELAP	PA	5/2/2006
EPA 625-Extended	n-Decane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Docosane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Dodecane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Eicosane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Hexadecane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Octadecane	NELAP	PA	5/2/2006
EPA 625-Extended	n-Tetradecane	NELAP	PA	5/2/2006
EPA 625-Extended	o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	7/3/2007
EPA 6850	Perchlorate	NELAP	PA	1/19/2011
EPA 7196A	Chromium VI	NELAP	PA	4/6/2006
EPA 7199	Chromium VI	NELAP	PA	1/4/2006
EPA 7470	Mercury	NELAP	PA	11/21/2005
EPA 8011	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	12/12/2005
EPA 8011	Dibromochloropropane (1,2-Dibromo-3-chloropropane, DBCP)	NELAP	PA	5/2/2006
EPA 8015	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
EPA 8015	Ethanol	NELAP	PA	12/4/2007
EPA 8015	Ethylene glycol	NELAP	PA	12/4/2007
EPA 8015	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
EPA 8015	Isopropyl alcohol (2-Propanol)	NELAP	PA	12/4/2007
EPA 8015	Methanol	NELAP	PA	12/4/2007
EPA 8015	Total petroleum hydrocarbons (TPH)	NELAP	PA	1/24/2007
EPA 8015B-Extended	Ethane	NELAP	PA	12/4/2007
EPA 8015B-Extended	Ethene	NELAP	PA	12/4/2007
EPA 8015B-Extended	Methane	NELAP	PA	12/4/2007
EPA 8015B-Extended	Propane	NELAP	PA	12/4/2007
EPA 8021	Benzene	NELAP	PA	12/12/2005
EPA 8021	Ethylbenzene	NELAP	PA	12/12/2005

Pennsylvania Department of Environmental Protection

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Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories, Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8021	Isopropylbenzene (Cumene)	NELAP	PA	12/12/2005
EPA 8021	Methyl tert-butyl ether (MTBE)	NELAP	PA	2/11/2011
EPA 8021	Naphthalene	NELAP	PA	6/24/2008
EPA 8021	Toluene	NELAP	PA	12/12/2005
EPA 8021	Xylenes, total	NELAP	PA	12/12/2005
EPA 8021	m-Xylene	NELAP	PA	11/23/2009
EPA 8021	o-Xylene	NELAP	PA	11/23/2009
EPA 8021	p-Xylene	NELAP	PA	11/23/2009
EPA 8081	4,4'-DDD	NELAP	PA	2/10/2006
EPA 8081	4,4'-DDE	NELAP	PA	12/12/2005
EPA 8081	4,4'-DDT	NELAP	PA	12/12/2005
EPA 8081	Aldrin (HHDN)	NELAP	PA	12/12/2005
EPA 8081	Chlordane (tech.)	NELAP	PA	12/12/2005
EPA 8081	Dieldrin	NELAP	PA	12/12/2005
EPA 8081	Endosulfan I	NELAP	PA	2/10/2006
EPA 8081	Endosulfan II	NELAP	PA	12/12/2005
EPA 8081	Endosulfan sulfate	NELAP	PA	12/12/2005
EPA 8081	Endrin	NELAP	PA	12/12/2005
EPA 8081	Endrin aldehyde	NELAP	PA	12/12/2005
EPA 8081	Endrin ketone	NELAP	PA	2/10/2006
EPA 8081	Heptachlor	NELAP	PA	12/12/2005
EPA 8081	Heptachlor epoxide	NELAP	PA	12/12/2005
EPA 8081	Kepone	NELAP	PA	5/2/2006
EPA 8081	Methoxychlor	NELAP	PA	12/12/2005
EPA 8081	Mirex	NELAP	PA	12/12/2005
EPA 8081	Toxaphene (Chlorinated camphene)	NELAP	PA	12/12/2005
EPA 8081	alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081	alpha-Chlordane	NELAP	PA	2/10/2006
EPA 8081	beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081	delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081	gamma-Chlordane	NELAP	PA	2/10/2006
EPA 8082	Aroclor-1016 (PCB-1016)	NELAP	PA	12/11/2006
EPA 8082	Aroclor-1221 (PCB-1221)	NELAP	PA	12/11/2006
EPA 8082	Aroclor-1232 (PCB-1232)	NELAP	PA	12/11/2006
EPA 8082	Aroclor-1242 (PCB-1242)	NELAP	PA	12/11/2006

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www.dep.state.pa.us Issue Date: 05/25/2011

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8082	Aroclor-1248 (PCB-1248)	NELAP	PA	12/11/2006
EPA 8082	Aroclor-1254 (PCB-1254)	NELAP	PA	12/11/2006
EPA 8082	Aroclor-1260 (PCB-1260)	NELAP	PA	12/11/2006
EPA 8082-Extended	Aroclor-1262 (PCB-1262)	NELAP	PA	7/23/2008
EPA 8082-Extended	Aroclor-1268 (PCB-1268)	NELAP	PA	7/23/2008
EPA 8141	Atrazine	NELAP	PA	12/12/2005
EPA 8141	Azinphos-methyl (Guthion)	NELAP	PA	12/12/2005
EPA 8141	Bolstar (Sulprofos)	NELAP	PA	12/12/2005
EPA 8141	Chlorpyrifos	NELAP	PA	12/12/2005
EPA 8141	Coumaphos	NELAP	PA	12/12/2005
EPA 8141	Demeton-O	NELAP	PA	12/12/2005
EPA 8141	Demeton-S	NELAP	PA	12/12/2005
EPA 8141	Diazinon (Spectracide)	NELAP	PA	12/12/2005
EPA 8141	Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	12/12/2005
EPA 8141	Disulfoton	NELAP	PA	12/12/2005
EPA 8141	EPN (Santox)	NELAP	PA	12/12/2005
EPA 8141	Ethion	NELAP	PA	12/12/2005
EPA 8141	Ethoprop (Prophos)	NELAP	PA	12/12/2005
EPA 8141	Famphur	NELAP	PA	12/12/2005
EPA 8141	Fensulfothion	NELAP	PA	12/12/2005
EPA 8141	Fenthion	NELAP	PA	12/12/2005
EPA 8141	Malathion	NELAP	PA	12/12/2005
EPA 8141	Merphos	NELAP	PA	12/12/2005
EPA 8141	Methyl parathion (Parathion, methyl)	NELAP	PA	12/12/2005
EPA 8141	Mevinphos	NELAP	PA	12/12/2005
EPA 8141	Naled	NELAP	PA	12/12/2005
EPA 8141	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	12/12/2005
EPA 8141	Phorate (Thimet)	NELAP	PA	12/12/2005
EPA 8141	Ronnel	NELAP	PA	12/12/2005
EPA 8141	Simazine	NELAP	PA	12/12/2005
EPA 8141	Stirophos (Tetrachlorovinphos)	NELAP	PA	5/2/2006
EPA 8141	Tokuthion (Prothiophos)	NELAP	PA	12/12/2005
EPA 8141	Trichloronate	NELAP	PA	5/2/2006
EPA 8141-Extended	Alachlor (Lasso)	NELAP	PA	1/21/2009
EPA 8141-Extended	Metolachlor	NELAP	PA	1/24/2007
EPA 8151	2,4,5-T	NELAP	PA	12/12/2005

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8151	2,4,5-TP (Silvex)	NELAP	PA	12/12/2005
EPA 8151	2,4-D	NELAP	PA	12/12/2005
EPA 8151	2,4-DB (Butoxon)	NELAP	PA	12/12/2005
EPA 8151	Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	12/12/2005
EPA 8151	Dicamba	NELAP	PA	12/12/2005
EPA 8151	Dichloroprop (Dichlorprop)	NELAP	PA	1/24/2007
EPA 8151	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	12/12/2005
EPA 8151	MCPA	NELAP	PA	12/12/2005
EPA 8151	MCPP (Mecoprop)	NELAP	PA	12/12/2005
EPA 8151	Pentachlorophenol (PCP)	NELAP	PA	12/12/2005
EPA 8151	Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid)	NELAP	PA	12/12/2005
EPA 8260	1,1,1,2-Tetrachloroethane	NELAP	PA	12/12/2005
EPA 8260	1,1,1-Trichloroethane	NELAP	PA	12/12/2005
EPA 8260	1,1,2,2-Tetrachloroethane	NELAP	PA	12/12/2005
EPA 8260	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	12/12/2005
EPA 8260	1,1,2-Trichloroethane	NELAP	PA	12/12/2005
EPA 8260	1,1-Dichloroethane	NELAP	PA	12/12/2005
EPA 8260	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	12/12/2005
EPA 8260	1,1-Dichloropropene	NELAP	PA	12/12/2005
EPA 8260	1,2,3-Trichlorobenzene	NELAP	PA	12/12/2005
EPA 8260	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	12/12/2005
EPA 8260	1,2,4-Trichlorobenzene	NELAP	PA	12/12/2005
EPA 8260	1,2,4-Trimethylbenzene	NELAP	PA	12/12/2005
EPA 8260	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	5/2/2006
EPA 8260	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	12/12/2005
EPA 8260	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8260	1,2-Dichloroethane	NELAP	PA	12/12/2005
EPA 8260	1,2-Dichloropropane	NELAP	PA	12/12/2005
EPA 8260	1,3,5-Trimethylbenzene	NELAP	PA	12/12/2005
EPA 8260	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8260	1,3-Dichloropropane	NELAP	PA	12/12/2005
EPA 8260	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8260	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	12/12/2005
EPA 8260	2,2-Dichloropropane	NELAP	PA	5/2/2006
EPA 8260	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	5/2/2006

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	2-Chloroethyl vinyl ether	NELAP	PA	12/12/2005
EPA 8260	2-Chlorotoluene	NELAP	PA	12/12/2005
EPA 8260	2-Hexanone	NELAP	PA	12/12/2005
EPA 8260	2-Nitropropane	NELAP	PA	1/19/2011
EPA 8260	2-Propanol (Isopropyl alcohol)	NELAP	PA	1/18/2011
EPA 8260	4-Chlorotoluene	NELAP	PA	12/12/2005
EPA 8260	4-Methyl-2-pentanone (MIBK)	NELAP	PA	12/12/2005
EPA 8260	Acetone	NELAP	PA	12/12/2005
EPA 8260	Acetonitrile	NELAP	PA	12/12/2005
EPA 8260	Acrolein (Propenal)	NELAP	PA	12/12/2005
EPA 8260	Acrylonitrile	NELAP	PA	12/12/2005
EPA 8260	Allyl chloride (3-Chloropropene)	NELAP	PA	12/12/2005
EPA 8260	Benzene	NELAP	PA	12/12/2005
EPA 8260	Benzyl chloride	NELAP	PA	7/3/2007
EPA 8260	Bromobenzene	NELAP	PA	12/12/2005
EPA 8260	Bromochloromethane	NELAP	PA	12/12/2005
EPA 8260	Bromodichloromethane	NELAP	PA	12/12/2005
EPA 8260	Bromoform	NELAP	PA	12/12/2005
EPA 8260	Carbon disulfide	NELAP	PA	12/12/2005
EPA 8260	Carbon tetrachloride	NELAP	PA	12/12/2005
EPA 8260	Chlorobenzene	NELAP	PA	12/12/2005
EPA 8260	Chloroethane	NELAP	PA	12/12/2005
EPA 8260	Chloroform	NELAP	PA	12/12/2005
EPA 8260	Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	7/3/2007
EPA 8260	Dibromochloromethane	NELAP	PA	12/12/2005
EPA 8260	Dibromochloropropane (1,2-Dibromo-3-chloropropane, DBCP)	NELAP	PA	12/12/2005
EPA 8260	Dibromomethane	NELAP	PA	5/2/2006
EPA 8260	Dichlorodifluoromethane (Freon 12)	NELAP	PA	12/12/2005
EPA 8260	Diethyl ether (Ethyl ether)	NELAP	PA	2/1/2011
EPA 8260	Epichlorohydrin (1-Chloro-2,3-epoxypropane)	NELAP	PA	4/17/2009
EPA 8260	Ethylbenzene	NELAP	PA	12/12/2005
EPA 8260	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	12/12/2005
EPA 8260	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	7/3/2007
EPA 8260	Isopropylbenzene (Cumene)	NELAP	PA	5/2/2006
EPA 8260	Methacrylonitrile	NELAP	PA	7/3/2007
EPA 8260	Methyl bromide (Bromomethane)	NELAP	PA	12/12/2005

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	Methyl chloride (Chloromethane)	NELAP	PA	12/12/2005
EPA 8260	Methyl tert-butyl ether (MTBE)	NELAP	PA	12/12/2005
EPA 8260	Methylene chloride (Dichloromethane)	NELAP	PA	12/12/2005
EPA 8260	Methylmethacrylate	NELAP	PA	5/25/2007
EPA 8260	Naphthalene	NELAP	PA	12/12/2005
EPA 8260	Propionitrile (Ethyl cyanide)	NELAP	PA	12/12/2005
EPA 8260	Styrene	NELAP	PA	12/12/2005
EPA 8260	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	12/12/2005
EPA 8260	Toluene	NELAP	PA	12/12/2005
EPA 8260	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	12/12/2005
EPA 8260	Trichlorofluoromethane (Freon 11)	NELAP	PA	12/12/2005
EPA 8260	Vinyl acetate	NELAP	PA	12/12/2005
EPA 8260	Vinyl chloride (Chloroethene)	NELAP	PA	12/12/2005
EPA 8260	Xylenes, total	NELAP	PA	12/12/2005
EPA 8260	cis-1,2-Dichloroethene	NELAP	PA	12/12/2005
EPA 8260	cis-1,3-Dichloropropene	NELAP	PA	12/12/2005
EPA 8260	m+p-Xylene	NELAP	PA	4/17/2009
EPA 8260	n-Butyl alcohol (n-Butanol, 1-Butanol)	NELAP	PA	4/17/2009
EPA 8260	n-Butylbenzene	NELAP	PA	12/12/2005
EPA 8260	n-Propylamine	NELAP	PA	12/12/2005
EPA 8260	o-Xylene	NELAP	PA	4/17/2009
EPA 8260	sec-Butylbenzene	NELAP	PA	12/12/2005
EPA 8260	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	12/12/2005
EPA 8260	tert-Butylbenzene	NELAP	PA	12/12/2005
EPA 8260	trans-1,2-Dichloroethene	NELAP	PA	12/12/2005
EPA 8260	trans-1,3-Dichloropropene	NELAP	PA	12/12/2005
EPA 8260	trans-1,4-Dichloro-2-butene	NELAP	PA	7/3/2007
EPA 8260 SIM	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	12/4/2007
EPA 8260-Extended	3,3'-Dimethyl-1-butanol	NELAP	PA	4/17/2009
EPA 8260-Extended	Ethyl tert-butyl ether (ETBE)	NELAP	PA	1/24/2007
EPA 8260-Extended	Gasoline-range organics (GRO)	NELAP	PA	6/8/2006
EPA 8260-Extended	Methyl acetate	NELAP	PA	1/24/2007
EPA 8260-Extended	Methyl iodide (Iodomethane)	NELAP	PA	5/25/2007
EPA 8260-Extended	Methylcyclohexane	NELAP	PA	1/21/2009
EPA 8260-Extended	Tetrahydrofuran (THF)	NELAP	PA	1/18/2011
EPA 8260-Extended	tert-Amyl alcohol (2-Methyl-2-butanol)	NELAP	PA	4/17/2009

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www.dep.state.pa.us Issue Date: 05/25/2011

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Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260-Extended	tert-Amyl methyl ether (TAME)	NELAP	PA	1/24/2007
EPA 8260-Extended	tert-Butyl formate	NELAP	PA	4/17/2009
EPA 8260B	4-Isopropyltoluene (p-isopropyltoluene)	NELAP	PA	1/24/2007
EPA 8260B	Ethanol	NELAP	PA	1/24/2007
EPA 8260B	Ethyl acetate	NELAP	PA	1/24/2007
EPA 8260B	Ethyl methacrylate	NELAP	PA	1/24/2007
EPA 8260B	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	1/24/2007
EPA 8260B	Pentachloroethane	NELAP	PA	1/24/2007
EPA 8260B	n-Propylbenzene	NELAP	PA	1/24/2007
EPA 8260B-Extended	Cyclohexane	NELAP	PA	7/3/2007
EPA 8260B-Extended	Diisopropyl ether (DIPE)	NELAP	PA	7/3/2007
EPA 8270	1,2,4,5-Tetrachlorobenzene	NELAP	PA	12/12/2005
EPA 8270	1,2,4-Trichlorobenzene	NELAP	PA	12/12/2005
EPA 8270	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8270	1,2-Diphenylhydrazine	NELAP	PA	12/12/2005
EPA 8270	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	12/12/2005
EPA 8270	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8270	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	12/12/2005
EPA 8270	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8270	1,4-Dinitrobenzene (1,4-DNB)	NELAP	PA	4/17/2009
EPA 8270	1,4-Naphthoquinone	NELAP	PA	12/12/2005
EPA 8270	1,4-Phenylenediamine	NELAP	PA	12/12/2005
EPA 8270	1-Chloronaphthalene	NELAP	PA	12/12/2005
EPA 8270	1-Naphthylamine (alpha-Naphthylamine)	NELAP	PA	12/12/2005
EPA 8270	2,3,4,6-Tetrachlorophenol	NELAP	PA	12/12/2005
EPA 8270	2,4,5-Trichlorophenol	NELAP	PA	12/12/2005
EPA 8270	2,4,6-Trichlorophenol	NELAP	PA	12/12/2005
EPA 8270	2,4-Dichlorophenol	NELAP	PA	12/12/2005
EPA 8270	2,4-Dimethylphenol	NELAP	PA	12/12/2005
EPA 8270	2,4-Dinitrophenol	NELAP	PA	12/12/2005
EPA 8270	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	12/12/2005
EPA 8270	2,6-Dichlorophenol	NELAP	PA	12/12/2005
EPA 8270	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	12/12/2005
EPA 8270	2-Acetylaminofluorene	NELAP	PA	12/12/2005
EPA 8270	2-Chloronaphthalene	NELAP	PA	12/12/2005
EPA 8270	2-Chlorophenol	NELAP	PA	12/12/2005

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	12/12/2005
EPA 8270	2-Methylnaphthalene	NELAP	PA	12/12/2005
EPA 8270	2-Methylphenol (o-Cresol)	NELAP	PA	12/12/2005
EPA 8270	2-Naphthylamine (beta-Naphthylamine)	NELAP	PA	12/12/2005
EPA 8270	2-Nitroaniline	NELAP	PA	12/12/2005
EPA 8270	2-Nitrophenol	NELAP	PA	12/12/2005
EPA 8270	2-Picoline (2-Methylpyridine)	NELAP	PA	5/2/2006
EPA 8270	3,3'-Dichlorobenzidine	NELAP	PA	12/12/2005
EPA 8270	3,3'-Dimethylbenzidine	NELAP	PA	7/3/2007
EPA 8270	3-Methylcholanthrene	NELAP	PA	12/12/2005
EPA 8270	3-Methylphenol (m-Cresol)	NELAP	PA	5/2/2006
EPA 8270	3-Nitroaniline	NELAP	PA	12/12/2005
EPA 8270	4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	12/12/2005
EPA 8270	4-Aminobiphenyl	NELAP	PA	12/12/2005
EPA 8270	4-Bromophenyl phenyl ether	NELAP	PA	12/12/2005
EPA 8270	4-Chloro-3-methylphenol	NELAP	PA	12/12/2005
EPA 8270	4-Chloroaniline	NELAP	PA	12/12/2005
EPA 8270	4-Chlorophenyl phenyl ether	NELAP	PA	12/12/2005
EPA 8270	4-Methylphenol (p-Cresol)	NELAP	PA	12/12/2005
EPA 8270	4-Nitroaniline	NELAP	PA	12/12/2005
EPA 8270	4-Nitrophenol	NELAP	PA	12/12/2005
EPA 8270	5-Nitro-o-toluidine	NELAP	PA	12/12/2005
EPA 8270	7,12-Dimethylbenz(a)anthracene	NELAP	PA	12/12/2005
EPA 8270	Acenaphthene	NELAP	PA	12/12/2005
EPA 8270	Acenaphthylene	NELAP	PA	12/12/2005
EPA 8270	Acetophenone	NELAP	PA	12/12/2005
EPA 8270	Aniline	NELAP	PA	12/12/2005
EPA 8270	Anthracene	NELAP	PA	12/12/2005
EPA 8270	Aramite	NELAP	PA	12/12/2005
EPA 8270	Benzidine	NELAP	PA	12/12/2005
EPA 8270	Benzo[a]anthracene	NELAP	PA	12/12/2005
EPA 8270	Benzo[a]pyrene	NELAP	PA	12/12/2005
EPA 8270	Benzo[b]fluoranthene	NELAP	PA	12/12/2005
EPA 8270	Benzo[ghi]perylene	NELAP	PA	12/12/2005
EPA 8270	Benzo[k]fluoranthene	NELAP	PA	12/12/2005
EPA 8270	Benzoic acid	NELAP	PA	12/12/2005

Pennsylvania Department of Environmental Protection

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Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Benzyl alcohol	NELAP	PA	12/12/2005
EPA 8270	Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	12/12/2005
EPA 8270	Chlorobenzilate	NELAP	PA	12/12/2005
EPA 8270	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	12/12/2005
EPA 8270	Di-n-butyl phthalate	NELAP	PA	12/12/2005
EPA 8270	Di-n-octyl phthalate	NELAP	PA	12/12/2005
EPA 8270	Dialiate (cis or trans)	NELAP	PA	12/12/2005
EPA 8270	Dibenz[a,j]acridine	NELAP	PA	12/12/2005
EPA 8270	Dibenzo[a,h]anthracene	NELAP	PA	12/12/2005
EPA 8270	Dibenzofuran	NELAP	PA	12/12/2005
EPA 8270	Diethyl phthalate	NELAP	PA	12/12/2005
EPA 8270	Dimethoate	NELAP	PA	12/12/2005
EPA 8270	Dimethyl phthalate	NELAP	PA	12/12/2005
EPA 8270	Dimethylaminoazobenzene (4-Dimethylaminoazobenzene)	NELAP	PA	5/2/2006
EPA 8270	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	12/12/2005
EPA 8270	Diphenylamine	NELAP	PA	12/12/2005
EPA 8270	Disulfoton	NELAP	PA	12/12/2005
EPA 8270	Ethyl methanesulfonate	NELAP	PA	12/12/2005
EPA 8270	Famphur	NELAP	PA	12/12/2005
EPA 8270	Fluoranthene	NELAP	PA	12/12/2005
EPA 8270	Fluorene	NELAP	PA	12/12/2005
EPA 8270	Hexachlorobenzene	NELAP	PA	12/12/2005
EPA 8270	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	12/12/2005
EPA 8270	Hexachlorocyclopentadiene	NELAP	PA	12/12/2005
EPA 8270	Hexachloroethane	NELAP	PA	12/12/2005
EPA 8270	Hexachloropropene	NELAP	PA	12/12/2005
EPA 8270	Indeno(1,2,3-cd)pyrene	NELAP	PA	12/12/2005
EPA 8270	Isodrin	NELAP	PA	12/12/2005
EPA 8270	Isophorone	NELAP	PA	12/12/2005
EPA 8270	Isosafrole	NELAP	PA	12/12/2005
EPA 8270	Kepone	NELAP	PA	12/12/2005
EPA 8270	Methapyrilene	NELAP	PA	12/12/2005
EPA 8270	Methyl methanesulfonate	NELAP	PA	12/12/2005
EPA 8270	Methyl parathion (Parathion, methyl)	NELAP	PA	5/25/2007
EPA 8270	N-Nitrosodi-n-butylamine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosodi-n-propylamine	NELAP	PA	12/12/2005

Pennsylvania Department of Environmental Protection

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	N-Nitrosodiethylamine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosodimethylamine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosodiphenylamine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosomethylethylamine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosomorpholine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosopiperidine	NELAP	PA	12/12/2005
EPA 8270	N-Nitrosopyrrolidine	NELAP	PA	12/12/2005
EPA 8270	Naphthalene	NELAP	PA	12/12/2005
EPA 8270	Nitrobenzene	NELAP	PA	12/12/2005
EPA 8270	Nitroquinoline-1-oxide	NELAP	PA	7/3/2007
EPA 8270	O,O,O-Triethyl phosphorothioate	NELAP	PA	12/12/2005
EPA 8270	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	5/25/2007
EPA 8270	Pentachlorobenzene	NELAP	PA	12/12/2005
EPA 8270	Pentachloronitrobenzene (PCNB)	NELAP	PA	12/12/2005
EPA 8270	Pentachlorophenol (PCP)	NELAP	PA	12/12/2005
EPA 8270	Phenacetin	NELAP	PA	12/12/2005
EPA 8270	Phenanthrene	NELAP	PA	12/12/2005
EPA 8270	Phenol	NELAP	PA	12/12/2005
EPA 8270	Phorate (Thimet)	NELAP	PA	12/12/2005
EPA 8270	Phthalic anhydride	NELAP	PA	1/21/2009
EPA 8270	Procamide (Kerb)	NELAP	PA	12/12/2005
EPA 8270	Pyrene	NELAP	PA	12/12/2005
EPA 8270	Pyridine	NELAP	PA	12/12/2005
EPA 8270	Safrole	NELAP	PA	12/12/2005
EPA 8270	Tetraethyl dithiopyrophosphate	NELAP	PA	4/17/2009
EPA 8270	Thionazine (Thionazin, Zinophos)	NELAP	PA	12/12/2005
EPA 8270	a,a-Dimethylphenethylamine (Phentermine)	NELAP	PA	12/12/2005
EPA 8270	bis(2-Chloroethoxy)methane	NELAP	PA	12/12/2005
EPA 8270	bis(2-Chloroethyl) ether	NELAP	PA	12/12/2005
EPA 8270	bis(2-Chloroisopropyl) ether	NELAP	PA	12/12/2005
EPA 8270	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	12/12/2005
EPA 8270	o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	12/12/2005
EPA 8270	tris-(2,3-Dibromopropyl) phosphate (tris-BP)	NELAP	PA	4/17/2009
EPA 8270 SIM	Acenaphthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Acenaphthylene	NELAP	PA	12/4/2007
EPA 8270 SIM	Anthracene	NELAP	PA	12/4/2007

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Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270 SIM	Benzo[a]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[a]pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[b]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[ghi]perylene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[k]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	12/4/2007
EPA 8270 SIM	Dibenzo[a,h]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM	Fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Fluorene	NELAP	PA	12/4/2007
EPA 8270 SIM	Indeno(1,2,3-cd)pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM	Naphthalene	NELAP	PA	12/4/2007
EPA 8270 SIM	Phenanthrene	NELAP	PA	12/4/2007
EPA 8270 SIM	Pyrene	NELAP	PA	12/4/2007
EPA 8270-Extended	1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	4/17/2009
EPA 8270-Extended	1,2,3,4-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270-Extended	1,2,3,4-Tetrahydronaphthalene	NELAP	PA	4/17/2009
EPA 8270-Extended	1,2,3,5-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/17/2009
EPA 8270-Extended	1-Methylnaphthalene	NELAP	PA	4/17/2009
EPA 8270-Extended	2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	1/19/2011
EPA 8270-Extended	6-Methylchrysene	NELAP	PA	1/19/2011
EPA 8270-Extended	Atrazine	NELAP	PA	1/22/2007
EPA 8270-Extended	Benzaldehyde	NELAP	PA	4/17/2009
EPA 8270-Extended	Benzenethiol	NELAP	PA	4/17/2009
EPA 8270-Extended	Caprolactam	NELAP	PA	4/17/2009
EPA 8270-Extended	Carbazole	NELAP	PA	12/12/2005
EPA 8270-Extended	Dibenz[a,h]acridine	NELAP	PA	4/17/2009
EPA 8270-Extended	Indene	NELAP	PA	4/17/2009
EPA 8270-Extended	N,N-Dimethylacetamide	NELAP	PA	4/17/2009
EPA 8270-Extended	N,N-Dimethylformamide	NELAP	PA	4/17/2009
EPA 8270-Extended	Quinoline	NELAP	PA	4/17/2009
EPA 8270-Extended	a-Methylstyrene	NELAP	PA	4/17/2009
EPA 8270-Extended	bis(2-Chloromethyl) ether	NELAP	PA	1/21/2009
EPA 8270-Extended	p-(Dimethylamino)azobenzene	NELAP	PA	4/17/2009
EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	NELAP	PA	6/30/2010

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	8/6/2010
EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	8/6/2010
EPA 8290	2,3,7,8-TCDD (Dioxin)	NELAP	PA	6/30/2010
EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	NELAP	PA	6/30/2010
EPA 8290	Total TCDD	NELAP	PA	6/30/2010
EPA 8290	Total TCDF	NELAP	PA	6/30/2010
EPA 8290	Total heptachlorodibenzo-p-dioxin (HpCDD)	NELAP	PA	6/30/2010
EPA 8290	Total heptachlorodibenzofuran (HpCDF)	NELAP	PA	6/30/2010
EPA 8290	Total hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	Total hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	Total pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290	Total pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8310	Acenaphthene	NELAP	PA	1/2/2007
EPA 8310	Acenaphthylene	NELAP	PA	1/2/2007
EPA 8310	Anthracene	NELAP	PA	1/2/2007
EPA 8310	Benzo[a]anthracene	NELAP	PA	1/2/2007
EPA 8310	Benzo[a]pyrene	NELAP	PA	1/2/2007
EPA 8310	Benzo[b]fluoranthene	NELAP	PA	1/2/2007
EPA 8310	Benzo[ghi]perylene	NELAP	PA	1/2/2007
EPA 8310	Benzo[k]fluoranthene	NELAP	PA	1/2/2007
EPA 8310	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/2/2007
EPA 8310	Dibenzo[a,h]anthracene	NELAP	PA	1/2/2007
EPA 8310	Fluoranthene	NELAP	PA	1/2/2007
EPA 8310	Fluorene	NELAP	PA	1/2/2007

Pennsylvania Department of Environmental Protection

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Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8310	Indeno(1,2,3-cd)pyrene	NELAP	PA	1/2/2007
EPA 8310	Naphthalene	NELAP	PA	1/2/2007
EPA 8310	Phenanthrene	NELAP	PA	1/2/2007
EPA 8310	Pyrene	NELAP	PA	1/2/2007
EPA 8315	1,2-Tolualdehyde (o-Tolualdehyde)	NELAP	PA	1/24/2007
EPA 8315	1,3-Tolualdehyde (m-Tolualdehyde)	NELAP	PA	5/2/2006
EPA 8315	1,4-Tolualdehyde (p-Tolualdehyde)	NELAP	PA	1/24/2007
EPA 8315	2,5-Dimethylbenzaldehyde	NELAP	PA	12/12/2005
EPA 8315	Acetaldehyde	NELAP	PA	12/12/2005
EPA 8315	Acrolein (Propenal)	NELAP	PA	12/12/2005
EPA 8315	Benzaldehyde	NELAP	PA	12/12/2005
EPA 8315	Butanal (Butyraldehyde)	NELAP	PA	5/2/2006
EPA 8315	Crotonaldehyde	NELAP	PA	12/12/2005
EPA 8315	Formaldehyde	NELAP	PA	12/12/2005
EPA 8315	Hexanal (Hexaldehyde)	NELAP	PA	1/21/2009
EPA 8315	Isovaleraldehyde	NELAP	PA	12/12/2005
EPA 8315	Pentanal (Valeraldehyde)	NELAP	PA	12/12/2005
EPA 8315	Propanal (Propionaldehyde)	NELAP	PA	1/21/2009
EPA 8330	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	12/12/2005
EPA 8330	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	12/12/2005
EPA 8330	2,4,6-Trinitrotoluene (2,4,6-TNT)	NELAP	PA	12/12/2005
EPA 8330	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	6/11/2007
EPA 8330	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	6/11/2007
EPA 8330	2-Amino-4,6-dinitrotoluene (2-Am-DNT)	NELAP	PA	12/12/2005
EPA 8330	2-Nitrotoluene	NELAP	PA	12/12/2005
EPA 8330	3-Nitrotoluene	NELAP	PA	12/12/2005
EPA 8330	4-Amino-2,6-dinitrotoluene (4-Am-DNT)	NELAP	PA	12/12/2005
EPA 8330	4-Nitrotoluene	NELAP	PA	12/12/2005
EPA 8330	Nitrobenzene	NELAP	PA	6/11/2007
EPA 8330	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	NELAP	PA	12/12/2005
EPA 8330	RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	NELAP	PA	12/12/2005
EPA 8330	Tetryl (2,4,6-Trinitrophenylmethylnitramine)	NELAP	PA	12/12/2005
EPA 8330-Extended	Nitroglycerin	NELAP	PA	1/24/2007
EPA 8330-Extended	Pentaerythritol tetranitrate (PETN)	NELAP	PA	5/2/2006
EPA 8332	Nitroglycerin	NELAP	PA	12/12/2005
EPA 9012	Total cyanide	NELAP	PA	12/12/2005

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www.dep.state.pa.us **Issue Date: 05/25/2011**

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 9040	pH	NELAP	PA	12/12/2005
EPA 9045	Corrosivity (pH)	NELAP	PA	4/17/2009
EPA 9050	Conductivity	NELAP	PA	12/12/2005
EPA 9056	Bromide	NELAP	PA	12/12/2005
EPA 9056	Chloride	NELAP	PA	12/12/2005
EPA 9056	Fluoride	NELAP	PA	12/12/2005
EPA 9056	Nitrate	NELAP	PA	12/12/2005
EPA 9056	Nitrite	NELAP	PA	1/19/2005
EPA 9056	Orthophosphate as P	NELAP	PA	11/23/2010
EPA 9056	Sulfate	NELAP	PA	12/12/2005
EPA 9060	Total organic carbon (TOC)	NELAP	PA	12/12/2005
EPA 9066	Total phenolics	NELAP	PA	12/12/2005
EPA 9095A	Paint filter liquids test	NELAP	PA	1/24/2007
FL-PRO	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
MA DEP EPH	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
MA DEP VPH	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
NWTPH-Dx	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
NWTPH-Gx	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
NWTPH-HCID	GRO/DRO/(ORO) Screen	NELAP	PA	10/16/2008
OA-1	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
OA-2	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
RSK-175	Ethane	NELAP	PA	6/29/2010
RSK-175	Ethene	NELAP	PA	6/29/2010
RSK-175	Methane	NELAP	PA	6/29/2010
RSK-175	Propane	NELAP	PA	6/29/2010
SM 2120 B	Color	NELAP	PA	4/17/2007
SM 2310 B	Acidity as CaCO3	NELAP	PA	4/17/2007
SM 2320 B	Alkalinity as CaCO3	NELAP	PA	1/19/2005
SM 2340 B	Total hardness as CaCO3	NELAP	PA	1/24/2007
SM 2340 C	Total hardness as CaCO3	NELAP	PA	4/17/2007
SM 2510 B	Conductivity	NELAP	PA	12/12/2005
SM 2540 B	Residue, total	NELAP	PA	4/17/2007
SM 2540 C	Residue, filterable (TDS)	NELAP	PA	4/17/2007
SM 2540 D	Residue, nonfilterable (TSS)	NELAP	PA	4/17/2007
SM 2540 F	Residue, settleable	NELAP	PA	4/17/2007
SM 3500-Cr B (20th ed.)	Chromium VI	NELAP	PA	5/24/2007

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www.dep.state.pa.us **Issue Date: 05/25/2011**

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
SM 3500-Fe B (20th ed.)	Ferrous iron	NELAP	PA	6/15/2009
SM 4500-CN- C	Cyanide	NELAP	PA	12/12/2005
SM 4500-CN- E	Cyanide	NELAP	PA	12/12/2005
SM 4500-CN- G	Amenable cyanide	NELAP	PA	5/24/2007
SM 4500-CO2 D	Free carbon dioxide	NELAP	PA	6/29/2010
SM 4500-Cl F	Total residual chlorine	NELAP	PA	4/17/2007
SM 4500-Cl- C	Chloride	NELAP	PA	4/17/2007
SM 4500-F- B	Preliminary distillation of fluoride	NELAP	PA	4/28/2010
SM 4500-F- C	Fluoride	NELAP	PA	1/19/2005
SM 4500-H+ B	pH	NELAP	PA	4/17/2007
SM 4500-NH3 B	Ammonia distillation	NELAP	PA	4/17/2007
SM 4500-NH3 C	Ammonia as N	NELAP	PA	4/17/2007
SM 4500-NH3 D	Ammonia as N	NELAP	PA	4/17/2007
SM 4500-O G	Oxygen (dissolved)	NELAP	PA	4/17/2007
SM 4500-P B	Phosphorus, total	NELAP	PA	4/28/2010
SM 4500-P E	Orthophosphate as P	NELAP	PA	12/12/2005
SM 4500-P F	Phosphorus, total	NELAP	PA	4/28/2010
SM 4500-S D	Sulfide	NELAP	PA	4/17/2007
SM 4500-S F	Sulfide	NELAP	PA	4/17/2007
SM 4500-SO3 B	Sulfite, SO3	NELAP	PA	4/17/2007
SM 4500-SiO2 C (20th ed.)	Silica, as SiO2	NELAP	PA	5/25/2007
SM 4500-SiO2 C (20th ed.)	Silica, dissolved	NELAP	PA	5/24/2007
SM 5210 B	Biochemical oxygen demand (BOD)	NELAP	PA	4/4/2005
SM 5210 B	Carbonaceous BOD (CBOD)	NELAP	PA	1/19/2005
SM 5310 B	Total organic carbon (TOC)	NELAP	PA	4/17/2007
SM 5310 C	Total organic carbon (TOC)	NELAP	PA	5/24/2007
SM 5540 C	Surfactants as MBAS	NELAP	PA	4/17/2007
SM 9222 D	Fecal coliforms	NELAP	PA	7/6/2007
TX1005 (TNRCC)	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
TX1006 (TNRCC)	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
WA-EPH	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WA-VPH	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
WI-DRO	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WI-GRO	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
AK-101	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
AK-102	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
AK-103	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
EPA 1010	Ignitability	NELAP	PA	1/19/2005
EPA 1311	Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	12/12/2005
EPA 1312	Synthetic precipitation leaching procedure (SPLP)	NELAP	PA	12/12/2005
EPA 3005A	Preconcentration under acid	NELAP	PA	4/4/2005
EPA 3010A	Hot plate acid digestion (HNO3 + HCl)	NELAP	PA	4/4/2005
EPA 3020A	Hot plate acid digestion (HNO3 only)	NELAP	PA	4/4/2005
EPA 3050B	Acid digestion of solids	NELAP	PA	4/4/2005
EPA 3060A	Alkaline digestion of Cr(VI)	NELAP	PA	4/4/2005
EPA 3510C	Separatory funnel liquid-liquid extraction	NELAP	PA	4/4/2005
EPA 3540C	Soxhlet extraction	NELAP	PA	4/4/2005
EPA 3546	Microwave extraction	NELAP	PA	9/25/2009
EPA 3550B	Ultrasonic extraction	NELAP	PA	4/4/2005
EPA 3620B	Florisil cleanup	NELAP	PA	4/4/2005
EPA 3630C	Silica gel cleanup	NELAP	PA	4/4/2005
EPA 3640A	Gel permeation cleanup (GPC)	NELAP	PA	4/4/2005
EPA 3660B	Sulfur cleanup	NELAP	PA	4/4/2005
EPA 3665A	Sulfuric acid/permanganate clean-up	NELAP	PA	4/4/2005
EPA 5030	Purge-and-trap (methanol)	NELAP	PA	12/4/2007
EPA 5035	Closed-system purge-and-trap (bisulfate option)	NELAP	PA	12/12/2005
EPA 5035	Closed-system purge-and-trap (methanol option)	NELAP	PA	4/4/2005
EPA 5035	Closed-system purge-and-trap (unpreserved)	NELAP	PA	4/4/2005
EPA 6010	Aluminum	NELAP	PA	1/19/2005
EPA 6010	Antimony	NELAP	PA	1/19/2005
EPA 6010	Arsenic	NELAP	PA	1/19/2005
EPA 6010	Barium	NELAP	PA	1/19/2005
EPA 6010	Beryllium	NELAP	PA	1/19/2005
EPA 6010	Boron	NELAP	PA	1/19/2005
EPA 6010	Cadmium	NELAP	PA	1/19/2005
EPA 6010	Calcium	NELAP	PA	1/19/2005
EPA 6010	Chromium	NELAP	PA	1/19/2005
EPA 6010	Cobalt	NELAP	PA	1/19/2005
EPA 6010	Copper	NELAP	PA	1/19/2005
EPA 6010	Iron	NELAP	PA	1/19/2005

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Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6010	Lead	NELAP	PA	1/19/2005
EPA 6010	Magnesium	NELAP	PA	1/19/2005
EPA 6010	Manganese	NELAP	PA	1/19/2005
EPA 6010	Molybdenum	NELAP	PA	1/19/2005
EPA 6010	Nickel	NELAP	PA	1/19/2005
EPA 6010	Potassium	NELAP	PA	1/19/2005
EPA 6010	Selenium	NELAP	PA	1/19/2005
EPA 6010	Silver	NELAP	PA	1/19/2005
EPA 6010	Sodium	NELAP	PA	1/19/2005
EPA 6010	Strontium	NELAP	PA	1/19/2005
EPA 6010	Thallium	NELAP	PA	1/19/2005
EPA 6010	Tin	NELAP	PA	1/19/2005
EPA 6010	Titanium	NELAP	PA	1/19/2005
EPA 6010	Vanadium	NELAP	PA	1/19/2005
EPA 6010	Zinc	NELAP	PA	1/19/2005
EPA 6020	Aluminum	NELAP	PA	4/29/2010
EPA 6020	Antimony	NELAP	PA	1/19/2005
EPA 6020	Arsenic	NELAP	PA	1/19/2005
EPA 6020	Beryllium	NELAP	PA	1/19/2005
EPA 6020	Cadmium	NELAP	PA	1/19/2005
EPA 6020	Calcium	NELAP	PA	4/29/2010
EPA 6020	Chromium	NELAP	PA	1/19/2005
EPA 6020	Cobalt	NELAP	PA	4/29/2010
EPA 6020	Copper	NELAP	PA	1/19/2005
EPA 6020	Iron	NELAP	PA	4/29/2010
EPA 6020	Lead	NELAP	PA	1/19/2005
EPA 6020	Magnesium	NELAP	PA	4/29/2010
EPA 6020	Manganese	NELAP	PA	4/29/2010
EPA 6020	Nickel	NELAP	PA	4/4/2005
EPA 6020	Potassium	NELAP	PA	4/29/2010
EPA 6020	Selenium	NELAP	PA	4/4/2005
EPA 6020	Silver	NELAP	PA	2/23/2010
EPA 6020	Sodium	NELAP	PA	4/29/2010
EPA 6020	Strontium	NELAP	PA	4/29/2010
EPA 6020	Thallium	NELAP	PA	1/19/2005
EPA 6020	Tin	NELAP	PA	4/29/2010

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Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6020	Vanadium	NELAP	PA	1/7/2010
EPA 6020	Zinc	NELAP	PA	2/1/2011
EPA 6020-Extended	Boron	NELAP	PA	4/29/2010
EPA 6020-Extended	Titanium	NELAP	PA	4/29/2010
EPA 6850	Perchlorate	NELAP	PA	1/19/2011
EPA 7.3.3.2	Reactive cyanide	NELAP	PA	12/12/2005
EPA 7.3.4.2	Reactive sulfide	NELAP	PA	12/12/2005
EPA 7196	Chromium VI	NELAP	PA	1/19/2005
EPA 7199	Chromium VI	NELAP	PA	5/2/2006
EPA 7471	Mercury	NELAP	PA	10/17/2007
EPA 8015	Ethanol	NELAP	PA	1/19/2005
EPA 8015	Ethylene glycol	NELAP	PA	12/4/2007
EPA 8015	Isopropyl alcohol (2-Propanol)	NELAP	PA	12/4/2007
EPA 8015	Methanol	NELAP	PA	1/19/2005
EPA 8015	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	1/12/2007
EPA 8015B	Diesel-range organics (DRO)	NELAP	PA	4/4/2005
EPA 8015B	Gasoline-range organics (GRO)	NELAP	PA	4/4/2005
EPA 8021	Benzene	NELAP	PA	1/19/2005
EPA 8021	Ethylbenzene	NELAP	PA	1/19/2005
EPA 8021	Isopropylbenzene (Cumene)	NELAP	PA	1/24/2007
EPA 8021	Methyl tert-butyl ether (MTBE)	NELAP	PA	5/2/2006
EPA 8021	Naphthalene	NELAP	PA	12/4/2007
EPA 8021	Toluene	NELAP	PA	1/19/2005
EPA 8021	Xylenes, total	NELAP	PA	1/19/2005
EPA 8021	m-Xylene	NELAP	PA	1/24/2007
EPA 8021	o-Xylene	NELAP	PA	1/24/2007
EPA 8021	p-Xylene	NELAP	PA	1/24/2007
EPA 8081	4,4'-DDD	NELAP	PA	1/19/2005
EPA 8081	4,4'-DDE	NELAP	PA	1/19/2005
EPA 8081	4,4'-DDT	NELAP	PA	1/19/2005
EPA 8081	Aldrin (HHDN)	NELAP	PA	1/19/2005
EPA 8081	Chlordane (tech.)	NELAP	PA	1/19/2005
EPA 8081	Dieldrin	NELAP	PA	1/19/2005
EPA 8081	Endosulfan I	NELAP	PA	1/19/2005
EPA 8081	Endosulfan II	NELAP	PA	1/19/2005
EPA 8081	Endosulfan sulfate	NELAP	PA	1/19/2005

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8081	Endrin	NELAP	PA	1/19/2005
EPA 8081	Endrin aldehyde	NELAP	PA	1/19/2005
EPA 8081	Endrin ketone	NELAP	PA	1/19/2005
EPA 8081	Heptachlor	NELAP	PA	1/19/2005
EPA 8081	Heptachlor epoxide	NELAP	PA	1/19/2005
EPA 8081	Kepone	NELAP	PA	1/19/2005
EPA 8081	Methoxychlor	NELAP	PA	1/19/2005
EPA 8081	Mirex	NELAP	PA	1/19/2005
EPA 8081	Toxaphene (Chlorinated camphene)	NELAP	PA	1/19/2005
EPA 8081	alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081	alpha-Chlordane	NELAP	PA	4/4/2005
EPA 8081	beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081	delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081	gamma-Chlordane	NELAP	PA	4/4/2005
EPA 8082	Aroclor-1016 (PCB-1016)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1016 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1221 (PCB-1221)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1221 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1232 (PCB-1232)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1232 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1242 (PCB-1242)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1242 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1248 (PCB-1248)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1248 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1254 (PCB-1254)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1254 (in oil)	NELAP	PA	5/24/2011
EPA 8082	Aroclor-1260 (PCB-1260)	NELAP	PA	1/2/2007
EPA 8082	Aroclor-1260 (in oil)	NELAP	PA	5/24/2011
EPA 8082-Extended	Aroclor-1262 (PCB-1262)	NELAP	PA	7/23/2008
EPA 8082-Extended	Aroclor-1268 (PCB-1268)	NELAP	PA	7/23/2008
EPA 8141	Atrazine	NELAP	PA	1/19/2005
EPA 8141	Bolstar (Sulprofos)	NELAP	PA	1/19/2005
EPA 8141	Coumaphos	NELAP	PA	1/19/2005
EPA 8141	Demeton-O	NELAP	PA	1/19/2005
EPA 8141	Demeton-S	NELAP	PA	1/19/2005

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories, Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program: Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8141	Diazinon (Spectracide)	NELAP	PA	1/19/2005
EPA 8141	Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	1/19/2005
EPA 8141	Disulfoton	NELAP	PA	1/19/2005
EPA 8141	EPN (Santox)	NELAP	PA	1/19/2005
EPA 8141	Ethion	NELAP	PA	1/19/2005
EPA 8141	Ethoprop (Prophos)	NELAP	PA	1/19/2005
EPA 8141	Famphur	NELAP	PA	1/19/2005
EPA 8141	Fensulfothion	NELAP	PA	1/19/2005
EPA 8141	Fenthion	NELAP	PA	4/4/2005
EPA 8141	Malathion	NELAP	PA	1/19/2005
EPA 8141	Merphos	NELAP	PA	1/19/2005
EPA 8141	Methyl parathion (Parathion, methyl)	NELAP	PA	5/25/2005
EPA 8141	Mevinphos	NELAP	PA	1/19/2005
EPA 8141	Naled	NELAP	PA	1/19/2005
EPA 8141	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	1/19/2005
EPA 8141	Phorate (Thimet)	NELAP	PA	1/19/2005
EPA 8141	Ronnel	NELAP	PA	1/19/2005
EPA 8141	Simazine	NELAP	PA	1/4/2006
EPA 8141	Stirophos (Tetrachlorovinphos)	NELAP	PA	1/19/2005
EPA 8141	Tokuthion (Prothiophos)	NELAP	PA	1/19/2005
EPA 8141	Trichloronate	NELAP	PA	1/19/2005
EPA 8141-Extended	Alachlor (Lasso)	NELAP	PA	1/21/2009
EPA 8141A	Azinphos-methyl (Guthion)	NELAP	PA	4/4/2005
EPA 8141A	Chlorpyrifos	NELAP	PA	4/4/2005
EPA 8151	2,4,5-T	NELAP	PA	1/19/2005
EPA 8151	2,4,5-TP (Silvex)	NELAP	PA	1/19/2005
EPA 8151	2,4-D	NELAP	PA	1/19/2005
EPA 8151	2,4-DB (Butoxon)	NELAP	PA	4/4/2005
EPA 8151	Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	1/19/2005
EPA 8151	Dicamba	NELAP	PA	1/19/2005
EPA 8151	Dichloroprop (Dichlorprop)	NELAP	PA	1/19/2005
EPA 8151	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	1/19/2005
EPA 8151	MCPA	NELAP	PA	1/19/2005
EPA 8151	MCPP (Mecoprop)	NELAP	PA	5/2/2006
EPA 8151	Pentachlorophenol (PCP)	NELAP	PA	1/19/2005
EPA 8151	Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid)	NELAP	PA	1/19/2005

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www.dep.state.pa.us Issue Date: 05/25/2011

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	1,1,1,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 8260	1,1,1-Trichloroethane	NELAP	PA	1/19/2005
EPA 8260	1,1,2,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 8260	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	5/2/2006
EPA 8260	1,1,2-Trichloroethane	NELAP	PA	1/19/2005
EPA 8260	1,1-Dichloroethane	NELAP	PA	1/19/2005
EPA 8260	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	1/19/2005
EPA 8260	1,1-Dichloropropene	NELAP	PA	1/19/2005
EPA 8260	1,2,3-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8260	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	1/19/2005
EPA 8260	1,2,4-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8260	1,2,4-Trimethylbenzene	NELAP	PA	1/19/2005
EPA 8260	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	5/25/2005
EPA 8260	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	1/19/2005
EPA 8260	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8260	1,2-Dichloroethane	NELAP	PA	1/19/2005
EPA 8260	1,2-Dichloropropane	NELAP	PA	1/19/2005
EPA 8260	1,3,5-Trimethylbenzene	NELAP	PA	1/19/2005
EPA 8260	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8260	1,3-Dichloropropane	NELAP	PA	1/19/2005
EPA 8260	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8260	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	1/19/2005
EPA 8260	2,2-Dichloropropane	NELAP	PA	1/19/2005
EPA 8260	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	1/19/2005
EPA 8260	2-Chloroethyl vinyl ether	NELAP	PA	1/19/2005
EPA 8260	2-Chlorotoluene	NELAP	PA	5/2/2006
EPA 8260	2-Hexanone	NELAP	PA	1/19/2005
EPA 8260	4-Chlorotoluene	NELAP	PA	1/19/2005
EPA 8260	4-Isopropyltoluene (p-Isopropyltoluene)	NELAP	PA	1/24/2007
EPA 8260	4-Methyl-2-pentanone (MIBK)	NELAP	PA	1/19/2005
EPA 8260	Acetone	NELAP	PA	1/19/2005
EPA 8260	Acetonitrile	NELAP	PA	1/4/2006
EPA 8260	Acrolein (Propenal)	NELAP	PA	1/19/2005
EPA 8260	Acrylonitrile	NELAP	PA	1/19/2005
EPA 8260	Allyl chloride (3-Chloropropene)	NELAP	PA	1/19/2005
EPA 8260	Benzene	NELAP	PA	1/19/2005

Pennsylvania Department of Environmental Protection

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Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	Benzyl chloride	NELAP	PA	1/4/2006
EPA 8260	Bromobenzene	NELAP	PA	1/19/2005
EPA 8260	Bromochloromethane	NELAP	PA	1/19/2005
EPA 8260	Bromodichloromethane	NELAP	PA	1/19/2005
EPA 8260	Bromoform	NELAP	PA	1/19/2005
EPA 8260	Carbon disulfide	NELAP	PA	1/19/2005
EPA 8260	Carbon tetrachloride	NELAP	PA	1/19/2005
EPA 8260	Chlorobenzene	NELAP	PA	1/19/2005
EPA 8260	Chloroethane	NELAP	PA	1/19/2005
EPA 8260	Chloroform	NELAP	PA	1/19/2005
EPA 8260	Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	4/17/2009
EPA 8260	Cyclohexane	NELAP	PA	6/29/2010
EPA 8260	Dibromochloromethane	NELAP	PA	1/19/2005
EPA 8260	Dibromochloropropane (1,2-Dibromo-3-chloropropane, DBCP)	NELAP	PA	1/19/2005
EPA 8260	Dibromomethane	NELAP	PA	1/19/2005
EPA 8260	Dichlorodifluoromethane (Freon 12)	NELAP	PA	1/19/2005
EPA 8260	Epichlorohydrin (1-Chloro-2,3-epoxypropane)	NELAP	PA	1/4/2006
EPA 8260	Ethanol	NELAP	PA	1/4/2006
EPA 8260	Ethyl acetate	NELAP	PA	1/4/2006
EPA 8260	Ethyl methacrylate	NELAP	PA	1/4/2006
EPA 8260	Ethylbenzene	NELAP	PA	1/19/2005
EPA 8260	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	1/19/2005
EPA 8260	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	1/24/2007
EPA 8260	Isopropyl alcohol (2-Propanol)	NELAP	PA	1/19/2005
EPA 8260	Isopropylbenzene (Cumene)	NELAP	PA	8/7/2005
EPA 8260	Methacrylonitrile	NELAP	PA	1/24/2007
EPA 8260	Methyl bromide (Bromomethane)	NELAP	PA	1/19/2005
EPA 8260	Methyl chloride (Chloromethane)	NELAP	PA	1/19/2005
EPA 8260	Methyl tert-butyl ether (MTBE)	NELAP	PA	1/19/2005
EPA 8260	Methylene chloride (Dichloromethane)	NELAP	PA	1/19/2005
EPA 8260	Methylmethacrylate	NELAP	PA	5/2/2006
EPA 8260	Naphthalene	NELAP	PA	1/19/2005
EPA 8260	Pentachloroethane	NELAP	PA	1/24/2007
EPA 8260	Propionitrile (Ethyl cyanide)	NELAP	PA	1/24/2007
EPA 8260	Styrene	NELAP	PA	1/19/2005
EPA 8260	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	1/19/2005

Pennsylvania Department of Environmental Protection

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	Toluene	NELAP	PA	1/19/2005
EPA 8260	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	1/19/2005
EPA 8260	Trichlorofluoromethane (Freon 11)	NELAP	PA	1/19/2005
EPA 8260	Vinyl acetate	NELAP	PA	1/19/2005
EPA 8260	Vinyl chloride (Chloroethene)	NELAP	PA	1/19/2005
EPA 8260	Xylenes, total	NELAP	PA	1/19/2005
EPA 8260	cis-1,2-Dichloroethene	NELAP	PA	1/19/2005
EPA 8260	cis-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 8260	m+p-Xylene	NELAP	PA	1/24/2007
EPA 8260	n-Butyl alcohol (1-Butanol, 1-Butanol)	NELAP	PA	1/19/2005
EPA 8260	n-Butylbenzene	NELAP	PA	1/19/2005
EPA 8260	n-Propylbenzene	NELAP	PA	1/4/2006
EPA 8260	o-Xylene	NELAP	PA	1/24/2007
EPA 8260	sec-Butylbenzene	NELAP	PA	1/19/2005
EPA 8260	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	1/19/2005
EPA 8260	tert-Butyl ethyl ether	NELAP	PA	5/25/2007
EPA 8260	tert-Butylbenzene	NELAP	PA	1/19/2005
EPA 8260	trans-1,2-Dichloroethene	NELAP	PA	1/19/2005
EPA 8260	trans-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 8260	trans-1,4-Dichloro-2-butene	NELAP	PA	1/24/2007
EPA 8260 SIM	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/17/2009
EPA 8260-Extended	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	5/2/2006
EPA 8260-Extended	3,3-Dimethyl-1-butanol	NELAP	PA	4/17/2009
EPA 8260-Extended	4-Chloro-2-nitrophenol	NELAP	PA	5/2/2006
EPA 8260-Extended	Cyclohexanone	NELAP	PA	7/3/2007
EPA 8260-Extended	Diisopropyl ether (DIPE)	NELAP	PA	7/3/2007
EPA 8260-Extended	Ethyl tert-butyl ether (ETBE)	NELAP	PA	7/3/2007
EPA 8260-Extended	Gasoline-range organics (GRO)	NELAP	PA	6/8/2006
EPA 8260-Extended	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	7/3/2007
EPA 8260-Extended	Methyl acetate	NELAP	PA	6/29/2010
EPA 8260-Extended	Methyl iodide (Iodomethane)	NELAP	PA	5/2/2006
EPA 8260-Extended	Methylcyclohexane	NELAP	PA	1/21/2009
EPA 8260-Extended	tert-Amyl alcohol (2-Methyl-2-butanol)	NELAP	PA	4/17/2009
EPA 8260-Extended	tert-Amyl methyl ether (TAME)	NELAP	PA	7/3/2007
EPA 8260-Extended	tert-Butyl formate	NELAP	PA	4/17/2009
EPA 8260-Extended	trans-1,4-Dichloro-2-butene	NELAP	PA	7/3/2007

Pennsylvania Department of Environmental Protection

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	1,2,4,5-Tetrachlorobenzene	NELAP	PA	4/4/2005
EPA 8270	1,2,4-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8270	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8270	1,2-Dinitrobenzene (1,2-DNB)	NELAP	PA	1/19/2005
EPA 8270	1,2-Diphenylhydrazine	NELAP	PA	5/2/2006
EPA 8270	1,3,5-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8270	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	1/4/2006
EPA 8270	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8270	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	1/19/2005
EPA 8270	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8270	1,4-Dinitrobenzene (1,4-DNB)	NELAP	PA	5/2/2006
EPA 8270	1,4-Naphthoquinone	NELAP	PA	1/19/2005
EPA 8270	1,4-Phenylenediamine	NELAP	PA	1/19/2005
EPA 8270	1-Chloronaphthalene	NELAP	PA	1/4/2006
EPA 8270	1-Naphthylamine (alpha-Naphthylamine)	NELAP	PA	4/4/2005
EPA 8270	2,3,4,6-Tetrachlorophenol	NELAP	PA	1/19/2005
EPA 8270	2,4,5-Trichlorophenol	NELAP	PA	1/19/2005
EPA 8270	2,4,6-Trichlorophenol	NELAP	PA	1/19/2005
EPA 8270	2,4-Dichlorophenol	NELAP	PA	1/19/2005
EPA 8270	2,4-Dimethylphenol	NELAP	PA	1/19/2005
EPA 8270	2,4-Dinitrophenol	NELAP	PA	1/19/2005
EPA 8270	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	1/19/2005
EPA 8270	2,6-Dichlorophenol	NELAP	PA	1/19/2005
EPA 8270	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	1/19/2005
EPA 8270	2-Acetylaminofluorene	NELAP	PA	1/19/2005
EPA 8270	2-Chloronaphthalene	NELAP	PA	1/19/2005
EPA 8270	2-Chlorophenol	NELAP	PA	1/19/2005
EPA 8270	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	1/19/2005
EPA 8270	2-Methylnaphthalene	NELAP	PA	1/19/2005
EPA 8270	2-Methylphenol (o-Cresol)	NELAP	PA	1/19/2005
EPA 8270	2-Naphthylamine (beta-Naphthylamine)	NELAP	PA	5/17/2005
EPA 8270	2-Nitroaniline	NELAP	PA	4/4/2005
EPA 8270	2-Nitrophenol	NELAP	PA	1/19/2005
EPA 8270	2-Picoline (2-Methylpyridine)	NELAP	PA	1/19/2005
EPA 8270	3,3'-Dichlorobenzidine	NELAP	PA	1/19/2005
EPA 8270	3,3'-Dimethoxybenzidine	NELAP	PA	4/17/2009

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www.dep.state.pa.us **Issue Date: 05/25/2011**

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	3,3'-Dimethylbenzidine	NELAP	PA	1/19/2005
EPA 8270	3-Methylcholanthrene	NELAP	PA	1/19/2005
EPA 8270	3-Methylphenol (m-Cresol)	NELAP	PA	1/4/2006
EPA 8270	3-Nitroaniline	NELAP	PA	1/19/2005
EPA 8270	4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	1/19/2005
EPA 8270	4-Aminobiphenyl	NELAP	PA	1/19/2005
EPA 8270	4-Bromophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 8270	4-Chloro-3-methylphenol	NELAP	PA	1/19/2005
EPA 8270	4-Chloroaniline	NELAP	PA	1/19/2005
EPA 8270	4-Chlorophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 8270	4-Methylphenol (p-Cresol)	NELAP	PA	1/19/2005
EPA 8270	4-Nitroaniline	NELAP	PA	4/4/2005
EPA 8270	4-Nitrophenol	NELAP	PA	1/19/2005
EPA 8270	5-Nitro-o-toluidine	NELAP	PA	4/4/2005
EPA 8270	7,12-Dimethylbenz(a)anthracene	NELAP	PA	1/19/2005
EPA 8270	Acenaphthene	NELAP	PA	1/19/2005
EPA 8270	Acenaphthylene	NELAP	PA	1/19/2005
EPA 8270	Acetophenone	NELAP	PA	1/19/2005
EPA 8270	Aniline	NELAP	PA	1/19/2005
EPA 8270	Anthracene	NELAP	PA	1/19/2005
EPA 8270	Arsenite	NELAP	PA	5/17/2005
EPA 8270	Benzidine	NELAP	PA	1/19/2005
EPA 8270	Benzo[a]anthracene	NELAP	PA	1/19/2005
EPA 8270	Benzo[a]pyrene	NELAP	PA	1/19/2005
EPA 8270	Benzo[b]fluoranthene	NELAP	PA	1/19/2005
EPA 8270	Benzo[ghi]perylene	NELAP	PA	1/19/2005
EPA 8270	Benzo[k]fluoranthene	NELAP	PA	1/19/2005
EPA 8270	Benzoic acid	NELAP	PA	1/19/2005
EPA 8270	Benzyl alcohol	NELAP	PA	1/19/2005
EPA 8270	Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	5/17/2005
EPA 8270	Chlorobenzilate	NELAP	PA	5/2/2006
EPA 8270	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/19/2005
EPA 8270	Di-n-butyl phthalate	NELAP	PA	1/19/2005
EPA 8270	Di-n-octyl phthalate	NELAP	PA	1/19/2005
EPA 8270	Diallate (cis or trans)	NELAP	PA	5/2/2006
EPA 8270	Dibenz[a,j]acridine	NELAP	PA	5/17/2005

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Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Dibenzo[a,h]anthracene	NELAP	PA	1/19/2005
EPA 8270	Dibenzofuran	NELAP	PA	1/19/2005
EPA 8270	Diethyl phthalate	NELAP	PA	1/19/2005
EPA 8270	Dimethoate	NELAP	PA	5/2/2006
EPA 8270	Dimethyl phthalate	NELAP	PA	1/19/2005
EPA 8270	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	5/2/2006
EPA 8270	Disulfoton	NELAP	PA	7/1/2007
EPA 8270	Ethyl methanesulfonate	NELAP	PA	1/19/2005
EPA 8270	Famphur	NELAP	PA	5/2/2006
EPA 8270	Fluoranthene	NELAP	PA	1/19/2005
EPA 8270	Fluorene	NELAP	PA	1/19/2005
EPA 8270	Hexachlorobenzene	NELAP	PA	1/19/2005
EPA 8270	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	1/19/2005
EPA 8270	Hexachlorocyclopentadiene	NELAP	PA	1/19/2005
EPA 8270	Hexachloroethane	NELAP	PA	1/19/2005
EPA 8270	Hexachloropropene	NELAP	PA	1/19/2005
EPA 8270	Indeno(1,2,3-cd)pyrene	NELAP	PA	1/19/2005
EPA 8270	Isodrin	NELAP	PA	5/2/2006
EPA 8270	Isophorone	NELAP	PA	1/19/2005
EPA 8270	Isosafrole	NELAP	PA	1/19/2005
EPA 8270	Kepone	NELAP	PA	5/2/2006
EPA 8270	Methapyrilene	NELAP	PA	1/19/2005
EPA 8270	Methyl methanesulfonate	NELAP	PA	1/19/2005
EPA 8270	Methyl parathion (Parathion, methyl)	NELAP	PA	5/25/2007
EPA 8270	N-Nitrosodi-n-butylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosodi-n-propylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosodiethylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosodimethylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosodiphenylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosomethylethylamine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosomorpholine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosopiperidine	NELAP	PA	1/19/2005
EPA 8270	N-Nitrosopyrrolidine	NELAP	PA	1/19/2005
EPA 8270	Naphthalene	NELAP	PA	1/19/2005
EPA 8270	Nitrobenzene	NELAP	PA	1/4/2006
EPA 8270	O,O,O-Triethyl phosphorothioate	NELAP	PA	5/2/2006

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Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	5/25/2007
EPA 8270	Pentachlorobenzene	NELAP	PA	1/19/2005
EPA 8270	Pentachloronitrobenzene (PCNB)	NELAP	PA	1/19/2005
EPA 8270	Pentachlorophenol (PCP)	NELAP	PA	1/19/2005
EPA 8270	Phenacetin	NELAP	PA	1/19/2005
EPA 8270	Phenanthrene	NELAP	PA	1/19/2005
EPA 8270	Phenol	NELAP	PA	1/19/2005
EPA 8270	Phorate (Thimet)	NELAP	PA	5/2/2006
EPA 8270	Phthalic anhydride	NELAP	PA	1/21/2009
EPA 8270	Pronamide (Kerb)	NELAP	PA	1/19/2005
EPA 8270	Pyrene	NELAP	PA	1/19/2005
EPA 8270	Pyridine	NELAP	PA	4/4/2005
EPA 8270	Safrole	NELAP	PA	1/19/2005
EPA 8270	Thionazine (Thionazin, Zinophos)	NELAP	PA	5/2/2006
EPA 8270	a,a-Dimethylphenethylamine (Phentermine)	NELAP	PA	5/2/2006
EPA 8270	bis(2-Chloroethoxy)methane	NELAP	PA	1/19/2005
EPA 8270	bis(2-Chloroethyl) ether	NELAP	PA	1/19/2005
EPA 8270	bis(2-Chloroisopropyl) ether	NELAP	PA	1/4/2006
EPA 8270	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	1/19/2005
EPA 8270	o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	1/19/2005
EPA 8270	tris-(2,3-Dibromopropyl) phosphate (tris-BP)	NELAP	PA	12/4/2007
EPA 8270 SIM	Acenaphthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Acenaphthylene	NELAP	PA	12/4/2007
EPA 8270 SIM	Anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[a]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[a]pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[b]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[ghi]perylene	NELAP	PA	12/4/2007
EPA 8270 SIM	Benzo[k]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	12/4/2007
EPA 8270 SIM	Dibenzo[a,h]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM	Fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM	Fluorene	NELAP	PA	12/4/2007
EPA 8270 SIM	Indeno(1,2,3-cd)pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM	Naphthalene	NELAP	PA	12/4/2007
EPA 8270 SIM	Phenanthrene	NELAP	PA	12/4/2007

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270 SIM	Pyrene	NELAP	PA	12/4/2007
EPA 8270-Extended	1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	12/4/2007
EPA 8270-Extended	1,2,3,4-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270-Extended	1,2,3,4-Tetrahydronaphthalene	NELAP	PA	12/4/2007
EPA 8270-Extended	1,2,3,5-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	12/4/2007
EPA 8270-Extended	1-Methylnaphthalene	NELAP	PA	12/4/2007
EPA 8270-Extended	6-Methylchrysene	NELAP	PA	12/4/2007
EPA 8270-Extended	Acrylamide	NELAP	PA	1/21/2009
EPA 8270-Extended	Atrazine	NELAP	PA	1/12/2007
EPA 8270-Extended	Benzaldehyde	NELAP	PA	12/4/2007
EPA 8270-Extended	Benzenethiol	NELAP	PA	12/4/2007
EPA 8270-Extended	Caprolactam	NELAP	PA	12/4/2007
EPA 8270-Extended	Carbazole	NELAP	PA	1/19/2005
EPA 8270-Extended	Dibenz[a,j]acridine	NELAP	PA	12/4/2007
EPA 8270-Extended	Indene	NELAP	PA	12/4/2007
EPA 8270-Extended	N,N-Dimethylacetamide	NELAP	PA	12/4/2007
EPA 8270-Extended	N,N-Dimethylformamide	NELAP	PA	12/4/2007
EPA 8270-Extended	Nitroquinoline-1-oxide	NELAP	PA	7/3/2007
EPA 8270-Extended	Quinoline	NELAP	PA	12/4/2007
EPA 8270-Extended	Tetraethyl dithiopyrophosphate	NELAP	PA	12/4/2007
EPA 8270-Extended	bis(2-Chloromethyl) ether	NELAP	PA	1/21/2009
EPA 8270-Extended	bis(2-Ethylhexyl) adipate (di(2-Ethylhexyl) adipate)	NELAP	PA	1/21/2009
EPA 8270-Extended	p-(Dimethylamino)azobenzene	NELAP	PA	5/2/2006
EPA 8270-Extended	p-Chloronitrobenzene	NELAP	PA	1/21/2009
EPA 8270C	Diphenylamine	NELAP	PA	5/2/2006
EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	8/6/2010
EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.
www.dep.state.pa.us Issue Date: 05/25/2011

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	8/6/2010
EPA 8290	2,3,7,8-TCDD (Dioxin)	NELAP	PA	6/30/2010
EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	NELAP	PA	6/30/2010
EPA 8290	Total TCDD	NELAP	PA	6/30/2010
EPA 8290	Total TCDF	NELAP	PA	6/30/2010
EPA 8290	Total heptachlorodibenzo-p-dioxin (HpCDD)	NELAP	PA	6/30/2010
EPA 8290	Total heptachlorodibenzofuran (HpCDF)	NELAP	PA	6/30/2010
EPA 8290	Total hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290	Total hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290	Total pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290	Total pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8310	Acenaphthene	NELAP	PA	1/19/2005
EPA 8310	Acenaphthylene	NELAP	PA	1/23/2007
EPA 8310	Anthracene	NELAP	PA	1/19/2005
EPA 8310	Benzo[a]anthracene	NELAP	PA	1/19/2005
EPA 8310	Benzo[a]pyrene	NELAP	PA	1/19/2005
EPA 8310	Benzo[b]fluoranthene	NELAP	PA	1/19/2005
EPA 8310	Benzo[ghi]perylene	NELAP	PA	1/19/2005
EPA 8310	Benzo[k]fluoranthene	NELAP	PA	1/19/2005
EPA 8310	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/19/2005
EPA 8310	Dibenzo[a,h]anthracene	NELAP	PA	1/19/2005
EPA 8310	Fluoranthene	NELAP	PA	1/19/2005
EPA 8310	Fluorene	NELAP	PA	5/25/2005
EPA 8310	Indeno(1,2,3-cd)pyrene	NELAP	PA	1/19/2005
EPA 8310	Naphthalene	NELAP	PA	1/19/2005
EPA 8310	Phenanthrene	NELAP	PA	1/19/2005
EPA 8310	Pyrene	NELAP	PA	1/19/2005
EPA 8315	2,5-Dimethylbenzaldehyde	NELAP	PA	1/21/2009
EPA 8315	Acetaldehyde	NELAP	PA	1/21/2009
EPA 8315	Acrolein (Propenal)	NELAP	PA	1/21/2009
EPA 8315	Benzaldehyde	NELAP	PA	1/21/2009

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Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 EPA Lab Code: PA00009 (717) 656-2300

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8315	Butanal (Butyraldehyde)	NELAP	PA	1/21/2009
EPA 8315	Crotonaldehyde	NELAP	PA	1/21/2009
EPA 8315	Formaldehyde	NELAP	PA	1/19/2005
EPA 8315	Hexanal (Hexaldehyde)	NELAP	PA	1/21/2009
EPA 8315	Isovaleraldehyde	NELAP	PA	1/21/2009
EPA 8315	Pentanal (Valeraldehyde)	NELAP	PA	1/21/2009
EPA 8315	Propanal (Propionaldehyde)	NELAP	PA	1/21/2009
EPA 8315	m-Tolualdehyde (1,3-Tolualdehyde)	NELAP	PA	1/21/2009
EPA 8315	o-Tolualdehyde (1,2-Tolualdehyde)	NELAP	PA	1/21/2009
EPA 8315	p-Tolualdehyde (1,4-Tolualdehyde)	NELAP	PA	1/21/2009
EPA 8318	3-Hydroxycarbofuran	NELAP	PA	4/4/2005
EPA 8318	Aldicarb (Temik)	NELAP	PA	4/4/2005
EPA 8318	Aldicarb sulfone	NELAP	PA	4/4/2005
EPA 8318	Carbaryl (Sevin)	NELAP	PA	4/4/2005
EPA 8318	Carbofuran (Furadan)	NELAP	PA	4/4/2005
EPA 8318	Methiocarb (Mesurol)	NELAP	PA	4/4/2005
EPA 8318	Methomyl (Lannate)	NELAP	PA	4/4/2005
EPA 8318	Propoxur (Baygon)	NELAP	PA	4/4/2005
EPA 8318-Extended	Aldicarb sulfoxide	NELAP	PA	12/12/2005
EPA 8318-Extended	Oxamyl (Vydate)	NELAP	PA	12/12/2005
EPA 8330	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	1/19/2005
EPA 8330	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	1/19/2005
EPA 8330	2,4,6-Trinitrotoluene (2,4,6-TNT)	NELAP	PA	1/19/2005
EPA 8330	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	1/19/2005
EPA 8330	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	1/19/2005
EPA 8330	2-Amino-4,6-dinitrotoluene (2-Am-DNT)	NELAP	PA	1/19/2005
EPA 8330	2-Nitrotoluene	NELAP	PA	1/19/2005
EPA 8330	3-Nitrotoluene	NELAP	PA	1/19/2005
EPA 8330	4-Amino-2,6-dinitrotoluene (4-Am-DNT)	NELAP	PA	1/19/2005
EPA 8330	4-Nitrotoluene	NELAP	PA	1/19/2005
EPA 8330	Nitrobenzene	NELAP	PA	1/19/2005
EPA 8330	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	NELAP	PA	1/24/2006
EPA 8330	RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	NELAP	PA	1/19/2005
EPA 8330	Tetryl (2,4,6-Trinitrophenylmethylnitramine)	NELAP	PA	1/19/2005
EPA 8330-Extended	Pentaerythritol tetranitrate (PETN)	NELAP	PA	11/21/2005
EPA 9012	Total cyanide	NELAP	PA	1/19/2005

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www.dep.state.pa.us Issue Date: 05/25/2011

Pennsylvania Department of Environmental Protection

Laboratory Scope of Accreditation

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State Laboratory ID: 36-00037 **EPA Lab Code: PA00009** **(717) 656-2300**

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster, PA 17601-5994

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 9040	Corrosivity (pH)	NELAP	PA	5/17/2005
EPA 9040	pH	NELAP	PA	1/19/2005
EPA 9045	pH	NELAP	PA	11/19/2008
EPA 9050	Conductivity	NELAP	PA	5/17/2005
EPA 9060	Total organic carbon (TOC)	NELAP	PA	1/19/2005
EPA 9066	Total phenolics	NELAP	PA	4/4/2005
EPA 9071B	Oil and grease	NELAP	PA	1/19/2005
EPA 9081	Cation exchange capacity of soils (Ammonium acetate)	NELAP	PA	5/25/2005
EPA 9095A	Paint filter liquids test	NELAP	PA	1/24/2007
FL-PRO	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
MA DEP EPH	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
MA DEP VPH	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
NWTPH-Dx	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
NWTPH-Gx	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
NWTPH-HCID	GRO/DRO/HRO Screen	NELAP	PA	10/16/2008
OA-1	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
OA-2	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
TX1005 (TNRCC)	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
TX1006 (TNRCC)	Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
WA-EPH	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WA-VPH	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
WI-DRO	Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WI-GRO	Gasoline-range organics (GRO)	NELAP	PA	12/12/2005

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www.dep.state.pa.us **Issue Date: 05/25/2011**

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC · Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	CAP03.00015	AE	FID	[EPA 25]	Non-Methane Organic Compounds
Applied	No	NJ	CAP03.00040	AE	GC	[EPA 18]	Volatile organics
Certified	Yes	NJ	CAP03.00184	AE	GC/MS, Canisters	[EPA TO-15]	Acetone
Certified	Yes	NJ	CAP03.00185	AE	GC/MS, Canisters	[EPA TO-15]	Acetonitrile
Certified	Yes	NJ	CAP03.00195	AE	GC/MS, Canisters	[EPA TO-15]	Acrolein
Certified	Yes	NJ	CAP03.00210	AE	GC/MS, Canisters	[EPA TO-15]	Acrylonitrile
Certified	Yes	NJ	CAP03.00215	AE	GC/MS, Canisters	[EPA TO-15]	Allyl chloride
Certified	Yes	NJ	CAP03.00225	AE	GC/MS, Canisters	[EPA TO-15]	Benzene
Certified	Yes	NJ	CAP03.00250	AE	GC/MS, Canisters	[EPA TO-15]	Bromodichloromethane
Certified	Yes	NJ	CAP03.00255	AE	GC/MS, Canisters	[EPA TO-15]	Bromoform
Certified	Yes	NJ	CAP03.00260	AE	GC/MS, Canisters	[EPA TO-15]	Bromomethane
Certified	Yes	NJ	CAP03.00265	AE	GC/MS, Canisters	[EPA TO-15]	Butadiene (1,3-)
Certified	Yes	NJ	CAP03.00270	AE	GC/MS, Canisters	[EPA TO-15]	Carbon disulfide
Certified	Yes	NJ	CAP03.00275	AE	GC/MS, Canisters	[EPA TO-15]	Carbon tetrachloride
Certified	Yes	NJ	CAP03.00300	AE	GC/MS, Canisters	[EPA TO-15]	Chlorobenzene
Certified	Yes	NJ	CAP03.00305	AE	GC/MS, Canisters	[EPA TO-15]	Chloroethane
Certified	Yes	NJ	CAP03.00310	AE	GC/MS, Canisters	[EPA TO-15]	Chloroform
Certified	Yes	NJ	CAP03.00315	AE	GC/MS, Canisters	[EPA TO-15]	Chloromethane
Certified	Yes	NJ	CAP03.00325	AE	GC/MS, Canisters	[EPA TO-15]	Chlorotoluene (2-)
Certified	Yes	NJ	CAP03.00333	AE	GC/MS, Canisters	[EPA TO-15]	Cyclohexane
Certified	Yes	NJ	CAP03.00342	AE	GC/MS, Canisters	[EPA TO-15]	Dibromochloromethane
Certified	Yes	NJ	CAP03.00350	AE	GC/MS, Canisters	[EPA TO-15]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CAP03.00355	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CAP03.00360	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	CAP03.00365	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	CAP03.00368	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.00370	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,1-)
Certified	Yes	NJ	CAP03.00375	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.00380	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (1,1-)
Certified	Yes	NJ	CAP03.00384	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	CAP03.00385	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (trans-1,2-)

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00390	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.00395	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropane (1,2-)
Certified	Yes	NJ	CAP03.00400	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CAP03.00401	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CAP03.00405	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorotetrafluoroethane (1,2-)
Certified	Yes	NJ	CAP03.00440	AE	GC/MS, Canisters	[EPA TO-15]	Dioxane (1,4-)
Certified	Yes	NJ	CAP03.00455	AE	GC/MS, Canisters	[EPA TO-15]	Ethyl acrylate
Certified	Yes	NJ	CAP03.00460	AE	GC/MS, Canisters	[EPA TO-15]	Ethylbenzene
Certified	Yes	NJ	CAP03.00480	AE	GC/MS, Canisters	[EPA TO-15]	Ethyltoluene (4-)
Certified	Yes	NJ	CAP03.00490	AE	GC/MS, Canisters	[EPA TO-15]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	CAP03.00495	AE	GC/MS, Canisters	[EPA TO-15]	Hexachloroethane
Certified	Yes	NJ	CAP03.00498	AE	GC/MS, Canisters	[EPA TO-15]	Hexanone (2-)
Certified	Yes	NJ	CAP03.00500	AE	GC/MS, Canisters	[EPA TO-15]	Heptane (n-)
Certified	Yes	NJ	CAP03.00505	AE	GC/MS, Canisters	[EPA TO-15]	Hexane (n-)
Certified	Yes	NJ	CAP03.00515	AE	GC/MS, Canisters	[EPA TO-15]	Isopropylbenzene
Certified	Yes	NJ	CAP03.00525	AE	GC/MS, Canisters	[EPA TO-15]	Methyl ethyl ketone
Certified	Yes	NJ	CAP03.00530	AE	GC/MS, Canisters	[EPA TO-15]	Methyl iodide
Certified	Yes	NJ	CAP03.00535	AE	GC/MS, Canisters	[EPA TO-15]	Methyl isobutyl ketone (MIBK)
Certified	Yes	NJ	CAP03.00545	AE	GC/MS, Canisters	[EPA TO-15]	Methyl methacrylate
Certified	Yes	NJ	CAP03.00550	AE	GC/MS, Canisters	[EPA TO-15]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.00555	AE	GC/MS, Canisters	[EPA TO-15]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	CAP03.00587	AE	GC/MS, Canisters	[EPA TO-15]	Naphthalene
Certified	Yes	NJ	CAP03.00612	AE	GC/MS, Canisters	[EPA TO-15]	Propylene
Certified	Yes	NJ	CAP03.00625	AE	GC/MS, Canisters	[EPA TO-15]	Styrene
Certified	Yes	NJ	CAP03.00635	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00640	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	CAP03.00645	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00650	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylpentane (2,2,4-)
Certified	Yes	NJ	CAP03.00652	AE	GC/MS, Canisters	[EPA TO-15]	Tert-butyl alcohol
Certified	Yes	NJ	CAP03.00655	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	CAP03.00660	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethene
Certified	Yes	NJ	CAP03.00665	AE	GC/MS, Canisters	[EPA TO-15]	Toluene

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00670	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.00675	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	CAP03.00680	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethene
Certified	Yes	NJ	CAP03.00684	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorofluoromethane
Certified	Yes	NJ	CAP03.00685	AE	GC/MS, Canisters	[EPA TO-15]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	CAP03.00700	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl acetate
Certified	Yes	NJ	CAP03.00705	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl bromide
Certified	Yes	NJ	CAP03.00710	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl chloride
Certified	Yes	NJ	CAP03.00715	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (m-)
Certified	Yes	NJ	CAP03.00720	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (o-)
Certified	Yes	NJ	CAP03.00725	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (p-)
Certified	Yes	NJ	CAP03.00730	AE	GC/MS, Canisters	[EPA TO-15]	Xylenes (total)
Certified	Yes	NJ	CAP03.05430	AE	GC/MS, Canisters	[EPA TO-14A]	Benzene
Certified	Yes	NJ	CAP03.06443	AE	GC/MS, Canisters	[EPA TO-14A]	Bromodichloromethane
Certified	Yes	NJ	CAP03.06447	AE	GC/MS, Canisters	[EPA TO-14A]	Bromoform
Certified	Yes	NJ	CAP03.06450	AE	GC/MS, Canisters	[EPA TO-14A]	Bromomethane
Certified	Yes	NJ	CAP03.06457	AE	GC/MS, Canisters	[EPA TO-14A]	Carbon disulfide
Certified	Yes	NJ	CAP03.06460	AE	GC/MS, Canisters	[EPA TO-14A]	Carbon tetrachloride
Certified	Yes	NJ	CAP03.06470	AE	GC/MS, Canisters	[EPA TO-14A]	Chlorobenzene
Certified	Yes	NJ	CAP03.06480	AE	GC/MS, Canisters	[EPA TO-14A]	Chloroethane
Certified	Yes	NJ	CAP03.06490	AE	GC/MS, Canisters	[EPA TO-14A]	Chloroform
Certified	Yes	NJ	CAP03.06500	AE	GC/MS, Canisters	[EPA TO-14A]	Chloromethane
Certified	Yes	NJ	CAP03.06510	AE	GC/MS, Canisters	[EPA TO-14A]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CAP03.06520	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CAP03.06530	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	CAP03.06540	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	CAP03.06550	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.06560	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethane (1,1-)
Certified	Yes	NJ	CAP03.06570	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.06580	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethene (1,1-)
Certified	Yes	NJ	CAP03.06590	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	CAP03.06591	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethene (trans-1,2-)

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.06595	AB	GCMS, Canisters	[EPA TO-14A]	Dichlorofluoromethane
Certified	Yes	NJ	CAP03.06600	AB	GCMS, Canisters	[EPA TO-14A]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	CAP03.06610	AB	GCMS, Canisters	[EPA TO-14A]	Dichloropropane (1,2-)
Certified	Yes	NJ	CAP03.06620	AB	GCMS, Canisters	[EPA TO-14A]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CAP03.06630	AB	GCMS, Canisters	[EPA TO-14A]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CAP03.06640	AB	GCMS, Canisters	[EPA TO-14A]	Dichlorotetrafluoroethane (1,2-)
Certified	Yes	NJ	CAP03.06650	AB	GCMS, Canisters	[EPA TO-14A]	Ethylbenzene
Certified	Yes	NJ	CAP03.06660	AB	GCMS, Canisters	[EPA TO-14A]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	CAP03.06670	AB	GCMS, Canisters	[EPA TO-14A]	Styrene
Certified	Yes	NJ	CAP03.06674	AB	GCMS, Canisters	[EPA TO-14A]	Methyl ethyl ketone
Certified	Yes	NJ	CAP03.06676	AB	GCMS, Canisters	[EPA TO-14A]	Methyl isobutyl ketone (MIBK)
Certified	Yes	NJ	CAP03.06678	AB	GCMS, Canisters	[EPA TO-14A]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.06680	AB	GCMS, Canisters	[EPA TO-14A]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	CAP03.06690	AB	GCMS, Canisters	[EPA TO-14A]	Tetrachloroethene
Certified	Yes	NJ	CAP03.06700	AB	GCMS, Canisters	[EPA TO-14A]	Toluene
Certified	Yes	NJ	CAP03.06710	AB	GCMS, Canisters	[EPA TO-14A]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	CAP03.06720	AB	GCMS, Canisters	[EPA TO-14A]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.06721	AB	GCMS, Canisters	[EPA TO-14A]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	CAP03.06730	AB	GCMS, Canisters	[EPA TO-14A]	Trichloroethene
Certified	Yes	NJ	CAP03.06740	AB	GCMS, Canisters	[EPA TO-14A]	Trichlorofluoromethane
Certified	Yes	NJ	CAP03.06750	AB	GCMS, Canisters	[EPA TO-14A]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	CAP03.06760	AB	GCMS, Canisters	[EPA TO-14A]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	CAP03.06770	AB	GCMS, Canisters	[EPA TO-14A]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	CAP03.06780	AB	GCMS, Canisters	[EPA TO-14A]	Vinyl chloride
Certified	Yes	NJ	CAP03.06785	AB	GCMS, Canisters	[EPA TO-14A]	Xylenes (total)
Certified	Yes	NJ	CAP03.06790	AB	GCMS, Canisters	[EPA TO-14A]	Xylene (o-)
Certified	Yes	NJ	CAP03.06800	AB	GCMS, Canisters	[EPA TO-14A]	Xylene (m-)
Certified	Yes	NJ	CAP03.06810	AB	GCMS, Canisters	[EPA TO-14A]	Xylene (p-)
Applied	No	NJ	CAP03.06850	AB	GCMS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Acetone
Applied	No	NJ	CAP03.06852	AB	GCMS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Allyl chloride
Applied	No	NJ	CAP03.06854	AB	GCMS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Benzene
Applied	No	NJ	CAP03.06856	AB	GCMS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Bromodichloromethane

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	CAP03.06858	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Bromoform
Applied	No	NJ	CAP03.06860	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Bromomethane
Applied	No	NJ	CAP03.06862	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Butadiene (1,3-)
Applied	No	NJ	CAP03.06864	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Carbon disulfide
Applied	No	NJ	CAP03.06866	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Carbon tetrachloride
Applied	No	NJ	CAP03.06868	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chlorobenzene
Applied	No	NJ	CAP03.06870	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chloroethane
Applied	No	NJ	CAP03.06872	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chloroform
Applied	No	NJ	CAP03.06874	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chloromethane
Applied	No	NJ	CAP03.06876	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chlorotoluene (2-)
Applied	No	NJ	CAP03.06878	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Cyclohexane
Applied	No	NJ	CAP03.06880	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dibromochloromethane
Applied	No	NJ	CAP03.06882	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dibromoethane (1,2-) (EDB)
Applied	No	NJ	CAP03.06884	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorobenzene (1,2-)
Applied	No	NJ	CAP03.06886	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorobenzene (1,3-)
Applied	No	NJ	CAP03.06888	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorobenzene (1,4-)
Applied	No	NJ	CAP03.06890	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorodifluoromethane
Applied	No	NJ	CAP03.06892	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethane (1,1-)
Applied	No	NJ	CAP03.06894	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethane (1,2-)
Applied	No	NJ	CAP03.06896	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethene (1,1-)
Applied	No	NJ	CAP03.06898	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethene (cis-1,2-)
Applied	No	NJ	CAP03.06900	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethene (trans-1,2-)
Applied	No	NJ	CAP03.06902	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloropropane (1,2-)
Applied	No	NJ	CAP03.06904	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloropropene (cis-1,3-)
Applied	No	NJ	CAP03.06906	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloropropene (trans-1,3-)
Applied	No	NJ	CAP03.06908	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorotetrafluoroethane (1,2-)
Applied	No	NJ	CAP03.06910	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dioxane (1,4-)
Applied	No	NJ	CAP03.06912	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Ethanol
Applied	No	NJ	CAP03.06914	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Ethylbenzene
Applied	No	NJ	CAP03.06916	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Ethyltoluene (4-)
Applied	No	NJ	CAP03.06918	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Heptane (n-)
Applied	No	NJ	CAP03.06920	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Hexachlorobutadiene (1,3-)

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	CAP03.06922	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Hexane (n-)
Applied	No	NJ	CAP03.06924	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Isopropanol
Applied	No	NJ	CAP03.06926	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methylene chloride (Dichloromethane)
Applied	No	NJ	CAP03.06928	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl ethyl ketone
Applied	No	NJ	CAP03.06930	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl isobutyl ketone (MIBK)
Applied	No	NJ	CAP03.06932	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl methacrylate
Applied	No	NJ	CAP03.06934	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl tert-butyl ether
Applied	No	NJ	CAP03.06936	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Styrene
Applied	No	NJ	CAP03.06938	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tert-butyl alcohol
Applied	No	NJ	CAP03.06940	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tetrachloroethane (1,1,2,2-)
Applied	No	NJ	CAP03.06942	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tetrachloroethene
Applied	No	NJ	CAP03.06944	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tetrahydrofuran
Applied	No	NJ	CAP03.06946	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Toluene
Applied	No	NJ	CAP03.06948	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichlorobenzene (1,2,4-)
Applied	No	NJ	CAP03.06950	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloroethane (1,1,1-)
Applied	No	NJ	CAP03.06952	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloroethane (1,1,2-)
Applied	No	NJ	CAP03.06954	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloroethene
Applied	No	NJ	CAP03.06956	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichlorofluoromethane
Applied	No	NJ	CAP03.06958	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Applied	No	NJ	CAP03.06960	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trimethylbenzene (1,2,4-)
Applied	No	NJ	CAP03.06962	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trimethylbenzene (1,3,5-)
Applied	No	NJ	CAP03.06964	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trimethylpentane (2,2,4-)
Applied	No	NJ	CAP03.06966	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Vinyl bromide
Applied	No	NJ	CAP03.06968	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Vinyl chloride
Applied	No	NJ	CAP03.06970	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Xylene (m- + p-)
Applied	No	NJ	CAP03.06972	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Xylene (o-)

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704194-10-4
Expiration Date: 8/31/2011
Issue Date: 10/15/2010

Lancaster Laboratories Inc.

2425 New Holland Pike
Lancaster, PA 17601-5994

These fields of accreditation supercedeall previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Tissue*

Method EPA 6010

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10155609
Antimony	TX	1005	10155609
Arsenic	TX	1010	10155609
Barium	TX	1015	10155609
Beryllium	TX	1020	10155609
Boron	TX	1025	10155609
Cadmium	TX	1030	10155609
Calcium	TX	1035	10155609
Chromium	TX	1040	10155609
Cobalt	TX	1050	10155609
Copper	TX	1055	10155609
Iron	TX	1070	10155609
Lead	TX	1075	10155609
Magnesium	TX	1085	10155609
Manganese	TX	1090	10155609
Molybdenum	TX	1100	10155609
Nickel	TX	1105	10155609
Potassium	TX	1125	10155609
Selenium	TX	1140	10155609
Silver	TX	1150	10155609
Sodium	TX	1155	10155609
Strontium	TX	1160	10155609
Thallium	TX	1165	10155609
Tin	TX	1175	10155609
Titanium	TX	1180	10155609
Vanadium	TX	1185	10155609
Zinc	TX	1190	10155609

Method EPA 6020

Analyte	AB	Analyte ID	Method ID

Texas Commission on Environmental Quality

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Lancaster Laboratories Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

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Matrix: *Tissue*

Antimony	TX	1005	10156204
Arsenic	TX	1010	10156204
Beryllium	TX	1020	10156204
Cadmium	TX	1030	10156204
Chromium	TX	1040	10156204
Copper	TX	1055	10156204
Lead	TX	1075	10156204
Nickel	TX	1105	10156204
Selenium	TX	1140	10156204
Thallium	TX	1165	10156204

Method EPA 7471

Analyte	AB	Analyte ID	Method ID
Mercury	TX	1095	10166208

Method EPA 8081

Analyte	AB	Analyte ID	Method ID
4,4'-DDD	TX	7355	10178606
4,4'-DDE	TX	7360	10178606
4,4'-DDT	TX	7365	10178606
Aldrin	TX	7025	10178606
alpha-BHC (alpha-Hexachlorocyclohexane)	TX	7110	10178606
beta-BHC (beta-Hexachlorocyclohexane)	TX	7115	10178606
Chlordane (tech.)	TX	7250	10178606
delta-BHC (delta-Hexachlorocyclohexane)	TX	7105	10178606
Dieldrin	TX	7470	10178606
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	TX	7120	10178606
Heptachlor	TX	7685	10178606
Heptachlor epoxide	TX	7690	10178606
Mirex	TX	7870	10178606
Toxaphene (Chlorinated camphene)	TX	8250	10178606

Method EPA 8082

Analyte	AB	Analyte ID	Method ID

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Tissue*

Aroclor-1016 (PCB-1016)	TX	8880	10179007
Aroclor-1221 (PCB-1221)	TX	8885	10179007
Aroclor-1232 (PCB-1232)	TX	8890	10179007
Aroclor-1242 (PCB-1242)	TX	8895	10179007
Aroclor-1248 (PCB-1248)	TX	8900	10179007
Aroclor-1254 (PCB-1254)	TX	8905	10179007
Aroclor-1260 (PCB-1260)	TX	8910	10179007

Method EPA 8270

Analyte	AB	Analyte ID	Method ID
1,2,4,5-Tetrachlorobenzene	TX	6715	10185805
2-Methylphenol (o-Cresol)	TX	6400	10185805
3-Methylphenol (m-Cresol)	TX	6405	10185805
4-Methylphenol (p-Cresol)	TX	6410	10185805
Benzidine	TX	5595	10185805
Benzo(a)anthracene	TX	5575	10185805
Benzo(a)pyrene	TX	5580	10185805
Chrysene	TX	5855	10185805
Hexachlorobenzene	TX	6275	10185805
Hexachlorobutadiene	TX	4835	10185805
Hexachlorocyclopentadiene	TX	6285	10185805
Hexachloroethane	TX	4840	10185805
Hexachlorophene	TX	6290	10185805
n-Nitrosodiethylamine	TX	6525	10185805
n-Nitroso-di-n-butylamine	TX	5025	10185805
Pentachlorobenzene	TX	6590	10185805
Pentachlorophenol	TX	6605	10185805
Pyridine	TX	5095	10185805

Lancaster Laboratories

Environmental Quality Policy Manual

Appendix J
Quality Control Types, Frequency, and Corrective Action

Current as of October 05, 2011
32 Total Pages (including this coversheet)

NOTE: Current information available in technical departments.

SW - 846 Quality Control GC/MS Volatiles Method 8260B		
Type	**Frequency**	**Corrective Action**
Surrogates: Toluene-d_8 Bromofluorobenzene 1,2-Dichloroethane-d_4 Dibromofluoromethane	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Samples: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once for each 12-hour time period or ≤20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Fluorobenzene Chlorobenzene-d_5 1,4-Dichlorobenzene-d_4	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

SW - 846 Quality Control GC/MS Semivolatiles Method 8270C		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene-d_5 2-Fluorobiphenyl Terphenyl-d_{14} Phenol-d_6 2-Fluorophenol 2,4,6-Tribromophenol	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Matrix Spike Duplicates (RPD): Same as for matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level	Re-extract and reanalyze blank and associated samples
Internal Standards (ISTD): 1,4-Dichlorobenzene-d_4 Naphthalene-d_8 Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

SW - 846 Quality Control GC/MS Semivolatiles Method 8270C SIM		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene-d_5 2-Fluorobiphenyl Terphenyl-d_{14}	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Matrix Spike Duplicates (RPD): Same as for matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level	Re-extract and reanalyze blank and associated samples
Internal Standards (ISTD): 1,4-Dichlorobenzene-d_4 Naphthalene-d_8 Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

SW - 846 Quality Control GC/MS Volatiles Method 8290		
Type	**Frequency**	**Corrective Action**
Surrogates: 13C Labeled Isotope of each of 17 Toxic PCDD/PCDF	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Samples: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once for each 12-hour time period or ≤20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): 13C12-1234-TCDD 13C12-123468-HxCDD	Each sample, MS, MSD, LCS, and blank	RT ± 15 secs of retention time in initial calibration.

SW-846 Quality Control Pesticides/PCBs Methods 8081; 8082; 8141; 8151		
Type	**Frequency**	**Corrective Action**
Surrogate: Organochlorine Pesticides & PCBs Decachlorobiphenyl (DCB) Tetrachloro-*m*-xylene (TCMX) Herbicides: Dichloroacetic acid (DCAA) Organophosphorous Pesticides: 2-nitro-*m*-xylene (2NMX)	Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase	Repeat extraction and analysis. If reanalysis confirms original result, report results and comment in case narrative
Matrix Spikes: Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene Herbicides & Organophosphorous Pesticides: all compounds of interest PCBs: Aroclor 1016 & Aroclor 1260	Each extraction group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene Herbicides & Organophosphorous Pesticides: all compounds of interest PCBs: Aroclor 1016 & Aroclor 1260	Each group (≤20) when MS/MSD falls outside established limits	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.

SW-846 Quality Control Pesticides/PCBs Methods 8081; 8082; 8141; 8151 (continued)		
Type	**Frequency**	**Corrective Action**
Matrix Spike Duplicates (RPD): Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene Herbicides & Organophosphorous Pesticides: all compounds of interest PCBs: Aroclor 1016 & Aroclor 1260	Each extraction group (≤20) of samples per matrix/level	Evaluated in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Blanks:	Once per extraction group (≤20) of samples, each matrix, level	Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted.
Internal Standards (ISTD): Herbicides: 4,4'-dibromo octafluorobiphenyl(DBOB) OP Pesticides: 1-bromo-2-nitrobenzene	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

SW-846 Quality Control Volatiles by GC 8021		
Type	**Frequency**	**Corrective Action**
Surrogates: Aromatics: 1-Bromo-4-chlorobenzene (PID)	Each sample, MS, MSD, LCS and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident.
Matrix Spikes: Spike all compounds of interest	Each group of samples (≤20) of similar matrix/level each method	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20); LCSD is analyzed if sufficient volume is not available for MS/MSD	Reanalyze LCS and associated samples for compounds outside of acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Internal Standard (ISTD): Aromatics: 1-chloro-3-fluorobenzene	Each sample, LCS , MS, MSD, blank, and standard	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed.
Matrix Spike Duplicate (RPD): Same compounds as matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	At least once per batch (≤20 samples) and once per 24 hours	Reanalyze blank and associated samples if blank is outside limits

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

SW-846 Quality Control Petroleum Analysis		
Type	**Frequency**	**Corrective Action**
Surrogate: α,α,α-Trifluorotoluene (PID)	Each sample, MS, MSD, LCS, and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident.
Matrix Spike: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level. LCSD analyzed if sufficient volume is not available for MS/MSD	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD):	Each group (≤20) of samples per matrix/level	Evaluated by an analyst in relationship to other QC results
Blanks:	At least once per batch (≤20 samples) and once per 24 hours	Reanalyze blank and associated samples if blank is outside limits
Internal Standards (ISTD): 1-Chloro-3-fluorobenzene (PID)	Each sample, MS, MSD, LCS, and blank analyzed on the PID	Reanalyze samples; if reanalysis confirms original result, document on report or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

SW-846 Quality Control PAHs by HPLC Method 8310		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene and Triphenylene	Added to each sample, MS/MSD, blank, LCS/LCSD prior to extraction	Re-extract and reanalyze. If re-extraction and reanalysis confirms then comment on report and/or case narrative. Re-extraction may not be needed if matrix related problems are evident. Comment in case narrative.
Matrix Spike: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20 samples), per matrix/level	Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

SW-846 Quality Control TPH-DRO 8015B		
Type	**Frequency**	**Corrective Action**
Surrogate: *o*-Terphenyl	Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase	Repeat extraction and analysis. If reanalysis confirms original result, report results and comment in case narrative.
Matrix Spike: # 2 Fuel	Each group (≤20) of samples per matrix/level	Reinject if surrogates appear low. If still out of spec, evaluate for matrix effect. If matrix effect, accept based on LCS data. If no matrix effect, repeat batch.
Laboratory Control Sample: # 2 Fuel	Each group (≤20) of samples per matrix/level	Reinject if surrogates appear low. If still out of spec, reextract batch. LCS that fails high and DRO is ND in the samples can be reported.
Laboratory Control Duplicates (RPD): # 2 Fuel	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level	Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

SW-846 Quality Control TPH-GRO 8015B		
Type	**Frequency**	**Corrective Action**
Surrogate: Trifluorotoluene (FID)	Each sample, MS/MSD, LCS, and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident.
Matrix Spike: Gasoline standard	Each group of samples of similar matrix/level (≤20) each method	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample Gasoline standard	Each group (≤20) of samples. LCSD analyzed if sufficient volume is not available for MS/MSD.	Reanalyze LCS and associated samples. LCS that fails high and GRO is ND in the samples can be reported.
Matrix Spike Duplicate (RPD): Same compounds as matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	At least one per 20 samples and at least once per 24 hours.	Reanalyze blank and associated samples if blank is outside limits

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change

SW-846 Quality Control* Inorganics (Metals)		
Type	**Frequency**	**Corrective Action**
Internal Standard (ICP & ICP/MS only):	Each sample, standard and QC (Unspiked, Dup., MS, MSD, LCS, dilution, post digestion spike and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤20) each method	Analyze post-digestion spike sample
Matrix Spike Duplicate (RPD):	Each group of samples of similar matrix/level (20) each method	Analyze post-digestion spike sample if not already run for MS, flag the data
Duplicates (RPD):	Each group of samples of similar matrix/level (≤20) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB)	Each element immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.)	Correct problem, recalibrate, and rerun
Preparation Blank	Each SDG or batch (≤20 samples)	Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <20× blank result
Serial Dilutions (ICP, ICP/MS only):	Each group of (≤20) of similar matrix/level	Flag the data
Interference Check Sample (ICP, ICP/MS only):	Each element after Initial Calibration Verification at beginning and end of the run or min. of 2× per 8 hour	Correct for interference, recalibrate the instrument
Laboratory Control Sample:	Each SDG or batch (≤20 samples), each method	Redigest and reanalyze LCS and associated samples. Elements in the LCS that fail high and are ND in the samples can be reported.
Post Digestion Spike:	When matrix spikes are outside 75 % - 125% range, or the statistical window (whichever is tighter).	Flag the data

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

QC Table for SW-846 Miscellaneous Water Tests			
Test	**QC Type**	**Frequency**	**Corrective Action**
Sulfide	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported.
	Duplicate	Each group of samples of similar matrix (≤20)	Ensure that LCS meets acceptance criteria.
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤20)	Ensure that LCS meets acceptance criteria.
Bromide (IC) Chloride (IC) Cyanide (total) Fluoride (IC) Nitrate/Nitrite (IC) Sulfate (IC)	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported.
	Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LCS meets acceptance criteria.
	Matrix Spike	Each group of samples of similar matrix (≤10)	Ensure that LCS meets acceptance criteria.
Phenols TOC Quad	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported.
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LCS meets acceptance criteria.
pH Moisture	Laboratory Control Sample	Each group of samples of similar matrix (≤20)	Re-analyze samples.
	Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LCS meets acceptance criteria.
Microbiology	Organism control	Each lot of media (minimum of one per month)	Investigate cause
	Negative control	Each lot of media (minimum of one per month)	Investigate cause

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

CLP Quality Control GC/MS Volatiles		
Type	**Frequency**	**Corrective Action**
Surrogates: Toluene-d_8 Bromofluorobenzene 1,2-Dichloroethane-d_4	Each sample, MS, MSD, and blank	Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: 1,1-Dichloroethene Trichloroethene Benzene Toluene Chlorobenzene	Each group of samples (≤20) per matrix/level	Advisory Only Evaluated by analyst in relationship to other QC results
Matrix Spike Duplicates (RPD): 1,1-Dichloroethene Trichloroethene Benzene Toluene Chlorobenzene	Each group of samples (≤20) per matrix/level	Advisory Only Evaluated by analyst in relationship to other QC results
Blanks:	Once for each 12-hour time period or ≤20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d_5	Each sample, MS, MSD, and blank	Reanalyze samples; if reanalysis confirms original, document on report or case narrative

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem other than the matrix exists, the samples will be reanalyzed.

CLP Quality Control GC/MS Semivolatiles		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene-d_5 2-Fluorobiphenyl Terphenyl-d_{14} Phenol-d_5 2-Fluorophenol 2,4,6-Tribromophenol 2-Chlorophenol-d_4 1,2-dichlorobenzene-d_4	Each sample, MS, MSD, and blank (Advisory) (Advisory)	Re-extract and reanalyze if more than one surrogate out per fraction (acid/base) or any recovery <10%; if re-extraction and reanalysis confirms originals, document on report and/or case narrative
Matrix Spikes & Matrix Spike Duplicates (RPD): Phenol 2-Chlorophenol 1,4-Dichlorobenzene N-Nitroso-di-n-propylamine 1,2,4-Trichlorobenzene 4-Chloro-3-methylphenol Acenaphthene 4-Nitrophenol 2,4-Dinitrotoluene Pentachlorophenol Pyrene	Each group (≤20) of samples per matrix/level	Advisory Only Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level, instrument	Reextract and reanalyze blank and associated samples, except for phthalate contamination, which is allowed to be present at levels up to 5 times the CRQL.
Internal Standards (ISTD): 1,4-Dichlorobenzene-d_4 Naphthalene-d_8 Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}	Each sample, MS, MSD, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst; a problem exists other than matrix, the sample will be reanalyzed.

CLP Quality Control Pesticides/PCBs		
Type	**Frequency**	**Corrective Action**
Surrogates: Tetrachloro-*m*-xylene (TCMX) Decachlorobiphenyl (DCB)	Added to each sample, MS/MSD, and blank during the extraction phase	Advisory Only for Samples For Blank, reinject; if still out reextract and reanalyze blank and associated samples
Matrix Spikes & Matrix Spike Duplicates (RPD): gamma-BHC (Lindane) Heptachlor Aldrin Dieldrin Endrin 4,4'-DDT	Each extraction group (≤20) of samples per matrix/level	Advisory Only Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level	Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reprepped.

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem exists other than matrix, the sample will be reanalyzed.

CLP Quality Control Inorganics		
Type	**Frequency**	**Corrective Action**
Internal Standard (ICP & ICP/MS only):	Each sample, standard and QC (Unspiked, Dup., MS, , LCS, dilution, post digestion spike and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤20) each method	Analyze post-digestion spike sample
Duplicates (RPD):	Each group of samples of similar matrix/level (≤20) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB) Preparation Blank	Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.) Each SDG or batch (≤20 samples)	Correct problem, recalibrate, and rerun Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <20× blank result
Serial Dilutions (ICP, ICP/MS only):	Each group of (≤20) of similar matrix/level	Flag the data
Interference Check Sample:	Each wavelength after Initial Calibration Verification at beginning and end of the run and per 20 samples	Correct for interference, recalibrate the instrument
Laboratory Control Sample:	Each SDG or batch (≤20 samples), each method	Redigest and reanalyze LCS and associated samples
Post Digestion Spike:	When matrix spikes are outside 75% to 125% range	Flag the data

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem exists other than matrix, the sample will be reanalyzed.

Drinking Water Quality Control Inorganics (Metals)		
Type	**Frequency**	**Corrective Action**
Internal Standard (ICP & ICP/MS only):	Each sample, standard and QC (Unspiked, Dup., MS, MS, LFB, Post Digestion Spike, dilution and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤10) each method	Analyze post-digestion spike sample
Duplicates (RPD):	Each group of samples of similar matrix/level (≤10) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB)	Each wavelength immediately after calibration verification at 10% frequency	Correct problem, recalibrate, and rerun
Preparation Blank	Each batch (≤10 samples)	Redigest and reanalyze blank and associated samples if sample result <10 times blank result or >LOQ
Laboratory Fortified Blank (LFB):	Each batch (≤10 samples)	Redigest and reanalyze LFB and associated samples. Elements that fail high in the LFB and are ND in the samples can be reported.
Post Digestion Spike:	When matrix spikes are outside range	Flag the data

Drinking Water EPA Method 525.2 Quality Control		
Type	**Frequency**	**Corrective Action**
Lab Reagent Blank (LRB):	One per extraction batch of (≤20) samples	Re-extract and reanalyze blank and associated samples
Lab Fortified Blank (LFB): Spike all compounds of interest	One per extraction batch of (≤20) samples	Re-extract and reanalyze LFB and associated samples for compounds outside acceptance limits. Compounds that fail high in the LFB and are ND in the samples can be reported.
Matrix Spike/Matrix Spike Duplicate (MS/MSD): Spike all compounds of interest	One per extraction batch of (≤20) samples	Recoveries for LFB must be within criteria. If there is insufficient sample for MSD, then a duplicate (extraction and analysis) of another sample in the batch must be performed.
Surrogates: 1,3-Dimethyl-2-nitrobenzene Perylene-d_{12} Triphenylphosphate	Each sample, LFB, MS, MSD, and blank	Re-extract and reanalyze the sample
Internal Standards (ISTD): Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12}	Each sample, LFB, MS, MSD, and blank	Reanalyze samples

QC Table for Miscellaneous Water Tests			
Test	**QC Type**	**Frequency**	**Corrective Action**
Alkalinity **Ammonia (ISE)** **Ammonia (Distill)** **Dissolved Solids** **Fluoride (ISE)** **Hardness** **Sulfate (TURB)** **Sulfide** **Total Solids** **Turbidity**	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Fortified Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.*
	Duplicate	Each group of samples of similar matrix (≤20) Alkalinity, Dissolved Solids, Total Solids, Turbidity each group of similar matrix (≤10)	Ensure that LFB meets acceptance criteria.
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤20) (not for Turbidity)	Ensure that LFB meets acceptance criteria.
Bromide (IC) **Chloride (IC)** **Cyanide (total & free)** **Fluoride (IC)** **Nitrogen (TKN)** **Nitrate/Nitrite** **Sulfate (IC)** **Total Phosphorus** **TOC**	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Fortified Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.*
	Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LFB meets acceptance criteria.
	Matrix Spike	Each group of samples of similar matrix (≤10)	Ensure that LFB meets acceptance criteria.
Phenols	Blank	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.
	Laboratory Fortified Blank/Laboratory Control Sample	Each group of samples of similar matrix (≤20)	Prepare the entire batch again and re-analyze.*
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LFB meets acceptance criteria.
pH **Moisture**	Laboratory Fortified Blank	Each group of samples of similar matrix (≤20)	Re-analyze samples.
	Duplicate	Each group of samples of similar matrix (≤10)	Ensure that LFB meets acceptance criteria.
Microbiology	Organism control (+)	Each lot of media (minimum of one per month)	Investigate cause
	Negative control (-)	Each lot of media (minimum of one per month)	Investigate cause

*LFBs that fail high and associated samples are ND can be reported.

QC Table for Drinking Water Methods: 507, 508, 515.1, 531.1		
Type of QC	**Frequency**	**Corrective Action**
Blank	Each batch of (≤20) samples	Inject a solvent blank to check for analytical system contamination. Re-inject the blank. If the re-injected blank is acceptable then any samples with positive results must be re-injected. If the re-injected blank is unacceptable, all associated samples must be re-extracted.
Surrogate	Added to each field and QC sample during the extraction.	Recovery must be within specifications unless matrix-related problems are evident, in which case report results and comment.
Matrix Spike/Matrix Spike Duplicate Spike all compounds of interest, except multipeak compounds	Each batch (≤20) of samples if sample volume is available.	Evaluate in conjunction with the LFB.
Laboratory Fortified Blank (LFB) Spike all compounds of interest, rotate multipeak compounds	Each batch of (≤20) samples. LCSD may be used if insufficient sample for MS/MSD is submitted.	If LFB compounds are outside of acceptance limits, re-extract and re-analyze the batch. Compounds that fail high in the LFB and are ND in the samples can be reported.

QC Table for Drinking Water Method: 524.2		
Type of QC	**Frequency**	**Corrective Action**
Blank	One blank for each 12-hour period or batch of ≤20 samples	Reanalyze blank and associated samples if blank is unacceptable.
Surrogate 4-Bromofluorobenzene 1,2-Dichlorobenzene-d_4	Added to each field and QC sample prior to analysis	Reanalyze sample if outside limits. If reanalysis confirms original, document on report.
Matrix Spike/Matrix Spike Duplicate Spike all compounds of interest	At client request.	Evaluate in conjunction with the LFB.
Laboratory Fortified Blank (LFB) Spike all compounds of interest	One LFB for each 12 hour period.	If target compounds are outside of acceptance limits, re-analyze the LFB. If second LFB fails, recalibrate instrument, re-analyze LFB and any associated samples. Compounds that fail high in the LFB and are ND in the samples can be reported.
Internal standard (ISTD) Fluorobenzene	Added to each field and QC sample prior to analysis	Reanalyze sample if outside limits. If reanalysis confirms original, document on report.

EPA 624 Quality Control GC/MS Volatiles		
Type	**Frequency**	**Corrective Action**
Surrogates: 4-Bromofluorobenzene 1,2-Dichloroethane-d_4 Fluorobenzene	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis is within limits, the reanalysis data is reported. If surrogates confirm original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each batch (≤20) of samples	Evaluated by analyst in conjunction with the LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Samples: Spike all compounds of interest	Each batch (≤20) of samples	Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each batch (≤20) of samples	Evaluated by analyst in relationship to other QC results
Blanks:	Once every 24-hour tune period and/or 20 samples, which ever comes first	Reanalyze blank and associated samples if blank outside QC limits
Internal Standards (ISTD): Bromochloromethane 2-Bromo-1-chloropropane 1,4-Difluorobenzene	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis is within limits, the reanalysis data is reported. If internals confirm original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

EPA 625 Quality Control GC/MS Semivolatiles		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene-d_5 2-Fluorobiphenyl Terphenyl-d_{14} Phenol-d_6 2-Fluorophenol 2,4,6-Tribromophenol	Each sample, MS, MSD, LCS, and blank	Re-extract and reanalyze if more than one surrogate out per fraction (acid/base) or any recovery <10%; if re-extraction and reanalysis confirms originals, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluate in conjunction with the LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Same as for matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level, instrument	Re-extract and reanalyze blank and associated samples
Internal Standards (ISTD): 1,4-Dichlorobenzene-d_4 2-Fluoronaphthalene Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

EPA 608 Quality Control Pesticides/PCBs		
Type	**Frequency**	**Corrective Action**
Surrogate: Organochlorine Pesticides & PCBs DCB TCMX	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis if reanalysis confirms original report results and comment in case narrative
Matrix Spikes: Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene PCBs: Aroclor 1016 and Aroclor 1260	Each batch (≤20) of samples	Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Matrix Spike Duplicates (RPD): Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene PCBs: Aroclor 1016 and Aroclor 1260	Each batch (≤20) of samples	Evaluated by analyst in relationship to other QC results
Laboratory Control Sample: Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene PCBs: Aroclor 1016 and Aroclor 1260	Each batch (≤20) of samples	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported.
Blanks:	Each batch (≤20) of samples	Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

EPA Method 602 Petroleum Analysis Acceptance Criteria		
Type	**Frequency**	**Corrective Action**
Surrogate: α,α,α-Trifluorotoluene (PID)	Each sample, MS, MSD, LCS, and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident.
Matrix Spike: Spike all compounds of interest	Each group (≤20) of samples	Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples. LCSD analyzed if sufficient volume is not available for MS/MSD	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Same compounds as the matrix spike	Each group (≤20) of samples	Evaluated by an analyst in relationship to other QC results
Blanks:	At least once per 24 hours	Reanalyze blank and associated samples if blank is outside limits
Internal Standards (ISTD): 1-Chloro-3-fluorobenzene (PID)	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original result, document on report or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change

EPA 610 Quality Control PAHs by HPLC		
Type	**Frequency**	**Corrective Action**
Surrogate: Nitrobenzene Triphenylene	Each sample, MS, MSD, LCS, and blank	Re-extract and reanalyze. If re-extraction and reanalysis confirms then comment on report and/or case narrative. Re-extraction may not be needed if matrix related problems are evident. Comment in case narrative.
Matrix Spike: Spike all compounds of interest	Each batch (≤20) of samples	Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each batch (≤20) of samples	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each batch (≤20) of samples	Evaluated by analyst in relationship to other QC results
Blanks:	Each batch (≤20) of samples	Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

EPA Method 600 Series (Method 200.8 for ICP/MS) Quality Control Inorganics (Metals)		
Type	**Frequency**	**Corrective Action**
Internal Standard:	Each sample, standard and QC (Unspiked, Dup., MS, LCS, dilution, Post Digestion Spike and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤10) each method	Analyze post-digestion spike sample
Matrix Spike Duplicate (RPD):	Not required	N/A
Duplicates (RPD):	Each group of samples of similar matrix/level (≤10) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB) Preparation Blank	Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.) Each SDG or batch (≤10 samples)	Correct problem, recalibrate, and rerun Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <20× blank result
Serial Dilutions:	Each group of (≤10) of similar matrix/level	Flag the data
Interference Check Sample:	Each wavelength after Initial Calibration Verification at beginning and end of the run or min. of 2 times per 8 hour	Correct for interference, recalibrate the instrument
Laboratory Control Sample:	Each SDG or batch (≤10 samples), each method	Redigest and reanalyze LCS and associated samples. Elements in the LCS that fail high and are ND in the samples can be reported.
Post Digestion Spike:	When matrix spikes are outside 70% to 130% range or within the statistical window (whichever is tighter)	Flag the data
Analytical Spike:	One per 10 field samples	ICP-MS – flag the data

Quality Control for Miscellaneous 600 Series Water Tests			
Test	**QC Type**	**Frequency**	**Corrective Action**
Alkalinity **Ammonia (ISE)** **Ammonia (Distill.)** **Dissolved Solids** **Fluoride (ISE)** **Hardness** **Sulfate (turb)** **Sulfide** **Total Solids** **Turbidity**	Blank	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.*
	Duplicate	Each batch (≤20) of samples	Ensure that LCS meets acceptance criteria.
	Matrix Spike/ Matrix Spike Duplicate	Each batch (≤20) of samples (not for turbidity)	Ensure that LCS meets acceptance criteria.
Bromide (IC) **Chloride (IC)** **Sulfate (IC)** **Cyanide (total & free)** **Fluoride (IC)** **Nitrogen (TKN)** **Nitrate/Nitrite** **Total Phosphorus** **TOC**	Blank	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.*
	Duplicate	Each batch (≤10) of samples	Ensure that LCS meets acceptance criteria.
	Matrix Spike	Each batch (≤10) of samples	Ensure that LCS meets acceptance criteria.
Phenols	Blank	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each batch (≤20) of samples	Prepare the entire batch again and re-analyze.*
	Matrix Spike/ Matrix Spike Duplicate	Each batch (≤10) of samples	Ensure that LCS meets acceptance criteria.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

*LCSs that fail high and associated samples are ND can be reported.

TO-15 Volatile Organics in Air		
Type	**Frequency**	**Corrective Action**
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Blanks:	Once for each 24-hour time period or ≤20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d_5	Each sample, LCS, and blank	Reanalyze samples, if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

TO-14A Volatile Organics in Air		
Type	**Frequency**	**Corrective Action**
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Blanks:	Once for each 24-hour time period or ≤20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d_5	Each sample, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Lancaster Laboratories

Environmental Quality Policy Manual

Appendix K
Microbiological Testing

Current as of October 05, 2011
5 Total Pages (including this coversheet)

MICROBIOLOGICAL TESTING

1. MICROBIOLOGICAL SAMPLE HANDLING

1.1. Microbiological Sample Collection

The containers for environmental microbiology are typically sterile, screw-cap plastic bottles. A minimum of 100 mL of sample is required. The sampling containers are purchased with a sterility certification. The sterility, absence of autofluoresence, and volume of each purchased lot of containers is verified by randomly selecting a container from each purchased lot and inoculating it with approximately 100 mL of sterile tryptic soy broth and placing it in incubation for 24 hours at 35° ± 0.5°C. Each lot of bottles is also checked for absence of autofluoresence with a 366-nm UV light with a 6-Watt bulb. The 100-mL calibration line on the container is verified using a 100-mL Class A graduated cylinder to 2.5% tolerance.

Samples collected for microbiological analyses must follow a specific protocol:

- The sampling taps are to be free of aerators, strainers, hose attachments, and purification devices; they should not be mixing type faucets, and avoid leaky faucets.
- Maintain a steady water flow for 3 to 5 minutes before collecting the sample.
- Using aseptic techniques, fill the container to just above the 100-mL mark on the container. This will allow for mixing and chlorine residual analysis.
- Do not overfill the container.
- If another environmental microbial analysis is required, or if the water is discolored (to act as a color standard), a separate container will be required.

1.2. Microbiological Sample Storage

Because sample integrity can be compromised by improper storage, the environmental microbiology samples are refrigerated with the temperature monitored until requested by the microbiologist for analysis.

Holding times for samples are monitored and analysis is scheduled accordingly. For SDWA compliance purposes, no sample (for total coliform analysis) with over 30 hours elapsed time from collection will be analyzed. HPC samples from SDWA surface water systems must be tested within 8 hours of collection. Fecal coliform tests on effluents for NPDES compliance purposes must be transported to the laboratory within 6 hours of collection. Samples that arrive past 6 hours of when they were collected can not be tested. Whenever possible, the sample should be tested within 2 hours of receipt.

1.3. Microbiological Sample Return/Disposal

All solid wastes generated from the microbiological analyses are disposed of in bags designated as "BioHazard", sterilized via autoclave and disposed of by incineration. Lancaster Laboratories uses a sophisticated, computerized sample management system (CSMS), which includes programming to assist in the identification of hazardous wastes at time of discard. In most cases, a sample for coliform testing is collected in a container that will also be the test vessel. These samples are assigned a discard location. If a sample is being tested for an analysis other than microbiology, it will be assigned a storage location.

2. MICROBIOLOGICAL TECHNICAL REQUIREMENTS AND TRACEABILITY OF MEASUREMENTS

2.1. Media

- Within the microbiology laboratory, procedures are in place to address preparation, labeling, storage, expiration, documentation, and quality/sterility evaluation requirements for these materials. Only commercially prepared or manufactured dehydrated media is used for SDWA water work. Media may not be formulated from basic ingredients. Each new lot of dehydrated or commercially prepared medium is checked against positive and negative culture controls. Each purchased lot of MMO-MUG media is tested for performance using *E. coli*, *K. pneumoniae*, and *Ps. aeruginosa*, or equivalent organisms following a standard operating procedure. The positive/negative organism check is performed on each new lot of purchased or prepared media for QC purposes.

- Each analytical method includes a list of media needed for the test. These are fully described, including name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed.

- The Microbiology Department is responsible for maintaining an inventory of the media needed. New supplies of media are checked by the Purchasing Department to ensure that they match the purchase order. The laboratory is responsible for checking that new supplies meet the method requirements.

- In addition to the name and concentration, the media containers are labeled with the storage conditions, the date opened, and an expiration or re-evaluation date. Subsequent media preparations at the laboratory are fully documented in a logbook and are traceable to, or labeled to include:

    1. Name of media
    2. Concentration, as appropriate
    3. Date prepared
    4. Name of analyst preparing or reference to logbook
    5. Storage conditions
    6. Expiration/re-evaluation date
    7. Manufacturer name and lot #
    8. Sterilization time and temperature
    9. Final pH, where required
    10. Sterility check result

2.2. Microbiological Standard Sources, Calibration, and Preparation

Microbial Control Species - Where required, laboratory cultures are obtained from the American Type Culture Collection (ATCC). Cultures used in testing are no more than five transfers from ATCC freeze-dried cultures.

2.3. Microbiological Equipment Maintenance

Equipment maintenance and calibration is addressed in instrument-specific Operation, Maintenance, and Calibration Procedures (OMC) or instrument-specific instruction manuals located within the department.

The general process for sterilization procedures are outlined below:

2.3.1. All autoclaving is done at 121° ± 1°C, with times as specified below (in minutes):

Carbohydrate media	25
Rinse water	60
Contaminated materials	minimum of 70

2.3.2. Sterile disposable single use membrane filter units or sterile glass filter funnels are used for methods that require filtration.

2.4. Microbiological Labware Cleaning

Sterile disposable plasticware is primarily used for microbiological analysis. However, procedures are in place to outline the washing process for each type of labware used in the laboratory. Most glassware is machine-washed. Labware that is washed by hand is either air dried or dried in specifically designed ovens and sterilized appropriately. Each new lot, or at least annually, of detergents used to wash glassware for Environmental Microbiology labware, is tested using the Inhibitory Residue Test, as outlined in SM20 9020.B.4.a.2).

MICROBIOLOGICAL INTERNAL QUALITY CONTROL CHECKS

2.5. Microbiological Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples or new lot of reagents, as required by the procedures, to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. Chromofluorogenic media QC tests are lot-specific and performed on each newly received lot.

As required in the procedure on written methods, each analytical method specifies (or cross-references another procedure) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the acceptable range.

The handling of QC data is described in the procedure addressing, "Quality Control Records." The types of QC samples and the information each provides are discussed in the following paragraphs.

2.5.1. Negative System Control - The QC on this is method specific and can be found in the Quality Control/Quality Assurance Procedure.

2.5.2. Positive and Negative Organism Controls - Each lot/batch of media is tested using positive and negative organism controls.

2.5.3. Duplicate Counting (Test Variability/Reproducibility) - duplicate counting is performed monthly on HPC and fecal MF plates. Each analyst who counted samples for a month, counts the plates and their results are evaluated. Counts must be within 10% difference of the total average for all analysts to be acceptable.

2.5.4. Duplicates - For heterotrophic plate count samples, a duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. The plate counts are averaged.

2.5.5. Serial Dilutions - Fecal coliform, biosolids analyses, and heterotrophic plate counts may require serial dilution of the sample.

2.6. Microbiological Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples, where appropriate. The corrective action required when a QC result fails to meet the acceptance criteria is also given, where appropriate.

The QC acceptance criteria are available to analysts in the laboratory. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This may include, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a comment stating the observed deviation, and invalidating results. It should be noted that resampling may be required in the case of invalidated results for SDWA, EPA, DEP, or DOH compliance samples due to the short hold-times in microbiological analysis.

2.7. Microbiological Water Systems

Laboratory Reagent Water Suitability Testing - On an annual basis, a sample is sent to a PADEP certified laboratory for suitability analyses. These serve as confirmation of our analyses, as well as to supply additional data on the water suitability.

2.8. Microbiological Reporting Limits

For microbiological analysis, the limits are method-specified and/or project-specific. This information is programmed into the LIMS for reporting purposes.

Analytical Resources Inc. Quality Assurance Plan

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Quality Assurance Plan

Analytical Resources, Inc.
4611 S. 134th Place, Suite 100
Tukwila, WA 98168-3240

Revision 013-000
8/17/09

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This Quality Assurance Plan is approved and authorized for release by:

Mark Weidner
Laboratory Technical Director

Brian N. Bebee
Organic Analysis Section Technical Director

Jay Kuhn
Inorganic Analysis Section Technical Director

David Mitchell
Quality Assurance Manager

Quality Assurance Plan

Analytical Resources Inc.

Table of Contents:

SECTION 1: INTRODUCTION

Quality Assurance Policy and Objectives

Analytical Resources, Inc. (ARI) is dedicated to providing accurate and reliable data in a timely and cost effective manner. The management of ARI is committed to analytical excellence and will provide the facilities and a professional environment to achieve this goal. The quality assurance program detailed in this document sets forth the policies and procedures that are followed by ARI to ensure that all reported results are both legally defensible and of the highest quality.

To ensure that data quality goals are achieved, the following characteristics must be considered:

Precision, Bias and Accuracy

For all analyses, there is a degree of uncertainty or error in the measurement process. This measurement error is generally one of two types: random error (precision) or systematic error (bias). Precision is a measure of agreement between replicate measurements. Bias is considered to be the difference between the expected value and the true value for a measurement or series of measurements. Accuracy is a determination of how closely a measurement is to the expected value. Both precision and bias are considered when determining the accuracy of measurements. Precision, bias and accuracy are evaluated through the use of method guidelines, and project and laboratory control limits.

Representativeness

Representativeness is an indicator of how closely one sample aliquot resembles another aliquot from the same bulk source or sample site. Sample representativeness is more easily obtained for particulate-free water samples than for solid samples or viscous liquids. Representativeness is an important consideration in achieving other data quality objectives.

Completeness

Completeness is an indicator of the number of valid (useable) data points compared with the overall number of data points obtained. Valid data are normally obtained when sample collection and analysis is performed in accordance with specified methods and procedures. Completeness is often expressed as a percentage: the higher the number of valid data points, the higher the overall completeness percentage. Conversely, fewer valid data points will result in an overall lower percentage of completeness. Project specifications will dictate the required level of completeness.

Comparability

Comparability is an indicator of how confidently one data set can be compared with another, as well as the consistency between data sets. Stable analytical conditions and adherence to standard procedures, combined with high levels of accuracy; help ensure that results obtained over a period of time will be comparable.

Timeliness

To ensure that the most accurate results possible are obtained, samples must be processed within specified time periods. Analytical holding times have been established to allow sufficient time for sample processing without compromising sample integrity. It is important that, while meeting timeliness requirements, other data quality objectives are still considered and met.

Documentation

Complete and accurate documentation is essential for verifying the integrity of analytical results. Achievement of other quality objectives cannot be used to substantiate data quality without full documentation of the analytical process. Documentation must be concise and readily available for subsequent review.

The quality assurance program at ARI has been developed to ensure that the specified data quality objectives are met for all reported results and the highest degree of completeness possible is achieved.

1.2 Ethics Policy on Data Quality and Confidentiality

To ensure that data quality or confidentiality is not compromised, ARI has established the following policy on corporate ethics. These steps must be taken when the quality or confidentiality of data is suspected or known to be compromised. This policy applies to all ARI employees at every organizational level.

General

ARI's corporate commitment to integrity and honesty in the workplace is clearly stated in the ARI Employee's Handbook, under "Standards of Conduct". The Standards of Conduct statement is attached as Appendix O. The ARI commitment to excellence in data quality extends to and includes all aspects of data production, review and reporting.

Any attempt by management or any employee to compromise this commitment presents a case for serious disciplinary action. Any indications or allegations of waste, fraud or abuse will be rigorously investigated by ARI management, with the penalties for verified cases to be employment termination, and if appropriate, prosecution. In addition to these steps, any such

charges related to data generated for the federal government will also be reported to the Inspector General of the appropriate department.

Circumstances

All ARI employees will immediately report to management any information concerning the misrepresentation or possible misrepresentation of analytical data (or any associated components).

Misrepresentation of data includes (but is not limited to) the following:

Altering an instrument, computer or clock to falsify time or output
Altering the content of a logbook or data sheet in order to misrepresent data
Falsifying analyst identity
Changing documents with correction fluid with the intent of falsifying information
Preparing or submitting counterfeit data packages or reports
Unauthorized release (either written or verbal) of confidential data
Illegal calibration techniques (peak shaving, fraudulent integrator parameters)
Any attempt to misrepresent data or events as they actually occur in the course of data production or reporting

Responsibilities

It is the responsibility of all ARI employees to report any situation which may be adverse to data quality or confidentiality, or which may impact the final data quality. All ARI employees have the obligation to discuss known or suspected violations of this policy with laboratory management, who in turn are obliged to inform the ARI Laboratory Manager. If a satisfactory resolution is not obtained or is not possible at laboratory level, all ARI employees have the right and responsibility to discuss the matter directly with the ARI Laboratory Manager.

It is the responsibility of the ARI Laboratory Manager to promptly investigate any reports of known or suspected violations. The ARI Laboratory Manager has the authority and responsibility to resolve all known or potential violations of the policy.

It is the responsibility of ARI management to provide all of its employees with the facilities, equipment, and training to achieve the quality goals stated in the policy. It is the responsibility of ARI to provide our clients with data of known and documented quality.

Documentation

To reaffirm an awareness of and commitment to the highest standards of data quality, excellence, and integrity, all employees are required to sign the following "Commitment to Excellence in Data Quality" statement:

"As an ARI employee, I have the right and responsibility to report any situation which may be adverse to quality or which may impact the final quality or integrity of data produced for our clients."

"I will report immediately to management any information concerning the misrepresentation or possible misrepresentation of analytical data (or any of its associated components). Examples of this include (but are not limited to): alteration of an instrument computer or clock, alteration of the contents of logbooks and/or data sheets in order to misrepresent data, misrepresentation of analyst identity, intentional falsification of documents with correction fluid ("white-out"), preparation and submittal of counterfeit data packages, use of illegal calibration techniques (peak shaving, use of fraudulent integrator parameters, etc.), or any attempt to misrepresent data or events as they actually occur in the course of an analysis."

"I will likewise alert management of any situation or activity which may be adverse to the confidentiality of clients' data."

"I will not knowingly participate in any such activity, nor fail to report such activities of which I may become aware. I understand that any voluntary participation on my part in such activities may result in the termination of my employment, and possible legal prosecution."

"Where circumstances permit, I will report any actual or suspected violations of this policy to my lab or section supervisor. If a satisfactory resolution is not obtained or is not possible at that level, I have the right and obligation to discuss the matter directly with the ARI Laboratory Manager."

Confidentiality

All information related to client projects, such as client work plans, documentation and analytical data will be considered confidential. This information will be released only to the

client or an authorized representative. Should an outside agency request information related to a client project, the client will be contacted for approval prior to releasing any information.

Some programs or contractual agreements (such as the USEPA Contract Laboratory Program) may have specific requirements for protecting a client's confidentiality Project Managers will be responsible for strict control of access to any such confidential information or documentation. All data generated from the analysis of confidential samples will also be considered confidential.

SECTION 2.0: QA MANAGEMENT AND RESPONSIBILITIES

The principal tenet of the Quality Assurance Program at Analytical Resources Inc. (ARI) is that every employee knows she/he is a vital component of the program, and holds a responsibility to produce high-quality, defensible data in a timely manner. While production of quality data is a global philosophy, held by the entire laboratory, each section is responsible for ensuring that the data produced within that section meets the required quality objectives.

2.1 Overall Structure

The Board of Directors shall direct ARI's QA Policy and shall determine the Philosophy of the QA Program. It shall be the responsibility of the Laboratory Director to translate this policy into practical procedures with respect to the business plan developed for ARI, and direct the Laboratory Manager and Section Managers regarding the incorporation of these procedures into daily laboratory activities.

The Laboratory Manager is responsible for coordination of laboratory activities to result in an integrated approach to quality data production. The Laboratory Manager will coordinate Client Services, Laboratory Section Management, Computer Services, and Data Services to ensure that project requirements and data quality objectives are met.

The Laboratory Section Managers and Supervisors shall hold the final authority in decisions concerning implementation of QA policy, with the contributions of the Laboratory Director, Laboratory Manager, QA Manager and Project Managers. Section Managers and Section Supervisors shall instruct employees in the proper employment of QA policies.

Each Section Supervisor will ensure that analyses are completed within required holding times, that data is submitted within required submission times, and all analyses are performed according to the current Standard Operating Procedures (SOPs). They will ensure that any client modifications or QA issues are well documented for each sample set and that all required documents are complete when submitted with each data set.

The analytical staff shall execute all methods following QA policies, and will write SOPs reflecting the methods exactly as performed. These SOPs will be reviewed for compliance by Section Managers and the Laboratory Director, and once approved will be submitted to the Quality Assurance Program Manager (QAPM).

The QAPM will be responsible for controlling Company SOPs and other internal documents, overseeing the scheduling and completion of detection limit studies. The QAPM will coordinate the production of control charts and distribution of control limit data to all laboratory sections. The QAPM will administer the blind QA proficiency tests and performance samples as described in the QA Program. The QAPM will verify that QA policies and procedures are followed through out ARI.

Data reviewers will be responsible for ensuring that all samples have been analyzed by the approved and requested methods, that data calculations are performed correctly, and that analyses meet the Data Quality Objectives of the client. They shall also be responsible for ensuring that the documentation from each laboratory section is intact and complete.

Computer Services is responsible for ensuring that the Laboratory Information Management System (LIMS) correctly reflects the preparations and analyses performed and that the LIMS is updated with the current SOP, MDL, RL and QL data as submitted from the QAPM. Computer Services personnel are also responsible for ensuring that all electronic deliverables for clients are formatted correctly as requested by the Project Managers and that this data matches the hardcopy deliverables submitted.

Client Services (Project Management, Sample Receiving), shall be responsible for ensuring that the laboratories understand and can meet project specific analytical requirements and DQO.

2.2 Hierarchical Responsibilities

Technical Director

> *It shall be the responsibility of the Laboratory Director to translate QA policy into practical procedures with respect to ARI's business plan, and to direct the Laboratory Manager and Section Managers in the implementation of these procedures in daily laboratory activities.*

The Director shall interpret overall QA Policy, and determine the broad practicality of policies based on methodologies, technological advances, and the current environmental market. It shall be the interpretation of these policies that will, in turn, direct the growth ARI, the addition or withdrawal of methods to ARI's repertoire, and ARI's marketing focus.

At a minimum of once a year the Technical Director shall include on the agenda of the Board of Directors meeting a discussion of ARI′s QA Policy. This discussion will include the reputation of ARI for producing quality analyses, the affect of QA policies on turn-around time, competitive edge and cost-of-analysis, needs for stricter or more flexible policies, and the response of employees to the QA policies in place at that time.

At a minimum of once every six months the Director shall attend management meetings, which include on the agenda the subject 'QA Program'. This format will allow for the dissemination of information on any QA issues addressed in the laboratory or by the Board of Directors. Management shall also use these meetings to discuss requirements of clients that are not met by ARI′s present QA Program, and the appropriate response to these requirements.

The Technical Director may be required to act as a technical advisor at any impromptu meetings called by management to address QA issues that cannot be immediately resolved within a laboratory section.

It shall also be the Director's authority and responsibility to hold final review approval for all SOPs of ARI. Once an SOP has been updated and reviewed by the laboratory section, it shall go through the Section and Laboratory Managers for approval, and then to the Laboratory Director for final approval before the SOP is released.

Laboratory Manager

> *The Laboratory Manager is responsible for coordination of laboratory activities to result in an integrated approach to quality data production. It shall be the Laboratory Manager's responsibility to coordinate Client Services, Laboratory Management, Computer Services, and Data Services to ensure that QA Program requirements and data quality objectives are met.*

The Laboratory Manager is required to attend all management meetings, at which the QA Program will be an agenda item. Management shall use these meetings to discuss requirements of clients that are not met by ARI′s present QA Program, the appropriate response to these requirements, and dissemination of information on any QA issues addressed in the laboratory or by the Board of Directors.

It is the responsibility of the Laboratory Manager, along with the QA Manager, Laboratory Director, Section Managers and Client Services, to determine in which QA Proficiency

Programs the Laboratory will participate, and those accreditations that ARI will pursue. It is the responsibility of the Laboratory Manager, with the Section Managers, to ensure that all laboratory sections perform the tasks required by the QA Manager to pursue each accreditation or to complete a scheduled audit.

The Laboratory Manager has the authority to direct Client Services to discontinue the bidding/contracting process for a new project, refuse samples, or to re-schedule projects based on Data Quality Objectives or current workload. The Laboratory Manager also shall evaluate staffing and equipment needs based on information from the Section Managers and Client Services and may elect to meet new project requirements by increasing staffing levels or purchasing additional equipment.

The Laboratory Manager serves as a senior-level technical reference for all laboratory activities, and as such will be brought in to advise on out-of-control events and trends, corrective actions, and/or other QA issues that require his/her expertise.

Laboratory Section Managers

> *The Section Managers shall hold the final authority in decisions concerning implementation of QA policy, with the contributions of the Laboratory Director, Laboratory Manager, QAPM and Project Managers. Section Managers are responsible for correcting out of control events within their respective laboratories. Section Managers and supervisors shall instruct employees in the proper employment of QA Policies.*

Laboratory Sections Managers shall have the final authority in decisions concerning QA policy. It is their expertise that will determine the final acceptable format of each method SOP, as they are the best resource to integrate methods into ARI's philosophy.

Laboratory Section Managers are responsible for completing or delegating updates of laboratory procedures and quality assurance manual sections as scheduled by the QA Manager.

The Section Managers are best able to determine capacity of the Laboratory Sections. To ensure that analyses are completed within required hold times, the Section Managers will give Supervisors the authority to balance employee workloads and modify employee work schedules. It is the Section Manager's responsibility to take reports from supervisors and work

with the Laboratory Manager to increase staffing levels or reject samples as needed. It is the Section Manager's responsibility to work with the Laboratory Manager and the section supervisor and analysts to ensure that sample capacity does not affect the quality of data generated from that laboratory section.

It is the responsibility of the Laboratory Section Managers, along with the QA Manager, Laboratory Director, Laboratory Manager and Client Services, to determine in which QA Proficiency Programs the Laboratory will participate, and which accreditation processes ARI will pursue. It is the responsibility of the Section Managers, with the Section Supervisors, to ensure that all laboratory sections perform the tasks required by the QA Manager to pursue each accreditation or to complete a scheduled audit.

The Section Manager will be responsible for reviewing training records of analysts produced by the Section Supervisor. Training shall be the responsibility of the Section Supervisor, but it is the responsibility of the Section Manager to oversee this training.

It is the Section Managers' responsibility to work with the Section Supervisor and Project Manager to assure that Project Requirements are achievable and valid for the given methods. At times, ARI′s clients have requests or requirements for methods that are 1) not the method of choice in the laboratory, 2) not presently performed by the laboratory, or 3) unachievable by the instrumentation used in the laboratory. It is the responsibility of the Section Supervisor, Section Manager and Project Manager to work with the client to resolve these issues before samples are accepted.

Clients may also request modifications to the methods that must be approved by the Section Supervisor, the Section Manager and the QAPM. These modifications must be thoroughly documented and all pertinent information on modifications must be conveyed to the analysts, sample preparation sections, sample receiving, and computer services, as needed for implementation.

The Section Manager is responsible for resolution of out-of-control events that have not or cannot be resolved by the analysts or Section Supervisor.

The Section Manager has the authority to re-classify analysts or require additional training of analysts based on their performance.

The Section Manager has the responsibility of balancing client requests and requirements with the QA policies of ARI. It is the Section Manager's task to evaluate a client's Data Quality Objectives (submitted through Client Services), and with the Project Managers, Laboratory Supervisors and Quality Assurance Manager to determine the feasibility of laboratory performance. Feasibility will be based on the quality objectives requested, current QA Manual, present workload (in-house and scheduled/pending), the technology in place, and staffing levels available. Current workload in-house will be evaluated using reports from Computer Services, and scheduled/pending workload will be evaluated using written and verbal input from Client Services.

Section Supervisors

> *It is the responsibility of each section Supervisor to ensure that analyses are completed following the most current version of ARI's SOP, within required holding and turn around times, and assure that analyses meet the Data Quality Objectives of each project. They will ensure that any client modifications or QA issues are well documented for each sample set, and that all documentation is complete when submitted with each data set.*

To ensure that analyses are completed within required hold times, the Supervisors have the authority to balance employee workloads and modify employee work schedules. The Section Supervisors, with the input of the Section Manager, have the authority to request overtime from employees should the workload warrant the additional effort, or to modify employee schedules to extend the operating hours of the laboratory section.

The Section Supervisors shall oversee the day-to-day section operations, using LIMS printouts and verbal or written workload estimates and requests from Project Managers to adjust section efforts as needed. It is also the Section Supervisors' responsibility to inform management (Section Manager, Data Review, and Project Managers), when capacities are limited, so that the appropriate adjustments can be made to reduce workloads or increase laboratory capacities. At no time should sample capacity be allowed to affect the quality of data generated from any laboratory section.

It is the Section Supervisor's responsibility to assure that employees have the proper training for their positions. This training will include training in the methods, use of the LIMS system if applicable, training in correct documentation procedures, and all information necessary for

adherence to the ARI QA Program. The Supervisor shall either perform the training personally, or designate the trainer for given methods or procedures. It is the Supervisor's responsibility to test each employee for each method or procedure, and to thoroughly document each employee's advances and current capabilities. The Supervisor shall have the authority to require further training or supervision for any employee, and shall be the authority to approve each employee for working without supervision. There will be a training record for each employee. These will be kept in the laboratory section; copies will be submitted to the QA Manager for record keeping.

It is the Supervisor's responsibility to work with the Section Manager and Project Manager to ensure that Project Requirements are achievable and valid for the given methods. At times clients have requests and/or requirements for methods that are 1) not the method of choice in the laboratory, 2) not presently part of the method as performed by the laboratory, or 3) unachievable by the instruments used in the laboratory. It is the responsibility of the Supervisor, Section Manager and Project Manager to work with the client to resolve these issues before samples are accepted.

It is the responsibility of the Section Supervisor to ensure that each analyst reads and understands all requirements submitted with each sample set, including those for any special analyte, calibration, or data deliverable. It is the Section Supervisor’s responsibility to clarify any issues, with the input of the Section Manager and the Project Manager for the client.

Clients also at times will request modifications to methods, which must be approved by the Supervisor and Section Manager. These modifications must be thoroughly documented and all pertinent information on modifications must be conveyed to the analysts, sample preparation sections, sample receiving, and computer services as needed for implementation.

It is the Supervisor's responsibility to ensure that each employee understands the requirements of all projects they work with. This may necessitate section meetings or project-specific cross-section teams to work with Project Managers for large, specialty projects to ensure that everyone has the same understanding of project requirements.

The Supervisor is responsible for resolution of out-of-control events that have not or cannot be resolved by the analysts, and for ensuring that the analysts complete all documentation. If the

Supervisor and laboratory section analysts cannot resolve the issues in a timely manner, the Supervisor's will request the assistance of laboratory management to bring the section into compliance. The Supervisor will also inform Project Management and his/her Section Manager of possible delays, and inform Data Review of possible time constraints they may face in preparation of data submissions from the lab section.

The Section Supervisors shall have the authority, usually in consultation with Laboratory or Project Management to use professional judgment in requiring samples be re-prepared, and shall determine which analysts have the authority to require re-preparation of samples.

It is the responsibility of the Section Supervisor to inform the QAPM, Section Manager and the Computer Services section of any changes in methodologies that will require revision of SOPs, MDLs, Control Limits or the LIMS programming. This includes changes in spiking compounds, spiking levels, preparation methods and analytical methods.

Analysts

> *The analytical staff shall execute all methods following QA Policies, and will write SOPs reflecting the methods exactly as performed. These SOPs will be reviewed for compliance by Section Managers, the Laboratory Manager, and the Laboratory Director, and once approved will be submitted to the QA Manager.*

The analysts are responsible for following the current SOPs (with project-specific modifications if required) in preparing and analyzing client samples and quality control samples to meet the project specific Data Quality Objectives. It is the analyst's responsibility to ensure that he/she understands all requirements of a project before proceeding with sample preparation or analysis.

Analysts are responsible for working with the Supervisor to ensure that all sample preparations and analyses are performed within required holding times and required turn-around times, and that all documentation is completed in a timely fashion. It is each analyst's responsibility to bring any recurrent or anticipated problems to the attention of laboratory management.

It is each analyst's responsibility to correct his/her own errors, to document corrective actions thoroughly, to perform peer review, and to ensure that fellow employees within the section follow documentation procedures.

The Section Supervisor may give lead analysts responsibility for training and evaluation of new staff members. This training will include instruction in the methods, use of the LIMS system if applicable, correct documentation procedures, and all information necessary for adherence to the ARI QA Program. Analysts will be responsible for maintaining all instruments and equipment in optimum operating condition and documenting this maintenance as required by the QA Program.

It is the responsibility of each analyst to request the assistance of Supervisors or Managers in resolving out-of-control situations that cannot be corrected in a timely manner, and to perform the documentation of all corrective action activities.

Quality Assurance Program Manager (QAPM)

> *The QAPM will be responsible for controlling Company SOPs and other internal documents. The QAPM will oversee the scheduling and completion of detection limit studies and control charts. The QAPM will administer the training program, analyst's proficiency documentation and performance evaluation analyses as described in the QA Program. The QAPM will verify that QA policies and procedures are followed at all levels in the Company. The QAPM will produce a "Quality Assurance report to Management" each calendar year.*

The QAPM is responsible for the oversight of the QA Program as defined by the Board of Directors and interpreted by the Laboratory Director and Laboratory Managers.

Part of this oversight will be monitoring of the QA Program through submission of performance evaluation samples, blind QA samples and double-blind QA samples. It is the responsibility of the QAPM, along with the Laboratory Manager, Laboratory Director, Section Managers and Client Services, to determine in which QA Proficiency Programs the Laboratory will participate. The QAPM will be responsible for submitting these samples to the laboratory for analysis, overseeing submission of the results to the appropriate agencies, and for control of documented proficiency results.

The QAPM will be responsible for scheduling laboratory section SOP and procedural reviews and revisions, and section updates of the Quality Assurance Manual. It is the responsibility of the QAPM to work with each Section Manager to attempt to stagger these review schedules across the year within each laboratory section. The QAPM will also be responsible for

maintaining document control of all SOPs, bench sheets, logbooks, and other forms used within the laboratory.

All laboratory sections, on an annual basis, will perform detection limit studies for each method used within each section. It is the responsibility of the QAPM to schedule, review, compile, and distribute the results of these studies.

The QAPM is responsible for evaluation of the laboratories' adherence to defined protocols through periodic audits of completed projects and of the laboratory facilities. Following the audit schedule (Appendix K), the QA Manager will perform the scheduled audit and prepare an evaluation that will be submitted to the Board of Directors in the Annual QA Report to Management.

The QAPM will be responsible for evaluation of outside accreditation requested by Client Services. The QA Manager will deliberate with the Laboratory Managers and Laboratory Director on the feasibility of pursuing accreditation based on the scope of the accreditation, the effort required to pursue accreditation and the scope of work that might become available once the accreditation is obtained. If a decision is made to pursue an accreditation, it is the responsibility of the QAPM to coordinate laboratory efforts towards the accreditation.

The QAPM will produce an annual "Quality Assurance Report to Management" to be distributed to ARI management personnel as described in Section 13 of this LQAP.

The QAPM will serve as a resource for quality-related issues for all Laboratory Sections, and will serve management in an advisory capacity.

The QAPM will have documented training in elementary statistics and Quality Systems theory.

Data Reviewers

> *Data reviewers will be responsible for ensuring that all samples have been analyzed by the approved and requested methods, that data calculations are performed correctly, and that analyses meet the Data Quality Objectives of the client. They shall also be responsible for ensuring that the documentation from each laboratory section is intact and complete.*

Data reviewers shall ensure that all samples are analyzed according to approved methods by reviewing the data released by each laboratory section. The data will be evaluated for compliance with all Data Quality Objectives as defined in the method SOP or in the project-

specific quality assurance plan, including instrument tuning and calibration, holding time, spiking level, and spiking recovery criteria. Data reviewers will also verify 100% of manual calculations, spot check computer calculations, check electronic data for correct sample matching, and do a 100% check on any manually entered data. Analytical parameters, which have concentration interdependence, will be evaluated in relationship to each other.

Final reports generated will be evaluated to ensure that laboratories are using the current detection limit/reporting limit values and the current control limits. Data will be checked to ensure that all QA issues are addressed and fully documented. Reviewers are responsible for working with Laboratory Supervisors, Laboratory Managers and Project Managers when out-of-control events are incompletely documented, or if data is found to not meet Data Quality Objectives of a project without documentation.

It is the responsibility of data reviewers, the QAPM and section supervisors to work with Computer Services to ensure that the LIMS is updated to the current limits and methods used within the laboratory.

Computer Services

> *Computer Services is responsible for ensuring that the LIMS correctly reflects the preparations and analyses performed and that the LIMS is updated to include the current SOP, MDL, RL and QL data, as submitted by the QA Manager. Computer Services personnel are also responsible for ensuring that all electronic deliverables for clients are formatted correctly as requested by the Project Managers and that electronic data matches the hardcopy deliverables submitted.*

It is the responsibility of the Computer Services Manager to update, or to designate the task of updating, the LIMS as determined by Laboratory Management, including adjustment to current MDL/RL data, additions of analytes to methods, changes in method designations or changes in calculations for methodologies.

Computer Services will be responsible for generating the work list scripts required to allow analysts to enter data into the LIMS, and for generating the report scripts that produce final hardcopy or electronic reports for clients.

Computer Services Management and personnel are also responsible for generation and review of electronic data deliverables (EDD), as requested by clients through Project

Management. Computer Services personnel will review the EDD for compliance with the Software Quality Assurance SOP before it is released to the client.

Computer Services will be responsible for informing laboratory Section Managers and Project Managers of any discrepancies found between the EDD and the hardcopy, and for following up on corrections to hardcopy and EDD as required.

Client Services

> *Client Services (CS) (Project Managers, Sample Receiving, and Sales Management) personnel are the primary interface between ARI's clients and the laboratory sections. CS staff shall be responsible, with the assistance of the Section Managers and Supervisors, for ensuring that the laboratories understand and can meet the Data Quality Goals and Requirements of each Project before committing laboratory services to the project. CS will monitor the quality of sample processing after they are received.*

Client Services Management and Project Managers shall ensure that the laboratories can meet the data quality objectives for a project. The Project Managers are responsible for knowing the capabilities of the laboratory, in order to develop project proposals or accept samples without consultation with laboratory management. It is the responsibility of Client Services to consult with the Laboratory Manager and Section Managers, or supervisors designated by Management, when data quality goals are not included in standard Company policies. Clients may, at times, request modifications to methods that must be approved by the Supervisor and Section Manager. These modifications must be thoroughly documented and all pertinent information on modifications must be conveyed to the analysts, sample preparation sections, sample receiving, and computer services as needed for verification of feasibility. Laboratory Management may determine that a project should not be pursued based on the specific Data Quality Objectives and on current or projected laboratory capacity.

Project Managers shall be responsible for ensuring that project requirements and analytical requests are submitted correctly to all laboratory sections. Once samples have been logged into the laboratory, it is the responsibility of the Project Managers to ensure that all information is available to the laboratories concerning the Data Quality Objectives and deliverables requirements. It is also the responsibility of the Project Managers to convey changes in client

requirements to the laboratories and ensure that all paperwork reflects the changes if necessary.

It is the responsibility of Project Managers and Client Services Management to assure that specific EDD formats are submitted to Computer Services and approved as feasible before contracting with a client to provide the EDD.

It is the responsibility of Project Managers to notify clients of out-of-control events, “problem” samples, or anticipated turn-around time delays, as conveyed to them by Laboratory Management. It is also the responsibility of Project Management to work with Laboratory Management in setting priorities during times of heavy sample workloads.

Project Managers shall be responsible for coordinating data submissions and compiling hardcopy data for final submission to the client. This involves conducting a fourth level data review, from which any data which is found to contain errors that were not found earlier in the review process is returned to the Data Reviewer for correction and/or corrective action. The Project Manager will be responsible for compiling all analyst notes into a project narrative. This will include discussion of any sample receipt discrepancies, sample preparation and analysis difficulties or non-compliance, and any corrective actions that may have been required during processing. It will also discuss quality control analyses and results if applicable to the sample set.

Project Managers shall work with Laboratory Management in determination of the direction of growth for ARI, as the Project Managers are best able to define the analytical needs of clients based on new technologies and new environmental regulations.

SECTION 3: PERSONNEL QUALIFICATIONS AND TRAINING

The production of quality analytical data is dependent upon a laboratory staff with qualifications and training necessary to perform assigned tasks. All personnel employed by ARI will receive adequate training and instruction specific to their responsibilities. Prior to assigning a staff member full responsibility for performing a laboratory procedure, her/his skills will be evaluated and verified acceptable. It is the obligation of ARI′s supervisors and managers to ensure that personnel are qualified to successfully perform all assigned duties.

ARI′s training program is described in SOP 1017S (*Training and Demonstration of Proficiency*). The procedures described in this SOP assure that all ARI employees are proficient at the tasks required to produce quality analytical data. The SOP also provides for periodic review of each employees training and proficiency status, which may indicate any need for additional or remedial training. All training and review procedures are documented as described in the SOP.

Basic elements of ARI′s training program are:

1. All employees are required to read and document their knowledge of non-technical documents that describe general policies in place at ARI. These documents include ARI′s *Employee Manual* and ARI′s *Chemical Hygiene Plan*.
2. All technical employees are required to read and document their knowledge of ARI′s *Laboratory Quality Assurance Plan* and quality assurance policies.
3. All new employees must attend a Quality Assurance Orientation during which ARI′s general and specific requirements for the production of quality analytical data are emphasized.
4. All new technical employees will attend a laboratory specific technical orientation conducted by their laboratory supervisor or manager that provides specific information about laboratory operation.
5. All employees will complete an ‘on the job’ training program designated by their supervisor. The training program will be laboratory, SOP and employee specific. The training is

incremental with each step documented in an employee Training File. While an analyst is in the training period, her/his supervisor or trainer must approve all analytical work.

6. Upon completion of the training program a technical employee must complete an Initial Demonstration of Capability (IDOC) as described in ARI SOP 1017S. An analyst is considered proficient and may perform analytical procedures without supervision only after they have completed training and a successful IDOC.

7. The proficiency of each employee performing a given laboratory SOP will be continually monitored and documented as described SOP 1017S. An employee must continually generate data that meets all of ARI's published acceptance criteria for a given SOP to be considered proficient. Unacceptable results or insufficient number of analyses performed in a calendar quarter will result in revocation of proficiency. This will result in a remedial training program.

8. Each analyst is responsible for maintaining a training record as described in SOP 1017S. The training record will document an employee's experience, training and capability. The training file will be maintained in the analysts' laboratory.

SECTION 4: FACILITIES AND EQUIPMENT

4.1 Facilities

ARI's facilities have been designed to allow for efficient sample processing and analysis while maintaining consideration for the health and safety of the staff. The facility accommodates the following operations:

Sample receipt and storage
Sample container preparation and shipment
Sample preparation and analysis (organic and inorganic)
Project planning and management
Quality assurance
Data review and report generation
Computer programming and operations
Records storage
Instrument spare parts storage
Frozen sample archive
Short-term hazardous waste storage

A detailed description of ARI's facilities is included as Appendix C.

4.2 Security

Facilities

To ensure that security at ARI is maintained, access to the facilities is limited to employees and escorted visitors. Upon arrival, ARI visitors are required to register at the reception desk, and must sign out prior to leaving. Visitors will be escorted at all times. A receptionist constantly monitors the main entrance. Other laboratory entrances remain closed at all times and can only be opened from the outside by key. Key access to the facility is controlled; keys are issued on a limited basis depending on access needs.

As a result of controlled access and a monitored alarm system, the entire facility is considered a secure area. This eliminates the need for locked sample storage refrigerators, data storage areas or file cabinets.

Data Access

The Computer Services Manager controls security of, and access to, electronic data on the LIMS. Security measures are required to ensure data integrity, but must not be so restrictive

as to prevent data accessibility. The security measures taken at ARI are to prevent intentional intrusion by outside parties. These measures include building security, limited computer system access, password systems, encryption, firewalls and the use of virus protection programs. ARI's Intranet is protected from outside tampering by a proxy server (firewall) connection to the Internet.

LIMS - System Security

Building/Computer Room Security

Access to the building is restricted to employees, vendors with security passes, and escorted visitors. Room 203 contains the computer and main console for the LIMS system. This room is closed and locked at all times. Access to this room is limited to Computer Services personnel, escorted repair technicians, and escorted visitors. Only Computer Services personnel will be allowed access to the main console.

System Password Policy

User name and password restrict access to the LIMS computer. Remote access to the LIMS server is not allowed.

Database Access Restrictions

Interaction with the database is menu-controlled and allows the LIMS Manager to restrict access. Technicians may be given the ability to fill a limited number of work lists, with no authorization to distribute data. Some users may be given "read only" access to the database.

Users will be given access to the database only to complete tasks for those analyses for which they are responsible. No users are to be given access to the shell or command prompt unless 1) they have completed the appropriate training and 2) administrative access to the computer systems is required by their job function

4.3 Safety

Ensuring that all sample processing and analysis procedures are performed under safe conditions is an important consideration at ARI. While safety is the responsibility of all staff members, ARI's Safety Committee meets monthly to review the safety activities of all laboratory sections and to ensure that all operations and equipment meet safety criteria. *The*

Chemical Hygiene Plan details those safety procedures and requirements that must be followed at ARI. *The Chemical Hygiene Plan* is reviewed annually and updated as needed to incorporate any changes to ARI's safety program.

4.4 Instrumentation and Support Equipment

4.4.1 Instrumentation

Generation of quality data is dependent upon instrumentation and support equipment that is in optimum operating condition. All instrumentation and support equipment will be optimally maintained following method requirements and/or manufacturer's recommendations. Preventative maintenance is performed on a scheduled basis, with more frequent maintenance during periods of increased sample load or after analysis of highly contaminated samples. Separate, permanently bound logbooks are provided for and kept at or near each instrument. The logbooks are used to record all instrument maintenance, routine and non-routine. When non-routine maintenance is required the following information must be recorded:

1. A statement of the problem or symptom that requires correction.
2. Details of the maintenance procedure including listing the parts repaired or replaced.
3. Documentation that the instrument has returned to routine performance.

Spare parts are kept on hand when possible; necessary parts are ordered on an expedited basis to minimize downtime.

Currently available Laboratory Instrumentation is detailed in Appendix D.

4.4.2 Support Equipment

4.4.2.1 Thermometers in use at ARI are traceable to an NIST standard and are calibrated or verified annually. The procedures are described in SOP 1020S. When appropriate, thermometers are assigned a correction factor based upon the most recent calibration. ARI personnel must calculate and record corrected temperatures.

4.4.2.2 Water Bath temperatures are recorded before each use to assure the temperature is acceptable for its intended use.

4.4.2.3 Incubator temperatures (corrected) are recorded and at least twice a day while in use. The date and time of each observation is recorded.

4.4.2.3 Oven temperatures are recorded before and after each use.

4.4.2.4 Refrigerator and Freezer temperatures are recorded automatically every 30 minutes by ARI's "ThermoLogger" computer system. The temperature of several refrigerators and freezers not connected to "Thermologger" are recorded daily.

4.4.2.4 Balance accuracy is verified daily prior to use with two Class S weights that bracket the normal weighting range of the balance. A balance must be accurate to ±0.1% or ±0.5 mg whichever is greater. All analytical balances are professionally cleaned and calibrated annually by an outside contractor. Class S weights are calibrated every five years by an outside contractor. Calibration reports are filed in the QA Office.

4.4.2.5 pH Meters are standardized prior to each use with at least two standards, one at 4.0 and one at 7.0 pH units. The meters are checked prior to each use with a pH 7.0 buffer.

4.4.2.6 Variable Volume Pipette accuracy is verified monthly following the procedure in SOP 1015S.

4.4.2.7 Mechanical Burettes are calibrated quarterly following the procedure in SOP 1015S.

4.4.2.8 Sample Containers – Upon client request ARI supplies containers for collection of field samples. All containers supplied for organic and trace metals analyses are certified pre-cleaned by the manufacturer. When the manufacturer's certified concentration is greater than ARI's reporting limit for a specific project, a container is used to prepare a method (bottle) blank. ARI certifies that the containers from the same lot are suitable for sample collection when target analytes are not detected in the bottle blank. Containers for conventional analyses are not pre-cleaned and are certified internally by ARI following the procedures in Appendix 12.3 of ARI SOP 001S (Sample Receiving).

Container lot numbers are recorded when containers are sent to a client.

4.4.3 Chemical Standards and Reagents

4.4.3.1 Reagent Water Supply

ARI maintains a centralized water purification system. The quality of the water produced is monitored and documented daily in a bound logbook. All reagent / de-ionized water used within the laboratory meet or exceed ASTM Type II Standards. Water used in the Volatile Organic Laboratory is also filtered through activated charcoal to remove organic compounds.

4.4.3.2 Chemical Standards

Most standards used to determine the concentration of target analytes are purchased as certified solutions. In general the standards are traceable to a National Institute of Standards & Technology standard. A Certificate of Analysis and/or traceability for quantitative standards is filed in the QA Section when available. All standards (traceable, non-traceable and those prepared by ARI) are verified by comparison with standard reference materials or existing standards in use. ARI documents the source, date of receipt, required storage conditions and an expiration date for all standards. Containers used to store standards are labeled with an expiration date. Receiving, storage and preparation of calibration standards is described in SOPs 526S (Metals Analysis), 620S (Conventional Analysis), 704S (Volatile Organic Analysis) and 1012S (GC and GC-MS Analyses).

4.4.3.3 Chemical Reagents

Many of the analytical processes in use at ARI require chemical reagents that are not directly used in the calibration process. These reagents are used for analyte preservation, adjustment of pH, formation of colorimetric indicators, etc. The reagents are purchased in a grade and purity sufficient for their intended use. The receipt of all reagents is recorded in the Chemical Receiving Logbook where a unique Inventory Number is assigned to each reagent. Each original reagent container is labeled with an Inventory Number, the date it is opened and an expiration date as appropriate. A Certificate of Analysis is obtained for reagents when available and archived in the QA Office.

Solutions prepared from reagents are recorded in the Reagent Preparation Logbook. The logbook includes a unique Reagent Number that is traceable to the Chemical Receiving

Logbook. Reagent containers are labeled with Reagent Number, date of preparation, expiration date, and preparer's identification.

Procedures for Reagent Receiving and Preparation are detailed in SOP 1013S.

Trace Metals Acids

To ensure the quality of acids, nitric and hydrochloric, used for trace metals analyses, only the highest quality, certified "metals free" acids are purchased. Each lot received is analyzed for purity prior to use in the laboratory to assure that it is acceptable for use. Whenever possible, entire lots will be reserved for use exclusively by ARI. This minimizes the possibility of receiving contaminated or unacceptable acid.

Solvents

To ensure the quality of solvents used for sample preparation and analysis, the highest purity of solvents required for sample processing will be used. Purity checks are performed on solvent lots received by the laboratory. Only those solvent lots determined acceptable will be used for sample processing. Whenever possible, entire solvent lots will be reserved for use. This minimizes the possibility of receiving contaminated or unacceptable solvents.

Compressed Gases

To reduce the possibility of system contamination, compressed gases and liquids used for operating analytical instrumentation will be of a specified purity level. Any cylinder suspected of introducing contamination into a system will be promptly replaced.

4.5 Computer Systems

ARI maintains several data systems. These are used to automate such diverse functions as accounting, payroll, sales and marketing, sample receiving, instrument data collection, production of hardcopy and electronic data deliverables, intra- and internet applications and project management. Specific information about these systems is contained in Appendix D and various SOPs.

ARI maintains a Laboratory Information Management System (LIMS) that stores analytical data, calculates final results and produces final reports (both hardcopy and electronic). The LIMS

system is the major data system used at ARI. A separate Software Quality Assurance Plan outlines the QA/QC procedures for the LIMS system.

SECTION 5: LABORATORY DOCUMENTATION AND RECORDS

All laboratory operations and procedures performed during sample processing are documented in logbooks, notebooks and on laboratory forms and bench sheets. Analytical data and copies of paper documents are also stored electronically. Consistent use of standard documents throughout the laboratory ensures that all activities will be traceable and serves as objective evidence of the work performed.

All procedures performed at ARI will be detailed in Standard Operating Procedures (SOPs). Sample preparation and analysis SOPs will reference approved analytical methods and detail the actual procedures followed by ARI staff. SOPs for non-analytical activities will detail the procedures developed specifically for use at ARI.

5.1 Responsibilities

All staff members are responsible for complete and accurate documentation of laboratory activities. Each laboratory section develops a comprehensive set of documents (bench sheets, forms, etc.) to record all activities performed in that section. All staff members are responsible for reviewing and understanding SOPs, and must sign a record to document this fact. The QAPM is responsible for maintaining control of laboratory documents and ensuring their consistent use.

To ensure that all documents, SOPs in particular, accurately reflect the activities performed at ARI, section supervisors and managers are required to review all documents annually and recommend changes to the QAP. The QAPM is responsible for coordinating document revisions and ensuring that all staff members have access to the most current laboratory documents.

5.2 Document Control

ARI's Quality Assurance Program requires that all forms and SOPs used within the laboratory be monitored to ensure that only the currently approved version of the documents are in use, centrally organized, and readily available to all staff members. All documents will include a revision date. The LQAP and SOPs will also have an effective date. The time between the revision and effective dates will be used for training and orderly implementation of changes.

Electronic copies of laboratory documents will be maintained as part of the quality assurance files. Each laboratory section maintains working copies of pertinent forms and SOPs. The QAPM coordinates the generation of new forms or SOPs and modifications to existing documents. Log number assignments will be as follows:

Laboratory Section	Form Number	SOP Number
Client Services	0001 - 0999	001 - 099
Computer Systems	1000 - 1999	100 - 199
Data Services	2000 - 2999	200 - 299
Extractions	3000 - 3999	300 - 399
GC Laboratory	4000 - 4999	400 - 499
Metals Laboratory	5000 - 5999	500 - 599
Conventional Laboratory	6000 - 6999	600 - 699
Volatile Organic Laboratory	8000 - 8999	700 - 799
Semi-volatile Laboratory	7000 - 7999	800 - 899
Quality Assurance Monitoring	10000 - 10999	1000 - 1099
GeoTech Laboratory	11000 - 11999	1100 - 1199

Document numbers will be include an F for forms and an S for SOPs i.e. 101F or 1234S. Document Control Logs of all forms and SOPs, detailing the form name and number, revision number and revision date will be maintained by the QA Officer. Outdated documents will be maintained in an electronic archive file.

The QAPM will distribute new and revised documents to the appropriate laboratory sections. Section staff will replace outdated copies of the document with the revised version. Laboratory forms and SOPs will be generated or revised on an “as needed” basis, and will be reviewed and revised as at least annually. Only the latest version of a form or SOP will be available in each laboratory. Section supervisors will periodically review these documents and recommend changes to be implemented by the QAPM. A comprehensive review of all laboratory documentation will be performed annually at the direction of the QAPM.

To maintain document security, release of documents to clients or other outside agencies will be controlled by the QAPM. The QAPM will record the document to be released, revision number, person and agency receiving the document, and the release date. All documents generated by the laboratory will be considered proprietary. ARI permission must be obtained by anyone releasing the document to other agencies or including the document in a project or quality assurance plan.

5.3 Reference Documentation

To provide an understanding of the procedures employed to generate quality data, a comprehensive set of reference materials is available to staff members. All activities performed within the laboratory can be referenced to a method or SOP. The laboratory maintains copies of the following method compilations:

Code of Federal Regulations (Section 40)
Test Methods for Evaluating Solid Waste (USEPA SW-846)
USEPA Contract Laboratory Program Statement of Work for Organics Analysis
USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis
Methods for Chemical Analysis of Water and Waste (USEPA 500 and 600 series methods)
Standard Methods for the Examination of Water and Wastewater
Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound (PSEP)
US Naval Facilities Engineering Support Activity –NFESC (formerly NEESA).
Hazardous Waste Remedial Actions Program (HAZWRAP)
State of Alaska Department of Environmental Conservation (ADEC)
Oregon Department of Environmental Quality (DEQ) Petroleum Hydrocarbon Methods
Washington Department of Ecology (WDOE) Guidance for Remediation of Releases from Underground Storage Tanks (Appendix L)
Washington State SARA
AFCEE Project Quality Assurance Plan
Washington State EPH/VPH Methods
National Environmental Laboratory Accreditation Conference
Department of Defense Quality Systems Manual
Washington State Sediment Sampling and Analysis Plan

Other methods followed within the laboratory are also available. Published modifications to analytical methods will be reviewed and incorporated into laboratory SOPs. If a method for a parameter is developed by ARI, it will be detailed in an SOP. SOPs will be available for all laboratory activities. Each laboratory section will maintain a file or notebook of SOPs pertinent to that section. A compilation of all laboratory SOPs is maintained as part of the Quality Assurance Program files. A listing of laboratory SOPs is included as Appendix E.

The Quality Assurance Manual provides an overview of the laboratory-wide Quality Assurance program. A copy of the Quality Assurance Manual is distributed to all laboratory sections. Distribution of the QAP is coordinated by the QAPM.

ARI maintains a file of various laboratory and environmental publications and reference texts. These reference materials are available to all staff members. Operation and maintenance manuals are available for all equipment and instrumentation used within the laboratory. Additionally, senior level staff members are available to serve as reference sources. These staff members have numerous years of pertinent experience and can provide insight and guidance for all procedures and laboratory activities.

5.4 Quality Assurance Policies

Quality Assurance Policies provide standards and procedures to guide ARI employees in proper implementation of the QA Program. Appendix P includes current QA Policies.

5.5 Worksheets and Logbooks

Use of Laboratory Forms and Logbooks

All activities noted on laboratory forms and logs are recorded in blue ink. Initials of the staff member performing the activity, as well as the date the activity is performed are noted on all forms and logs. Any supplementary information about the activity, such as unusual observations or suspected procedural errors are noted on the forms and logs. The QAPM or his/her designee prepares and controls laboratory logbooks.

Changes to existing information is annotated by drawing a single line through the original entry and initialing and dating the deletion. Correct information is written above the deleted entry. When appropriate to clarify the intent of the change a note describing the reason for the change is added. The use of correction fluids or other techniques that cover an entry in its entirety is forbidden on laboratory documents.

Since sample processing within an analytical laboratory involves many detailed steps, documentation can be quite extensive and varied. The following guidelines will be followed to encourage consistency in laboratory record keeping:

Standard Logbooks

Preparation of all stock and working standards is documented in the appropriate standards logbook. Each entry includes preparation date, initial and final concentrations (including solute and solvent amounts), standard ID number, expiration date and the identity of the person preparing the standard. Stock solution entries include standard lot number and supplier. Working solution entries include the stock solution ID number. Commercially prepared stock standards are recorded in the stock standard logbook.

Sample Storage Temperature Logs

The temperature of all refrigerators and freezers used for sample and standards storage is monitored daily. The temperature and recorder's initials are recorded on the temperature log attached to each unit. The acceptable temperature range for each unit is noted on the log sheet. Any out of control temperatures and/or corrective actions, must be noted on the log sheet and reported to appropriate personnel (Lab Supervisor and QA Manager)

Balance Calibration Logs

The true and measured values for each calibration check weight are recorded, along with the date and recorder's initials. Any actions taken, such as notifying the QAPM of malfunctions is indicated alongside the entry for that date.

Instrument Logs

The Instrument Run Logs must detail all samples analyzed on a given instrument for a given parameter. Instrument conditions, analysis date and time for each sample, analyst initials and standard or sample identifications in the analytical sequence must be recorded in the log. Comments related to sample analysis and minor maintenance are noted on the instrument logs. For GC/MS analyses, instrument performance is documented by recording internal standard response alongside the sample identification.

Sample Preparation/Analysis Worksheets

Sample preparation and analysis activities are documented on appropriate worksheets. Sample identifications, weights or volumes used, intermediate cleanups, final volumes, preparation dates and analyst initials will be noted as well as any observations about

sample condition. Any issues encountered during sample preparation are also noted. Surrogate and spiking solution ID numbers, and concentrations added to the samples, must be indicated on the bench sheet.

For some parameters, analytical results are summarized on an analysis worksheet. Sample identifications, sample preparation information, sample results, quality control results, analysis date, analyst initials and reported detection limits must be indicated on the worksheet. Any necessary data qualifiers are also noted on the worksheet.

Maintenance Logs

All major maintenance performed on instrumentation or laboratory equipment must be documented. Maintenance performed, date and analyst performing the maintenance, and steps taken to verify that the maintenance was successful are detailed in the log. Routine maintenance of GC-MS instruments is documented on "maintenance cards" attached to each instrument. The demonstration that GC instruments are in-control following maintenance is documented in the instrument run log.

Individual Laboratory Notebooks

Staff members preparing USEPA CLP samples must maintain unique laboratory notebooks for these analyses. Each case submitted is documented on a separate, sequentially numbered page. A listing of all samples prepared as part of the case, the date and the preparer's initials, and any notes specific to sample preparation must be annotated in the logbook. Individual notebooks are used only when required by a specific contract. All sample preparation information is recorded on a laboratory bench sheet.

5.5 Document /Data Storage and Archival

Logbooks

All active logbooks will remain in the appropriate laboratory sections. Completed logbooks will be forwarded to the QAPM for archival.

Magnetic Tapes and Diskettes

When instrument capabilities permit, all data generated is archived and stored on magnetic tapes or disks. The electronic media remains on file for five years.

Chromatograms and Instrument Documentation

Electronic or paper copies of chromatograms, instrument calibrations, quantification reports and any other printed documentation generated during sample analysis are maintained as part of the permanent data files. All hardcopy data remain on file at ARI for five (5) years or as specified by contract.

Project Data and Documentation

Project data and support documentation, electronic or paper copies, will be filed a minimum of five years, or as specified by contract.

SECTION 6: SAMPLE CONTROL

All samples analyzed by the laboratory will be monitored in accordance with sample control procedures. Sample control includes operations such as container preparation, sample collection, receipt and storage, and tracking of the sample throughout all processing steps. Documentation of all sample control activities and adherence to standard procedures is an important aspect of ensuring that data quality objectives are met.

6.1 Sample Collection

Production of quality analytical data begins with proper sample collection. Improper sampling procedures may result in inaccurate final results. Although the laboratory is not routinely involved with sample collection, it will minimize the possibility for error by providing clients with appropriate sample containers and sampling instructions for the requested parameters. If, upon receipt, sample integrity appears to be compromised, the client will be immediately notified to allow for re-sampling if necessary.

6.2 Sample Container Preparation and Shipment

To minimize the possibility of contamination from containers furnished by outside sources, the laboratory will furnish all necessary sample containers for client projects when requested by the client. Sample containers, pre-cleaned to EPA specifications, or certified clean by the manufacturer or ARI, are supplied for most parameters. Containers for special purposes may be acquired upon request. Lot numbers for containers are tracked to link bottle orders to lot numbers.

A blank sample label is affixed to each sample container prior sending the container to a client. The sample label allows for recording of the following information at the time of collection: client name, client sample identification, sampling site, date and time of sample collection, analytical parameters, and any preservatives used. Sample labels provided by ARI are coated to prevent bleeding of recorded information if labels become wet.

To ensure that the correct number of appropriate sample containers are prepared and submitted to the client, a Bottle Request is completed by a Client Services staff member or Project Manager at the time sample containers are ordered by the client. All necessary preservatives are also noted on the Bottle Request. The Bottle Request is then forwarded to

appropriate personnel in the Sample Receiving Section for order preparation. All required containers will be gathered and preservatives added as specified. A copy of the Bottle Request accompanies the sample containers to allow the client to verify that the order is properly filled. Additional containers will be supplied for quality control purposes and in case of container breakage or sampling complications. A complete listing of containers and preservatives used within the laboratory is included as Appendix F.

To facilitate transportation of containers to the sampling site, sample containers will be placed in coolers along with appropriate packing material. The inclusion of packing materials, such as vermiculite or "bubblewrap", is provided to minimize the possibility of container breakage and cross-contamination. Sample containers will be organized in the coolers per analytical or client specifications. Depending on client preference and project requirements, coolers and sample containers will be shipped to a specified location, delivered by ARI courier, or held at the laboratory for pick up. To ensure that sample identification, analytical parameters, and sample custody are properly documented, Chain of Custody records will accompany all sample container shipments. When appropriate, as for drinking water source sampling events or for parameters that require preservation in the field, sample collection instructions will also be included with shipments.

6.3 Sample Admission

All samples received by the laboratory are processed in a central Sample Receiving area. To ensure the safety of staff members receiving samples, coolers will be opened under a hood or in a well-ventilated area. Appropriate protection, such as disposable gloves, safety glasses and laboratory coats will be worn during sample receipt and log-in. Additionally, all general safety practices as specified in ARI's Chemical Hygiene Plan will be employed.

Upon receipt, sample coolers will be inspected for general condition and custody seals. Time and date of sample receipt, as well as identification of the staff member receiving the samples, will be indicated on each Chain of Custody record accompanying the shipment. Cooler temperatures will be determined using an IR temperature measuring device or by placing a thermometer in the cooler immediately after the cooler is opened. If samples cannot be logged-in within 30 minutes after receipt, the sample coolers will be tagged and placed in the walk-in sample storage refrigerator for short-term storage. Chain of Custody records for the

stored coolers will remain in Log-In to ensure that processing of the stored samples is not overlooked.

Samples to be processed will be removed from the coolers and organized by sample identification. The number and type of sample containers received will be verified against the Chain of Custody record. Each sample container will be examined to verify that the condition is acceptable and that sample integrity has not been compromised during shipment. Sample containers broken during shipment should be handled according to procedures detailed in the Chemical Hygiene Plan (Section 5, Waste Disposal Procedures).

After sample organization and initial inspection has been completed, sample information will be entered into the LIMS, and a Service Request will be generated for the sample set. The Service Request serves as a work order for the laboratory. The Service Request will contain the following information:

Client Name
Client Project Name and/or Number
Client Contact
Verified Time of Sample Receipt (VTSR)
Required Turnaround Time
Laboratory Job Number
Client Sample Identifiers(s)
Laboratory Sample Number(s)
Required Parameters
Additional Analytical Requirements/Comments

Also entered into the LIMS are the number of sample containers for each sample, sample conditions, and cooler temperatures.

A sequential laboratory job number will be assigned to each sample set. Laboratory sample numbers, determined by the job number and a sequential letter, will be assigned to each sample. Containers for each sample will also be numbered sequentially. The accuracy of sample container labeling is verified by a second person. These identifiers will be used to monitor the sample set and container throughout sample processing. All samples logged for the sample set and the analytical parameters required for each sample will be indicated on the Service Request. Client specific quality control requirements and any other pertinent information indicated on the Chain of Custody Record will also be noted. Discrepancies

between the Chain of Custody record and sample containers will be noted, as well as discrepancy resolutions. To reduce the possibility of inaccurate sample processing, the sample receiving staff working with the Project Manager will resolve all noted discrepancies prior to releasing the samples to the analytical sections.

Upon completion of sample log-in, all documentation will be placed in a master folder and forwarded to the assigned Project Manager for review and approval. The master folder will be color-coded as follows:

Master File Color	Designation
Red	Accelerated Turnaround (≤ week)
Blue	Accelerated Turnaround/Fuels
Clear	Routine Turnaround

The Project Manager will review all aspects of the documentation, specify any additional analytical requirements and resolve any remaining discrepancies before sample processing begins. After Project Manager final approval has been obtained (indicated by the Project Managers initials and the date on the Service Request and laboratory-specific parameter sheets), the master file will be returned to Log-In for preparation of laboratory job folders. A job folder will be created for each laboratory section involved in sample processing for a given project. Laboratory job folders are color-coded as follows:

Job Folder Color	Designation
Red	Accelerated Turnaround (≤ 10 days)
Manila	Normal Turnaround (11 to 14 days)
Blue	Accelerated Turnaround (≤ 7 days) for Fuels Analyses (NWTPH, AK103 etc.)
Yellow	Extended Turnaround (>14 day TAT)
Other (Green, Purple ,etc)	Client or Project Specific Analyzes

Copies of the Service Request and all pertinent laboratory-specific documentation required to accurately complete sample analysis will be placed in each laboratory job folder. Laboratory

job folders will then be distributed to appropriate laboratory sections for analysis and incorporation into the section tracking system.

Subcontracting Policies

ARI may be required to subcontract work to other laboratories. The following policies are followed to assure that data produced by a subcontractor is high quality, defensible and will meet the client's expectations.

1. ARI's client must be made aware that samples will be subcontracted and what laboratory will perform the analyses.
2. Subcontractor laboratories must qualify to perform the analyses using the same criteria applied to ARI. When appropriate, subcontracted laboratories must submit proof of certification or accreditation, quality assurance plans, standard operating procedures, results of method detection limit studies, control limits to ARI. ARI may at its discretion perform an on-site assessment of subcontracted laboratories. Failure to submit requested documents or refusal of an on-site assessment will disqualify laboratories from subcontracting ARI sample analyses.
3. ARI will not subcontract Department of Defense work to be performed under the Quality Systems Manual (DoD-QSM) unless the subcontract lab is approved to perform DoD-QSM analyzes.
4. The sample information and analytical requirements are first entered into the ARI LIMS in the same way that samples for in-house analyses are processed. Subcontractor laboratories are contacted to verify their preparedness, and samples are then submitted to them using ARI chain-of-custody forms. These chain-of-custody documents are included in the master folder for the project.
5. ARI may request that subcontract laboratories analyze, on double blind performance testing (PT) sample obtained from commercial vendors at the subcontractor's expense.
6. The laboratory must be willing to maintain an annual contract with ARI, and must list ARI as a co-insured on the subcontract laboratory's liability insurance policies.
7. Financial stability is also evaluated on a lab-by-lab basis.

6.4 Sample Custody

To ensure the traceability of sample possession, chain of custody is documented from sample collection to completion of final analysis, and is maintained during sample storage in archive prior to disposal. This is achieved through completion of a written chain of custody record. Custody of all samples and extracts processed by the laboratory is documented at each step of the analytical process.

The National Enforcement Investigations Center (NEIC) of EPA defines custody in the following ways:

It is in your actual possession, or
It is in your view, after being in your physical possession, or
It was in your possession, then you locked or sealed it up to prevent tampering, or
It is in a secure area.

Sample handling may vary and specific custody procedures have been developed for each laboratory section.

Custody at Sample Log-in

A Chain of Custody Record must accompany all samples received by the laboratory. This record documents all sampling activities as well as persons handling the samples prior to receipt by the laboratory. Sample receiving staff assumes custody of samples upon receipt from the client or courier. Samples will remain in the custody of Sample receiving until the samples are delivered to a laboratory section. Should samples require shipment to a subcontracting laboratory, a separate Chain of Custody Record will be completed to document the sample transfer. Chain of Custody records will be included with sample data reports in the final analytical package submitted to the client. Copies of these records will be filed with project data.

Custody of Volatile Organic Analysis (VOA) Samples

Upon completion of sample the sample receiving process, samples requiring analysis for volatile organic analysis will be placed in the VOA refrigerator designated for incoming samples and logged into the VOA sample receipt logbook. The samples are now in the custody of the VOA laboratory. To avoid possible cross-contamination of low level samples,

those samples known or suspected to contain high levels of contaminants, such as underground storage tank (UST) samples, will be stored in a separate refrigerator prior to analysis.

VOA Laboratory analysts complete the receiving process and move the samples to a refrigerator designated for “active” samples. Samples removed from storage for analysis are considered to be in the custody of the analyst responsible for sample processing. All samples to be analyzed will be listed in the analytical logbook for the selected instrument. Laboratory and client sample identifications, the bottle number and identification of the analyst performing the analysis will be indicated in the logbook. If it is necessary for sample custody to be transferred to another instrument or analyst, the second analyst will record this information. Thus, custody of a given sample can be traced throughout the analytical process, regardless of the number of instruments or analysts involved. Analysts will initial all raw data generated from sample analysis, to further document sample custody.

After completion of sample analysis, soil and intact water sample containers will be placed in the refrigerator designated for sample archival. Any water sample remaining in the container after completion of analysis will be considered compromised and will be discarded. The samples will remain in archive and in the custody of the VOA laboratory until final disposal.

Custody of Semi-volatile Organic Analysis (SVOA) Samples

Upon completion of sample log-in, samples requiring extraction for organic parameters will be placed in walk-in cooler number 5. All samples placed in the cooler will be logged into the *Walk-in Admission Logbook*. Removal of samples from the refrigerator for processing by Extractions or Conventional personnel must be indicated in the *Walk-in Admission Logbook*. Samples stored in this walk-in refrigerator remain in Log-In custody until removed to a laboratory for processing.

The analyst responsible for the custody and initial handling of samples within the sample preparation laboratory will be indicated on the Sample Preparation Worksheet. All analysts involved in the subsequent steps of sample processing will also be indicated on the worksheet. Residual sample volumes will be archived in the refrigerator designated for extractable organic samples. Transfer of residual samples to this refrigerator will be documented in the *Sample*

Archive Refrigerator Logbook. Transfer of prepared sample extracts to the appropriate analytical sections will be documented in the Extract Log in the preparation laboratory and in the Extract Log in the analytical section. Upon extract transfer, the analytical section receiving the extract assumes custody.

Extracts removed from storage for analysis are considered to be in the custody of the analyst responsible for analysis. Removal of extracts for analysis will be indicated in the Extract Log in the analytical section. All extracts to be analyzed will be indicated in the analytical logbook for the selected instrument. Laboratory and client sample identifications, as well as the analyst performing the analysis will be indicated in the logbook. Analysts will initial raw data generated from extract analysis to further document sample custody. After completion of analysis, extracts will be placed in the refrigerator designated for archive. Extracts will remain in storage and in the custody of the analytical section until final disposal.

Custody of Inorganic and Metals Samples

Upon completion of the sample receiving process, samples requiring preparation or analysis for inorganic parameters will be placed in the designated walk-in cooler. Selected samples such as those requiring a critical analysis are placed directly in the laboratory. Removal of samples from the refrigerators for digestion and/or analysis will be indicated in the *Walk-in Admission Logbook* for the appropriate refrigerator. Samples stored in the walk-in refrigerators remain in Log-In custody until the laboratory removes the samples for processing.

The analyst responsible for custody and initial handling of samples within the metals preparation laboratory will be indicated on the Sample Digestion Worksheet. All analysts involved in the subsequent steps of sample processing will also be indicated on the worksheet. Transfer of completed sample digests to the metals instrument (analysis) laboratory will be documented by the metals preparation laboratory. Upon transfer of digests, custody is considered to be the responsibility of the analytical section receiving the digests.

Digests removed from storage are considered to be in the custody of the responsible analyst. All digests to be analyzed will be indicated in the analytical logbook for the selected instrument. Laboratory sample identifications and the analyst performing the analysis will be indicated in the logbook. If it is necessary for digest custody to be transferred to another instrument or

analyst, the second analyst records this information. Thus, custody of a given digest can be traced throughout the analytical process, regardless of the number of instruments or analysts involved. Analysts will initial all raw data generated from digest and analysis to further document sample custody. After completion of analysis, digests will be stored by and remain in the custody of the analytical laboratory personnel until final disposal.

The analyst performing the sample analysis will remove samples requiring analysis for other inorganic (conventional) parameters from storage. Removal will be documented in the *Walk-in Admission Logbook*. Custody of the sample will be considered to be the responsibility of that analyst. All samples to be analyzed will be indicated on the worksheet for the required parameter. Laboratory sample identifications and the analyst performing the analysis will be indicated on the worksheet. If it is necessary for sample custody to be transferred to another instrument or analyst, the second analyst will record this information. Thus, custody of a given sample can be traced throughout the analytical process, regardless of the number of instruments or analysts involved. The analysts' initials will be indicated on the worksheet to further document sample custody.

Special Chain of Custody Requirements

Should a client project require additional or more detailed custody documentation, requirements will be incorporated into the procedures for that project. Samples processed as part of the USEPA Contract Laboratory Program require more stringent chain of custody procedures. For this program, removal of samples and extracts for analysis (or any reason) will be documented in the Sample Control Log. Date, time and reason for removal, and date and time of return, will be fully documented. Removal of samples or extracts for permanent archiving or disposal will also be fully documented in the Sample Control Log.

6.5 Sample Archival and Disposal

After completion of analysis, unused sample aliquots are routinely stored for a specified period of time: 30 days for water samples and 60 days for soil samples. Colored markers are placed on samples with specific storage requirements during the sample receiving process. The color-coding is defined in the following table:

Label Color	Storage Requirement
Red	Hold until further notice
Orange	Suspected Hazardous
Yellow	Shared Sample Containers
Blue	Samples to be frozen

Samples submitted for archival will be logged into the Sample Archive Logbook. Laboratory and client identifications, as well as archive date will be indicated in the logbook. The anticipated disposal date for the sample set will also be noted. The logbook will be reviewed several times during each week to determine samples scheduled for disposal. On or soon after the scheduled disposal date, the samples will be removed from archive storage and disposed.

In consideration of disposal requirements for hazardous samples, each sample processed by the laboratory will be evaluated for contamination levels based on final analytical results. Those samples containing analytes of interest at or above regulated disposal levels will be identified and handled as hazardous waste. A designated staff member coordinates periodic pickup and disposal of hazardous waste by an USEPA approved TSD (Treatment, Storage, and Disposal) Company and maintains hazardous waste disposal records. Specific guidelines for handling hazardous samples and waste are detailed in the Chemical Hygiene Plan (Section 5, Waste Disposal Procedures)

SECTION 7: PROJECT MANAGEMENT AND TRACKING

7.1 Project Management

Concise and accurate communication between a client and ARI, and within the laboratory, is an extremely important requirement for generating quality analytical results. All clients contracting with ARI will be assigned to a Project Manager. The Project Manager confirms that project requirements are consistent with laboratory capabilities, and coordinates with laboratory sections to provide analytical results within specified project timelines. Project organization, monitoring, and follow-up is the responsibility of Project Management staff.

Client project requirements and Project Managers' areas of expertise will be considered for client assignment. To ensure that all clients and projects receive the attention necessary for successful project completion, Project Manager workloads will also be considered. Project Managers will serve as the central focus for all project related activities and communications.

The Project Manager will review work plans and requirements for all pending projects. Any questions related to the work plan will be addressed prior to project commencement. The Project Manager will consult with appropriate analytical sections to clarify any issues regarding procedures and capabilities. Project deliverables requirements will also be addressed at this time. Upon receipt and log-in of project samples, the Project Manager will review all documentation to ensure that samples were properly logged in, and that analytical and QC requirements were correctly specified. The Project Manager will also provide any additional project related information that will assist the analytical sections with sample analysis. Laboratory sections will not process a sample until Project Manager approval has been given. Exceptions are parameters with critical (less than 48 hour) holding times or those that arrive on weekends or holidays when none of the Project Managers can be contacted.

Throughout the project, the Project Manager will monitor all analytical activities to help ensure that the project is completed and delivered on schedule. Any issues arising during sample processing will be promptly discussed with the client. Likewise, the analytical staff will be informed of any client concerns or project modifications. The Project Manager will also address any issues that arise during subsequent review of the analytical data by the client.

7.2 Project Tracking

Monitoring the laboratory workload ensures that adequate staffing and equipment will be available to produce quality analytical data and meet client needs. At the time a client project is tentatively scheduled, information regarding the project will be documented in the Project Management Database. Project particulars, sample quantities, parameters and anticipated sample delivery dates will be specified, as well as any prearranged analytical costs. Project work plans and any other project information will be kept on file with the Project Manager. Schedules for pending projects are communicated to the lab sections through periodic distribution of database printouts. Upon receipt of project samples, the project Inquiry number will be referenced to ensure project requirements are accurately specified. The original project documentation will be placed in the master folder as part of the project file.

Each laboratory section analyzing project samples will be responsible for ensuring that all analyses are accurately completed by the required date. All staff members are required to be aware of holding times, special analytical requirements, and required turnaround times. Analytical sections will remain in close communication with the Project Management staff so that any issues arising during sample analysis can be promptly addressed or discussed with the client.

Project Managers or their designee are responsible for monitoring project status. Sample status reports are generated as needed from LIMS and are distributed to lab sections and Project Managers. These reports allow the Project Managers to review project status and identify any samples which must be expedited to meet project timelines. Additionally, verbal communication between Project Managers and lab sections provides information about project status.

After sample analysis, report generation, and final review have been completed, data and final reports will be forwarded to the Project Manager. If requested, preliminary and interim results will be forwarded to the client. When all final data are available, the Project Manager will assemble the final package, verifying that all analyses were completed and project requirements met. A project narrative detailing the particulars of sample processing will be generated. After assembly and prior to shipment, the Project Manager will perform a final, cursory review of the package for any inconsistencies or incorrect information. The package will then be forwarded to clerical

personnel for photocopying and shipment. The Project Manager will determine final analytical costs and submit this information to the Accounting department for invoicing. Upon completion, all raw data and documentation associated with each client project will be compiled and stored as part of the laboratory project files. A chart detailing laboratory workflow as described in this section is included as Appendix G.

SECTION 8: ANALYTICAL METHODS

To ensure that all data generated are consistent and comparable, clearly defined procedures will be followed for all aspects of sample processing, control and management. Standard Operating Procedures (SOPs) provide detailed guidelines for completing a procedure. Document control procedures and periodic audits will ensure that operations are performed in accordance with the most current SOPs. All routine deviations from published will be noted in the SOPs. Analysis specific deviation will be noted in Analyst Notes and in the Analytical Narrative.

8.1 Responsibilities

It is the responsibility of staff members to perform all procedures in accordance with the guidelines specified in the Standard Operating Procedures. Laboratory management is responsible for ensuring that SOPs are followed throughout the laboratory. The QAPM is responsible for coordinating periodic review and revision of existing SOPs and generation of additional SOPs. The QAPM is also responsible for maintaining SOP document control and ensuring that the most current versions of all SOPs are available to staff members.

8.2 Methods

Laboratory procedures may reference any established methods specified in the following publications:

1. Code of Federal Regulations (Section 40)
2. Test Methods for Evaluating Solid Waste (USEPA SW-846)
3. USEPA Contract Laboratory Program Statement of Work for Organic Analysis
4. USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis
5. Methods for Chemical Analysis of Water and Waste (USEPA 500 and 600 series)
6. Standard Methods for the Examination of Water and Wastewater
7. Protocols for Measuring Selected Environmental Variables in Puget Sound (PSEP)
8. Navy Installation Restoration Laboratory Quality Assurance Guide(February 1996)
9. Hazardous Waste Remedial Actions Program (HAZWRAP)
10. State of Alaska Department of Environmental Conservation (ADEC)
11. Oregon Department of Environmental Quality (DEQ) Petroleum Hydrocarbon Methods
12. Washington Department of Ecology (WA-Ecology) Guidance for Remediation of Releases from Underground Storage Tanks (Appendix L)
13. The Department of Defense Quality Systems Manual (DoD-QSM)
14. Washington State Sediment Sampling and Analysis Plan

The laboratory will adhere to established methods whenever possible. Occasionally, however, procedures determined to provide more accurate final results will be incorporated into the method. Should the laboratory procedures deviate from the established method, all modifications will be detailed in the associated SOP. A listing of laboratory SOPs is included as Appendix E.

8.3 Standard Operating Procedures

Standard Operating Procedures (SOPs) are detailed, step-by-step instructions for completing a laboratory operation. An SOP is available for all procedures within the laboratory, from initial project identification to final data archival. SOPs are generated for procedures developed within the laboratory and for those that follow established methods.

To ensure consistency in defining procedural guidelines, all SOPs that describe analytical procedures will contain the following sections:

1) Method, matrix or matrices, detection limit, scope & application, components to be analyzed
2) Summary of the test method
3) Definitions
4) Interferences
5) Safety
6) Equipment and supplies
7) Reagents and standards
8) Sample collection, preservation, shipment and storage
9) Quality control
10) Calibration and standardization
11) Procedure
12) Data analysis and calculations
13) Method performance
14) Pollution prevention
15) Data assessment and acceptance criteria for quality control measures
16) Corrective actions for out of control data
17) Contingencies for handling out-of-control or unacceptable data
18) Waste management
19) References
20) Appendices, tables, diagrams, flowcharts and validation data.

SOPs will be monitored through the laboratory document control system. Each SOP will be assigned a document control number as detailed in Section 5.2 of this LQAP. SOPs are revised whenever a laboratory procedure is changed or modified. All SOPs are reviewed and revised as necessary at least once a year. Personnel normally performing the procedure or

analysis perform the review. SOPs will be generated for each new procedure implemented within the laboratory. Review, modification, new SOP generation, and distribution will be coordinated through the QAPM. The QAPM will periodically audit the laboratory sections to verify that the most current versions of all SOPs are in use. Document release will be controlled as detailed in section 5.2.

8.4 Method Selection and Use

Method selection will be based on availability of analytical instruments and equipment, chemical standards, expected method performance and marketability. Methods that are defined and accepted by regulatory agencies and familiar to ARI's clients are preferred. The Laboratory Manager and QAPM in consultation with marketing, client service, and laboratory supervisory staff are responsible for selecting appropriate methods. Client or project-specific methods may be used when appropriate.

The most recently promulgated method will be used for all procedures. Non-promulgated methods will be investigated if requested by a client. Section supervisors and managers are responsible for ensuring that the procedures in use reflect the requirements of the promulgated methods. Any modifications made to the method must be documented in the SOPs. Method modifications may be acceptable, provided all acceptance criteria specified in the method are met.

Section supervisors and managers review newly promulgated methods. SOPs will be modified as necessary to reflect the new methods. When possible, the annual SOP review will be coordinated with anticipated method promulgation dates. This is especially useful for large method compilations, such as SW-846. If the annual SOP review and method promulgation cannot be coordinated, SOPs will be revised as soon as possible after a method has been promulgated, especially when method changes are significant.

SOPs will be generated to reflect the most commonly used methods and protocols. If more than one method is used for an analysis, separate SOPs should be generated. Several methods may be incorporated into one SOP, provided that each method is clearly identified and defined in the SOP. Method modifications or special requirements for ongoing projects, or for specific programs (Navy, CLP, etc.), will be incorporated into the SOP. These

requirements will be annotated to indicate that they are project/program specific. Analysts and technicians will be responsible for ensuring that, when required, project or program specific procedures are followed. SOPs will be controlled as specified in section 5.2.

8.5 Method Performance

Method performance must be demonstrated for all new methods prior to using methods for sample analysis. Section supervisors and managers are responsible for ensuring that method performance is demonstrated and support procedures have been performed.

Method performance will be demonstrated in the following manner:

A draft SOP will be generated for the method. The SOP must provide sufficient detail to perform the analysis and must accurately reflect the published method. Any steps in the method for which analyst discretion is allowed must be clearly defined.

A method detection limit (MDL) study must be performed for the method. Method detection limits must be verified to be at or lower than any method-specified detection limits. Method detection and reporting limits must be established.

Method precision and accuracy must be evaluated. This may be determined using an MDL or IDL study. Replicates will be evaluated for precision; analyte values will be compared with spike amounts to determine accuracy. Any method-specified precision and accuracy criteria must be met.

All method performance results will be reviewed and compiled by the section supervisor. Results will be filed with the QA section. A final SOP will be generated and distributed. MDL updates will be communicated to Computer Services for LIMS updates and distributed to laboratory sections as needed.

SECTION 9: INSTRUMENT CONTROL

9.1 Detection Limits

To verify that reported limits are within instrument and method capabilities, three levels of detection have been established: instrument detection limits, method detection limits, and reporting limits. Instrument and method detection limits are statistically based values, determined from replicate analyses of analytical standards. Reporting limits are based upon the experience and judgment of an analyst. Reported values will be qualified based on the established limits. All limits will be summarized and controlled by the QAPM and are included as Appendix I.

Instrument Detection Limits

The instrument detection limit (IDL) is considered to be the smallest signal above background noise that an instrument can reliably detect. This limit reflects whether or not the observed signal has been caused by a real signal or is only a random fluctuation of noise from the blank. The IDL does not take into consideration the performance or efficiency of analytical methods.

Instrument detection limits are determined annually, or when ever a major change has been made, for each instrument in the metals analysis laboratory. Seven replicates, of a blank, or standards containing analytes at levels three to five times the expected IDLs are analyzed on three non-consecutive days. The IDL value for an analyte is three times the average of the standard deviations from the three replicate sets of analyses.

Method Detection Limits

The method detection limit (MDL) is considered to be the lowest concentration of an analyte that a method can detect with 99% confidence. Method detection limits will be established for all analytical parameters according to the guidelines specified in the Code of Federal Regulations, Section 40. Seven replicate samples are fortified with target analytes at levels that are one to five times (but not exceeding 10 times) the expected detection limits. The MDL for an analyte is determined to be the standard deviation of the replicates times the appropriate

student's t-test value. More than seven replicates may be processed, but all replicates must be used in the MDL determination. MDLs are verified by analyzing a sample spiked at a concentration 3 to 5 times the calculated MDL concentration. When the analyte(s) are detected the MDL is verified. When the analytes is not detected, the concentration in the verification sample is increased until it is detected. The concentration at which the analytes is first detected then becomes the MDL.

Laboratory supervisors or managers review all statistically determined MDLs for accuracy and validity. The section supervisor or manager is responsible for ensuring that any unusable MDL studies are reprocessed. Once accepted, MDL study results and associated raw data will be forwarded to the QA section for further review and additional approval. MDLs approved by both section management and QA will be considered final and acceptable for use. Finalized MDL values are forwarded to Computer Services for incorporation into ARI's LIMS.

MDL studies will be conducted for all analyses performed by the laboratory on representative water, sediment and, tissue samples when appropriate and suitable sample matrices are available. MDL studies will be performed on all instruments used for sample analysis. To allow for reevaluation of method performance, MDL studies will be performed on an annual basis. The QAPM is responsible for ensuring that all MDL studies are performed at least annually. Section supervisors and managers are responsible for determining if and when additional MDL studies should be performed due to changes in analytical methods, instrumentation or personnel.

Reporting Limits

Reporting Limits (RL) are the lowest quantitative value routinely reported. Analytical results below the RL will be expressed as "less than" the reporting limit. RLs are estimated values based upon the MDLs, experience and judgment of the analyst, method efficiency, and analyte sensitivity. No reporting limit will be lower than its corresponding MDL. RLs will be verified on a regular basis either by having a calibration standard at the limit or by analyzing a standard at the RL immediately following initial calibration.

Analytical Standards

Generation of high quality results is dependent upon the use of accurately prepared analytical standards. Many stock standards used within the laboratory are commercially prepared solutions with certified analyte concentrations. Neat standards used for stock standard preparation are of the highest purity obtainable. Standard preparations are fully documented in appropriate logbooks.

Responsibilities

It is the responsibility of each laboratory employee involved with standards preparation to ensure that all standards are correctly and accurately prepared through the use of good laboratory practices and analytical verification. It is also the responsibility of these staff members to properly document the receipt and/or preparation of all standards. Management is responsible for ensuring that all staff members follow specified standards preparation and inventory procedures. The QAPM is responsible for periodically auditing standard preparation records to verify compliance with the laboratory Quality Assurance Program.

Organic Standards Preparation

Two types of standards are utilized for extractable organic compounds: neat standards from which stock solutions are prepared, and commercially prepared stock solutions from which working solutions are prepared. The type of standard depends upon availability. Commercially prepared standards are preferred when available.

Preparation of stock solutions will be documented in the Stock Solutions Log. To ensure traceability, commercially prepared stock solutions will also be documented in the Stock Standard Solutions Log. Each solution will be assigned a unique stock number determined by the page number and entry number on the page, preceded by “S” to indicate the solution is a stock, volatile stock standard are labeled “VS”. For example, the third entry on page 44 will be assigned the stock number S44-3. For stock solutions prepared from neat standards, the compound(s), supplier, lot number, preparation schematic, preparation date, expiration date, and analyst initials will be recorded. After preparing the standard, another analyst should review the preparation information to verify accuracy. For commercially prepared stock solutions, the compound, supplier, lot number and expiration date will be recorded. As a stock

solution is not actually prepared in-house for these commercial solutions, it is not necessary to record or verify a preparation schematic.

Preparation of working solutions (including spike and surrogate solutions) will be documented in the Working Standard Solutions Logbook. Each solution will be assigned a working standard number determined by the page number and entry number on the page. For example, the second entry on page 73 will be assigned the working standard number 73-2. For volatile organic standards, the working standard number is preceded by "VW". The compound, stock solution reference, preparation schematic, preparation date, expiration date, and analyst initials will be recorded. After preparing the standard, another analyst will review the preparation information to verify accuracy. After analyzing the standard and confirming that it is acceptable, analytical verification will be documented in the logbook.

Discarded or consumed standards will be annotated in the logbook by drawing a single line through the entry, indicating "discarded" or "consumed" above the line with confirming initial and date. Existing standard numbers will not be reused. Instead, each new stock or working solution made will be assigned a new number.

Standards preparation will be performed in accordance with good laboratory practices. Syringes, glassware and other preparation equipment will be thoroughly cleaned prior to and after use. Standard material weights and solution volumes will be accurate to ± 3%. Neat standards that are less than 97% pure must be corrected for concentration. Standard solutions will be stored in amber bottles with Teflon-lined caps. Each standard solution will be labeled with the solution number, compound, analyst initials and expiration date. Stock solutions will be stored in the appropriate standards freezer; working solutions will be stored in the appropriate standards refrigerator.

Metals Standard Preparation

Commercially prepared single element stock solutions are used for all elements. Preparation of working solutions from these single element stocks will be documented in the Solutions Logbook. Preparation of check standards will also be documented in the Solutions Logbook. The element, preparation schematic, preparation date, expiration date, and analyst initials will be recorded. Working calibration standards are prepared weekly for furnace and ICP analyses

and as needed for ICP-MS. Calibration verification standards are prepared daily for GFA analyses and as needed for ICP and ICP-MS analyses.

Standards preparation will be performed in accordance with good laboratory practices. All preparation equipment will be thoroughly cleaned prior to and after use.

Inorganic (Wet Chemistry) Standard Preparation

Working standards for wet chemistry parameters will be prepared on a daily basis, prior to starting an analysis. Stock and check standard solutions will be replaced as solutions expire or are consumed. Stock and check standard solutions will be labeled with the compound, preparation data (weight and volume), units of concentration, preparation date, expiration date, and analyst initials.

Standards preparation will be performed in accordance with good laboratory practices. Glassware and other preparation equipment will be thoroughly cleaned prior to and after use. Standard material weights and solution volumes will be accurate to ± 3%. Stock standards will be stored in containers appropriate for the parameter.

9.3 Calibration

Instrumentation and equipment used for sample processing and analysis must be operating optimally to ensure that accurate analytical results are generated. Verification of optimum operation is accomplished through various tuning and calibration procedures. Criteria for determining the accuracy of calibration are specified for all instrumentation and equipment. Prior to sample analysis, calibrations will be analyzed and evaluated against specified acceptance criteria. Acceptance criteria are either published as part of the method or generated at ARI using control charts. Calibration verifications will also be analyzed throughout an analytical sequence to ensure that instrument performance continues to meet acceptance criteria.

Gas Chromatography/Mass Spectrometry (GC/MS)

All GC/MS systems will be evaluated through analysis of an instrument performance check solution and calibration standards. The composition of the standards varies depending on the analysis performed on the system. System evaluation will be performed prior to sample

analysis. Evaluation criteria used for GC/MS analyses are as specified for the SW846 methods.

Instrument Performance Check Solution - Prior to analysis, the system will be evaluated to ensure that mass spectral ion abundance criteria are met. Bromofluorobenzene (BFB) is analyzed for volatile organic analyses and Decafluorotriphenylphosphine (DFTPP) is analyzed for semi-volatile organic analyses. All ions must meet method-specified criteria.

The instrument performance check solution will be analyzed at a minimum of every 12 hours during the analytical sequence. Each analysis of the check solution will be verified against the specified criteria.

Calibration - After instrument performance has been verified, each GC/MS system will be calibrated to verify response linearity. For volatile organic analyses, up to eight standards ranging from 1 to 200 µg/L will be analyzed. For semi-volatile organic analyses, five to seven standards ranging from 2 to 80 µg/L will be analyzed. The standard levels evaluated will vary depending on the compound. Initial calibration results will meet percent relative standard deviation acceptance criteria.

A continuing calibration verification standard at a mid-level concentration (routinely 50 µg/L for VOA and 250 µg/L for SVOA) will be analyzed at a minimum of every 12 hours during the analytical sequence. For continuing calibrations, minimum response factor and percent difference criteria will be considered in evaluating the acceptability of the calibration. Initial and continuing calibration acceptance criteria for volatile and semi-volatile organic analyses are presented in Appendix J. All calibration data printouts will include the following documentation:

Date of calibration,
Identification of standard used
Identification of person performing the calibration

The analyst performing the calibration will include documentation of any problems encountered during the calibration analyses with the data, and will also note any corrective actions taken. The calibration data will be tabulated, and summary statistics will be generated. These results will be kept on file with the raw data in the Data Services section.

Internal Standard Responses - Internal standard responses and retention times in all standards will be evaluated immediately after analysis. This will serve as a baseline from which all sample internal standard responses and retention times will be evaluated.

Gas Chromatography (GC)

Each GC and HPLC system will be calibrated to verify response linearity. Depending on the parameter, five to seven standards at concentrations covering the linear range of the

instrument will be analyzed. Percent relative standard deviations for initial calibrations will not exceed SW-846 limits or 25% when those limits are not applicable.

A continuing calibration standard at mid-range concentration will be analyzed after every 10 samples or more frequently if the method or conditions warrant. Percent differences between initial and continuing calibrations will not exceed SW-846 limits or 25% when those limits are not applicable.

Calibration for organochlorine pesticides will follow SW-846 guidelines. The initial calibration sequence specifies the analysis of Resolution Check, Performance Evaluation, five-point initial calibration, individual standards and instrument blanks. Criteria for evaluating these standards are as follows:

> Performance Evaluation - The Performance Evaluation standard will be analyzed immediately following the Resolution Check standard. All standard peaks will be completely resolved. Individual breakdowns of DDT and Endrin will be less than or equal to 15% on both columns. A Performance Evaluation standard will also be analyzed at the end of the calibration sequence.
>
> Initial Calibration - The percent relative standard deviation (RSD) will not exceed SW-846 guidelines or 20% on each column.
>
> Continuing Calibration - A midpoint Aroclor 1660 and or a midpoint pesticide standard along with a performance evaluation standard are analyzed after every ten (10) sample analyses. The continuing calibration standards will be within 85 - 115% of the initial calibration. The Performance Evaluation standard will meet previously specified criteria.

The analytical sequence may continue indefinitely, provided that calibration criteria are met throughout the sequence. Additionally, retention times for all compounds will fall within the retention time windows established by the initial calibration sequence of the three standard concentration levels.

All calibration data printouts will include the following documentation:

> *Date of calibration,*
> *Identification of standard used, and*
> *Identification of person performing the calibration.*

The analyst performing the calibration will include documentation of any problems encountered during the calibration analyses with the data, and will note any corrective actions taken. The calibration data will be tabulated, and summary statistics will be generated.

Metals

Analytical instrumentation for metals will be evaluated through the analysis of calibration standards, calibration blanks, and calibration verification standards. Initial calibrations will be performed prior to sample analysis.

Inductively Coupled Plasma Atomic Emission Spectrometry (ICP)

Initial standardization is performed daily, or more frequently as required, by analyzing a blank and four multiple element standards with a single concentration for each analytical wavelength. The calibration is immediately verified with the analysis of an initial calibration verification standard (ICV) obtained from a source independent from the IC standard. The calibration will then be verified throughout the analytical sequence by analyzing a continuing calibration verification standard (CCV) after every 10 sample analyses. The calibration check standard values will be within ± 10% of the true value.

After initial calibration, a calibration blank (ICB) will be analyzed to check for baseline drift or carryover. The level of analyte in the calibration blank should be ±2 RL. Calibration blanks (CCB) will be analyzed immediately following each calibration verification standard analysis.

Following calibration verification a standard at the reporting limit (CRI) is analyzed for all elements. Warning limits have been set at ±1RL and any sample determined to have a concentration below this standard will be reported as undetected.

The upper limit of the calibration range, linear dynamic range, is established for each analytical wavelength using standards of increasing concentrations. These standards are analyzed against the normal calibration curve and must be within 10% of their true value to verify linearity. At a minimum this upper range will be checked every six months or whenever major changes are made to the instrument. Any sample analyzed with a concentration above this linear dynamic range will be diluted and reanalyzed.

Also to verify the inter-element correction equations, inter-element correction standards (ICS) are analyzed both at the start and end of the analytic run. Both the major interfering and the interfered with elements are evaluated.

Atomic Absorption Spectroscopy (Graphite Furnace and Cold Vapor)

Atomic absorption instrumentation is initially calibrated using a minimum of three standards of varying concentrations and a calibration blank. Initial calibration is

performed daily or more frequently if conditions warrant. The calibration is immediately verified with the analysis of an independent source initial calibration verification standard (ICV). The calibration will then be verified throughout the analytical sequence by analyzing a continuing calibration verification standard (CCV) after every 10 sample analyses. The initial calibration verification standard value will be within ± 10% of the true value whereas the CCV will be considered in control if it is within ±10% for Graphite Furnace analysis or ±20% for Cold Vapor analysis.

After initial calibration, a calibration blank (ICB) will be analyzed to check for baseline drift or carryover. The level of analyte detected in the calibration blank should be ±1 RL. Calibration blanks (CCB) will be analyzed immediately following each calibration verification standard analysis.

Following calibration verification a standard at the reporting limit is analyzed for all elements. Warning limits have been set at ±1RL and any sample determined to have a concentration below this standard will be reported as undetected. Any sample determined to have a concentration above the high calibration standard will be diluted and reanalyzed.

Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

Initial standardization is performed daily, or more frequently as required, by analyzing a blank and four multiple element standards. The calibration is immediately verified with the analysis of an independent source initial calibration verification standard (ICV). The calibration will then be verified throughout the analytical sequence by analyzing a continuing calibration verification standard (CCV) after every 10 sample analyses. The calibration check standard values will be within ± 10% of the true value.

After initial calibration, a calibration blank (ICB) will be analyzed to check for baseline drift or carryover. The level of analyte in the calibration blank should be ±1 RL. Calibration blanks (CCB) will be analyzed immediately following each calibration verification standard analysis.

Following calibration verification a standard at the reporting limit (CRI) is analyzed for all elements. Warning limits have been set at ±1RL and any sample determined to have a concentration below this standard will be reported as undetected.

The upper limit of the calibration range, linear dynamic range, is established for each analytical wavelength using high level standards. These standards are analyzed daily, or as necessary, against the normal calibration curve and must be within 10% of their true value to verify linearity. Any sample analyzed with a concentration above this linear dynamic range will be diluted and reanalyzed.

Also to verify the inter-element correction equations, inter-element correction standards (ICS) are analyzed both at the start and end of the analytic run. Both the major interfering and the interfered with elements are evaluated.

Inorganic Analyses other than Metals (Conventional Analyses)

Instrumentation and equipment used in analyzing samples for conventional wet chemical parameters (predominantly inorganic anions and aggregate organic characteristics) will be evaluated through the analysis of either internally prepared primary standards or externally derived Standard Reference Materials.

Depending upon the analysis, calibration is based upon direct stoichiometric relationships, regression analysis, or a combination of the two. Stoichiometry generally involves standardization of a titrant against a known primary standard and then the use of that titrant for determining the concentration of an unknown analyte (e.g. the use of sodium thiosulfate in the iodometric titration of dissolved oxygen). Regression analysis involves the determination of the mathematical relationship between analyte concentration and the response produced by the measurement being employed. Regression analysis is used for colorimetric determinations, ion specific electrode analysis and ion chromatography. The curve of response versus concentration is fit by the method of least squares using linear, polynomial or logarithmic regression dependant upon the pattern of response being measured.

Calibration is repeated for each analytical batch. Immediately following calibration, the standardized titrant or the calibration curve will be verified by the analysis of an Initial Calibration Verification standard (ICV) and Initial Calibration Verification Blank (ICB). The verification standard will be derived from a source other than that used for standardization or development of the standard curve. The ICV must return a value within 10% of its known concentration. The ICB must be less than the Reporting Limit (RL) or the lowest point on the standard curve, whichever is less. Initial calibration verification must be successfully completed prior to the analysis of any samples.

Calibration verification will be repeated after every ten samples processed during an analytical run. This Continuing Calibration Verification (CCV) will validate the method performance through an analytical sequence. If the continuing calibration values for either the standard or blank are out-of-control, the analyst will verify the outlying condition and, if verified, the analysis will stop and the method will be re-calibrated. All samples run between the outlying

CCV and the preceding in-control CCV will be re-analyzed. In-control verification standards and blanks must bracket all samples within an analytical run.

Initial calibration depending upon the analysis is based on a direct stoichiometric relationship, a linear regression analysis or a combination of the two. Stoichiometry generally involves standardization of a titrant and use of that titrant for determining the concentration of an unknown analyte (e.g. the use of thiosulfate in iodometric determination of dissolved oxygen). Regression analysis involves the determination of the mathematical relationship between the analyte concentration and the response produced by the measurement being employed. The curve is fit by the method of least squares using a linear, polynomial or logarithmic regression depending on the response being measured. The regression coefficient will be greater than or equal to 0.995 for the calibration to be considered acceptable.

Initial calibration curve is verified throughout the analytical sequence by analyzing a calibration verification standard after every 10 sample analyses. The calibration verification standard value will be within ± 10% of the initial calibration.

After initial calibration, a calibration blank will be analyzed to determine target analyte concentration levels. The level of analyte detected in the calibration blank will be less than the lowest standard concentration in the initial calibration.

SECTION 10: DATA VALIDATION and REVIEW

One hundred percent (100%) of laboratory data generated at ARI are subjected to a four level validation (review) process prior to release from the laboratory. The four levels of review are:

1. Analyst review
2. Peer review
3. Supervisory review
4. Administrative review

The data review process is outlined below and detailed in SOPs 200S through 206S.

In addition, Quality Assurance Personnel review 10% or more of all completed data packages for technical accuracy, project compliance and completeness. The data validation outlined below is completed in addition to the initial project review explained in Section 7 and QA specific reviews outlined in Section 11. If it is determined at any point during the analysis, reporting, or review process that data are unacceptable, prompt and appropriate corrective action must be taken. The corrective action will be determined by the situation. It is the responsibility of all staff members involved in data reporting and review to be aware of the quality control requirements and to be able to identify occurrences that require corrective action.

Analyst review:

Each analyst is responsible for producing quality data that meets ARI's established requirements for precision and accuracy and is consistent with a client's expectation.

Prior to sample preparation or analysis an analyst will verify that:

1. Sample holding time has not expired.
2. The condition of the sample or extract is described accurately on the laboratory bench sheet.

3. Specified methods of analysis are appropriate and will meet project required Data Quality Objectives.

4. Equipment and Instrumentation are in proper operating condition.

5. Instrument calibration and/or calibration verification are in control.

During sample preparation or analysis an analyst will:

1. Verify that Method Blanks and Laboratory Control Samples are in control.

2. Verify that QC (replicate, matrix spike analyses, SRM, etc.) samples meet precision and accuracy requirements.

3. In addition to verifying that quality control requirements are met, the analyst will review each sample to determine if any compound of interest is present at levels above the calibrated range of the instrument.

5. Check for data translation or transcription errors

6. Record all details of the analysis in the appropriate bench sheet or logbook.

7. Note any unusual circumstances encountered.

Following the analysis or sample preparation an analyst will:

1. Examine each sample and blank to identify possible false positive or false negative results.

2. Determine whether any sample requires reanalysis due to unacceptable quality control.

3. Review data for any unusual observances that may compromise the quality of the data, such as matrix interference

4. Review and verify that data entry and calculations are accurate and no transcription errors have occurred.

5. Document anomalous results or other analytical concerns on the bench sheet, corrective action form or Analyst Notes for incorporation into the case narrative.

6. Note data with qualifying flags as necessary.

7. Enter reviewed data into LIMS as appropriate, incorporate all necessary sample and quality control information into the data package and forward it for further review.

Peer review:

A second analyst trained in the appropriate SOPs will complete a peer review. Peer review will include at a minimum:

1. Verification that all QA (holding times, calibrations, method blanks, LCS, spiked sample analyses, etc.) criteria are in control.
2. Examination the data for possible calculation and transcription errors.
3. Review bench sheets and analyst notes for completeness and clarity.
4. Approve the analytical results or recommend corrective action to the laboratory supervisor.

When a second trained analyst is not available a peer review is not completed.

Supervisory Review:

Following analyst and peer review the data is forwarded to the laboratory section supervisor for review. The supervisor will:

1. Review the data package for completeness and clarity.
2. Follow-up on the peer review recommendations.

Designated reviewers normally perform the peer and supervisory reviews for GC-MS data. The reviewers are identified on the organizational chart in Appendix A.

Administrative Review:

The results of all analyses are reviewed for compliance with quality control criteria and technical correctness before data is released to the Project Manager for distribution to clients. Designated reviewers in the Metals, Conventional and Organic laboratories perform administrative reviews. Personnel responsible for administrative reviews are noted in the Organizational Chart in Appendix A to this LQAP.

Administrative review is the final data validation process. Personnel performing the administrative review are responsible for the final sign-off and release of the data. Following administrative review the data is released to Project Managers for incorporation into the final data deliverable package.

Administrative review will:

1. Verify that the analytical package submitted for reporting is complete and contains all necessary information and documentation.
2. Verify that appropriate and necessary data qualifying flags (Listed in Appendix N) have been used.
3. Verify that method blank and LCS data are acceptable, quality control requirements were met for surrogates in all samples and blanks, and that all necessary re-analyses or dilutions were performed.
4. Check the technical validity (i.e. are total metal ≥ dissolved metals, is the cation/anion balance correct, etc.) of the complete data set.
5. Verify that all necessary final data reports have been generated and that all necessary data and documentation are included in the package.
6. Approve data reports for release.

10.2 Quality Assurance Review

10% (1 out each 10) final data packages are reviewed by ARI's QA staff for compliance with ARI's QA Program. This assessment includes, but is not limited to, review of the following areas:

1. Reporting and analysis requirements
2. Initial and continuing calibration records
3. Quality control sample results (method blank, LCS, spikes, replicates, reference materials)
4. Internal and surrogate standard results
5. Detection and reporting limits
6. Analyte identifications.

Data review activities are summarized and documented by the reviewer. The review notes are filed with the associated raw data in the project file. Any QA-related deficiencies identified during the data review will be forwarded to the QAPM for corrective action.

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SECTION 11: QUALITY CONTROL SAMPLE ANALYSIS AND EVALUATION

Routine analysis of quality control (QC) samples is necessary to validate the quality of data produced in ARI's laboratory. ARI routinely utilizes the following quality control analyses as defined in Section 11.3:

1. method blank (MB)
2. holding blank (HB)
3. surrogate standard analyses (SS)
4. laboratory control sample (LCS)
5. laboratory control sample duplicate (LCSD)
6. standardized reference material (SRM)
7. sample(matrix) replicate (MD)

8 matrix spike (MS)

9. matrix spike duplicate (MSD)

The number and type of QC analyses depend on the analytical method and/or the QA/QC protocol required for a specific project. A range of acceptable result is defined for each type of QC analysis. When all quality control sample results are acceptable, the analysis is considered to be "in-control" and the data suitable for its intended use. Conversely, quality control sample results that do not meet the specified acceptance criteria indicate that the procedure may not be generating acceptable data and corrective action may be necessary to bring the process back "in-control".

Detailed information concerning sample preparation batches, QC analyses and surrogate standards follow:

11.1 Sample Preparation Batch

All QC samples will be associated with a discrete sample preparation batch. A preparation batch is defined as 20 or fewer field samples of similar matrix processed together by the same analysts, at the same time, following the same method and using the same lot of reagents. Additional batch requirements are detailed in ARI's method specific standard operating procedures. Each preparation batch will be uniquely identified. All samples, field and QC, will be assigned an ARI LIMS ID number and will be linked to their respective preparation batch. Each sample batch will contain all required QC samples in addition to a maximum of twenty field samples.

ARI will accommodate client, QC protocol or QAPP specific sample batching schemes.

11.2 QC Sample Requirements

Each preparation batch will include, at a minimum, a method blank (MB) and a laboratory control sample (LCS). Additional QC samples will be analyzed based upon the specific QC protocol required, data deliverable requirements or client request. ARI recommends that QC samples used to measure analytical precision also be included in each sample batch. These may include: a matrix spike and a matrix spike duplicate pair; a sample duplicate and a matrix spike pair or an LCS duplicate (LCSD) for comparison with the LCS.

11.3 QC Sample Definitions

11.3.1 Method Blank (MB)

A method blank is an aliquot of water or solid sample matrix that is free of target analytes and is processed as part of a sample batch. The method blank is used to verify that contaminants or compounds of interest are not introduced into samples during laboratory processing. Method blanks will be spiked with surrogate standards for all organic analyses.

ARI defines an acceptable method blank as one that contains no target analytes at a concentration greater than one-half ARI's reporting limit or 5% of an appropriate regulatory limit or 10% of the analyte concentration in the sample which ever is greatest.

A minimum of one method blank will be included in each preparation batch. A maximum of twenty samples may be associated with one method blank. An acceptable method blank is

required prior to analysis of field samples from a preparation batch. For methods not requiring pre-analysis sample preparation, a minimum of one method blank will be analyzed immediately prior to sample analysis, periodically throughout the analytical sequence, and also at the end of the sequence.

The results of the method blank analysis will be reported with the sample results.

11.3.2 Holding Blank (HB)

Holding blanks are organic-free water samples that are placed in each volatile organic sample storage refrigerator to monitor for possible cross-contamination of samples within the storage units. A holding blank from each refrigerator will be analyzed every 14 days. Holding Blank analyses will be reviewed by laboratory management and archived in ARI's electronic document archive.

11.3.3 Laboratory Control Sample (LCS)

An LCS is processed as part of each preparation batch, and is used to determine method efficiency. An LCS is an aliquot of water or solid matrix free of target analytes to which selected target analytes are added in known quantities. The analytes spiked into LCS samples are listed in ARI's method specific SOPs. LCS will be spiked with surrogate standards for all organic analyses.

Following analysis the percent recovery of each added analyte is calculated and compared to historical control limits. Current control limits are listed in Appendix K of this document. When calculated recovery values for all spiked analytes are within specified limits, the analytical process is considered to be in control. Any recovery value not within specified limits requires corrective action prior to analysis of any field samples from the associated preparation batch.

A minimum of one LCS will be prepared for each sample preparation batch. LCS analysis for those methods not requiring pre-analysis sample preparation will be performed after each continuing calibration. The results of all LCS performed will be reported with the sample results. A maximum of twenty samples may be associated with one LCS.

Specific clients or QA protocol may require the analysis of a duplicate LCS. When LCS duplicates are analyzed the failure of any analyte in either LCS to meet QC limits must trigger a corrective action.

11.3.4 Replicate Analysis

Replicate analyses are often used to determine method precision. Replicates are two or more identical analyses performed on subsamples of the same field sample at the same time. Replicate analyses should be performed on samples that are expected to contain measurable concentrations of target analytes.

The calculated percent difference between replicates must be within specified limits or corrective actions are required. Percent differences exceeding the specified limit signal the need for procedure evaluation unless the excessive difference between the replicate samples is clearly matrix related.

For inorganic analyses, a minimum of one replicate set should be processed for each analytical batch. Replicate sample analyses are not routinely performed for organic parameters. Instead, analytical precision is evaluated through the analysis of a duplicate matrix spike sample (MSD).

In order to perform replicate analyses, ARI's must receive sufficient volume to prepare the replicate aliquots.

Field replicates submitted to the laboratory will be analyzed as discrete samples.

11.3.5 Matrix Spike

A matrix spike is an environmental sample to which known quantities of selected target analytes have been added. The matrix spike is processed as part of an analytical batch and is used to measure the efficiency and accuracy of the analytical process for a particular sample matrix. The analytes spiked into MS samples are listed in ARI's method specific SOPs. MS samples will be spiked with surrogate standards for all organic analyses.

Following MS analysis the percent recovery of each spiked analyte is calculated and compared to historical control limits. If recovery values for the spiked compounds fall within specified

limits, the analytical process is considered to be in control. When calculated recovery is outside of historical limits corrective action is recommended.

Matrix spike duplicate (MSD) analyses are often used to measure method precision and accuracy. In this case the relative percent difference for recovery of spiked compounds is calculated and compared to established criteria.

Unless directed otherwise, ARI's policy is to prepare a matrix spike and a duplicate with each batch of samples for inorganic analysis and an MS/MSD set for each batch of samples for organic analyses. Analyte recovery and RPD values are reported with sample data.

11.3.6 Standardized Reference Material (SRM)

An SRM is material analyzed and certified by an outside organization to contain known quantities of selected target analytes independent of analytical method. SRMs are normally purchased from outside suppliers outside of ARI and are supplied with acceptance criteria. Analysis of SRM is used to assess the overall accuracy of ARI's analytical process. SRM are routinely analyzed with each batch of samples for wet chemistry (conventionals analysis) samples. External reference samples are analyzed after instrument calibration and prior to sample analysis. Compound recovery values not within the specified limit signal the need to evaluate either the calibration standards or instrumentation.

11.3.7 Other Quality Indicators

In addition to analyzing the quality control samples outlined previously, various indicators are added to environmental samples to measure the efficiency and accuracy of ARI's analytical process. Surrogate standards are added to extractable organic samples prior to extraction to monitor extraction efficiency. Surrogate standards will also be added to volatile organic samples prior to analysis to monitor purging efficiency. Internal standards are added to metals digestates for ICP-MS analyses and to organic samples or extracts prior to analysis to verify instrument operation.

The calculated recovery of surrogate analytes is compared to historical control limits to aid in assessing analytical efficiency for a given sample matrix.

11.4 Control Limits

To provide a means for evaluating whether or not a process is in control, acceptance limits have been established. These are based on internal, historical data for organic analyses and method specified limits for inorganic analyses. Samples associated with a specific program or contract (such as the USEPA Contract Laboratory Program) will be evaluated against program/contract-specified criteria. Routine samples will be evaluated against internally generated control limits. Project specific control limits will be used as required provided they have been reviewed for feasibility and approved by laboratory management.

Results of QA analyses are transferred from the LIMS to a control limit and chart generation program. The QAPM coordinates control chart and control limit generation. Control limits will be generated for LCS compound recoveries, surrogate recoveries, and matrix spike compound recoveries, on a method and matrix specific basis. Advisory control limits will be utilized for analyses performed on an infrequent basis until a sufficient number of usable data points are collected. Control limits are updated at least annually, but may be updated more frequently if method or instrument changes have been made. Laboratory control and acceptance limits are detailed in Appendix K.

Two levels of control limits are utilized in evaluating process control: warning limits and action limits. Limits are statistically determined from values obtained from LCSs or other control samples. Warning limits, within which 95% of all results are expected, equal $\pm$ two standard deviations from the average result. Action limits, within which 99.7% of all results are expected, are equal to $\pm$ three standard deviations from the average result. Mean values, warning limits, and action limits are necessary for thorough evaluation of process control.

11.5 Control Charts

Control charts, in conjunction with other control sample analyses, are useful in verifying that an analytical procedure is performing as expected. The control chart provides a pictorial representation of how closely control sample results approximate expected values, as well as showing analytical trends. Indicated on the control chart are the mean and upper and lower warning and action limits. The warning and action limits are used to determine whether or not an analytical process is in control. The mean is used to determine whether results obtained for

a procedure are trending upward or downward, which may ultimately affect the accuracy of sample results.

The QA Officer will coordinate generation of control charts based on laboratory data at least semi-annually. These control charts will be distributed to and reviewed by section supervisors and managers. Any significant trends or variations in results will be identified, and the source of the trend corrected. Copies of control charts will remain on file in the QA section. At the bench/instrument level, individual results from quality control samples are evaluated against the limits.

SECTION 12: CORRECTIVE ACTIONS AND REESTABLISHMENT OF CONTROL

To produce quality data, it is important that all aspects of the analytical process are under control and that all specified quality control criteria are met. On occasion, however, procedures, reagents, standards, and instrumentation can fail to meet specified criteria. Should any of those situations occur, the quality of data produced may be compromised. When procedures no longer appear to be in control, sample processing will be halted and appropriate actions will be taken to identify and rectify any instrument malfunctions or process-related issues. Prior to resuming sample analysis, verification of control will be made through the analysis of various control samples. Actions taken and observations made during reestablishment of control will be fully documented on the bench sheet or as an Analyst Note. Only when control has been regained and all actions documented will sample processing resume. This ensures that no results generated during the suspect period will be reported.

12.1 Responsibilities

It is the responsibility of all laboratory personnel involved with sample processing to be able to determine whether or not a procedure is in control and to verify that all data are produced under conditions that are “in control”. It is at the analytical level that unacceptable conditions are most easily detected and addressed. These personnel are also responsible for employing and documenting all necessary corrective actions taken to regain control of a procedure. Samples processed during suspect periods will be reprocessed, and suspect data will be appropriately annotated to indicate that it is of questionable quality. The analytical staff will verify that all data submitted for review has been generated under acceptable conditions. All anomalies will be documented on the Analyst Notes form and will include such information as: type and source of anomaly, reasons for the anomaly, and actions taken to correct the problem. All personnel involved with subsequent and final data review are responsible for verifying that data were generated under acceptable conditions. If suspect data are identified at the review level, responsible analysts should be contacted to determine whether additional actions (such as reanalysis) will be taken. In addition, reviewers will confirm that anomalies

noted by the analyst were indeed addressed and that appropriate corrective actions were taken.

On occasion, it is not possible to generate data that meet all Quality Control Standards. This may be due to sample volume limitations or sample matrix effects. It is the responsibility of the analytical and data review staff to document these situations and to maintain communication with the Project Management staff. The Project Management staff, in turn, is responsible for notifying the client or specifying additional actions to be taken. Project Managers are further responsible for ensuring that clients fully understand which data are questionable and the reasons why acceptable results could not be generated.

It is the responsibility of the QAPM to perform regular reviews of corrective action procedures to ensure that unacceptable conditions or suspect data will be identified prior to releasing results. Section managers and supervisors are responsible for ensuring that appropriate corrective action procedures are in place and that all staff members are trained to identify and act upon “out of control” situations.

12.2 Corrective Actions

There are various stages of the analytical process where the procedure may fall out of control and require corrective action. In general, all procedures and equipment will be monitored to verify that control is maintained during sample processing. The following details those stages as well as the actions taken to reestablish and verify control.

Sample Preparation

During sample preparation, all glassware associated with a specific sample will be clearly labeled to eliminate the possibility of sample mix-up or mislabeling. Laboratory staff will ensure that sample-identifying labels are accurately completed and that correct sample identification is maintained at all times. If a sample appears to have been misidentified or mixed with another sample during preparation, the suspect samples will be discarded and new aliquots taken. If there is insufficient sample for a second preparation, the situation will be documented on the bench sheet and the Project Manager will be immediately notified.

Addition of surrogate standards or matrix spiking solutions will be carefully monitored to ensure that all samples are accurately fortified. Volumes and standard solution numbers of all

standards added to samples will be recorded on the bench sheet. If there is suspicion that a sample has been incorrectly spiked a new sample aliquot should be prepared. If there is insufficient volume for re-preparation, the bench sheet will be annotated to indicate which samples may be inaccurately fortified.

If sample matrix hinders processing per standard procedures, the section supervisor or manager will be consulted for guidance on appropriate actions. Preparation of smaller sample aliquots or employment of different procedures may be necessary. Any deviations from normal protocols will be documented on the bench sheet.

If at any time during sample preparation sample integrity is compromised or a procedural error is noted, the sample will be discarded and re-prepared. If insufficient sample volume is available for re-preparation, the situation will be documented on the bench sheet and the Project Manager will be immediately notified.

Calibration and Tuning

Prior to sample analysis, all instrumentation will be calibrated and tuned to ensure that equipment meets all criteria necessary for production of quality data. Equipment must meet the calibration criteria specified in the section entitled “Calibrations”, per manufacturer specifications or per project/contract requirements. If these criteria are not met, corrective actions must be employed. Any corrective actions taken will be fully documented in the appropriate logbook, indicating the problem, the actions taken, and verification. Samples will not be analyzed until initial verification of system performance has been made. In the event that continuing calibration results do not meet criteria, sample analysis will not resume until corrective actions have been employed or the system has been re-calibrated.

GC/MS Analyses - Analysis of the instrument performance check solution (BFB or DFTPP) will meet the specified ion abundance criteria. Initial calibration standards at a minimum of five concentrations will meet specified response factor and percent relative standard deviation criteria. It criteria are not met for initial calibration, the system will be inspected for malfunction. The initial tuning and calibration will be repeated, with all necessary corrective actions taken, until calibration criteria are met.

A check of the calibration curve will be performed at a minimum of once every 12 hours. All response factor criteria will be met. Additionally, the percent difference between the initial and continuing calibrations will meet specified criteria. If criteria

are not met, the system will be inspected for malfunction. The initial tuning and calibration verification will be repeated, with all necessary corrective actions taken, until calibration criteria are met.

Internal standard responses and retention times for standards will meet specified criteria. Any sample not meeting internal standard criteria will be reanalyzed. If reanalysis yields the same response and the instrument is determined to be functioning correctly, the failure to meet criteria will be attributed to sample matrix interference. No further re-analyses will be required.

GC Analyses - Organochlorine pesticide calibrations will be evaluated using either USEPA CLP or SW-846 guidelines. The Resolution Check standard will meet resolution criteria and Endrin and DDT breakdown in the Performance Evaluation standard will meet breakdown criteria. Initial calibrations will meet percent relative standard deviation criteria. If, during the initial calibration sequence, criteria are not met, the system will be inspected for malfunction and the initial calibration be reanalyzed. Samples will not be analyzed until all initial calibration criteria are met.

Continuing calibrations of either the mid-level calibration standard or Performance Evaluation standard will be analyzed every 12 hours. If continuing calibration criteria are not met, the system will be inspected for malfunction and corrective actions will be taken to bring the system back into compliance. If, after corrective actions, the system is still not in compliance, re-calibration will be performed. After the system has been successfully corrected or re-calibrated, all samples previously analyzed between the acceptable and unacceptable continuing calibration will be reanalyzed.

If, during the analytical sequence, retention time shifting occurs, the system will be inspected for malfunction and corrective actions will be taken to bring the system back into compliance. If, after corrective actions, the system is still not in compliance, re-calibration will be performed. After the system has been successfully corrected or re-calibrated, all samples with retention times outside the specified windows will be reanalyzed.

For all other analyses, initial calibration standards analyzed at a minimum of five concentrations will meet percent relative standard deviation criteria. If criteria are not met for initial calibration, the system will be inspected for malfunction. The calibration will be repeated, with all necessary corrective actions taken, until calibration criteria are met.

A check of the calibration curve will be performed after every 10 samples. All percent differences between the initial and continuing calibrations will meet specified criteria. If criteria are not met, the system will be inspected for malfunction and re-calibration will be performed. Samples analyzed between an acceptable and unacceptable calibration check will be reanalyzed.

Metals and Inorganic Analyses - Initial calibrations will be verified by analyzing a calibration check standard immediately after calibration. The percent differences between the initial calibration and calibration check standard will meet specified percent difference criteria. If criteria are not met, the system will be inspected for

malfunction. The initial calibration and calibration check will be reanalyzed until acceptance criteria are met.

The calibration check standard analyzed after every 10 samples will meet percent difference criteria. If the calibration check standard is not acceptable, the system will be inspected for malfunction and re-calibration will be performed as necessary. Samples analyzed between acceptable and unacceptable calibration check standards will be reanalyzed.

Instrument Blanks

Prior to sample analysis, instrument and/or calibration blanks may be evaluated for the presence of target analytes. If analytes are detected, the concentrations must be below the reporting limits for those analytes. If analytes are detected at levels above the reporting limits, the source of contamination will be identified. Sample analysis will not commence until analyte levels in instrument and calibration blanks are below the reporting limits. Instrument and calibration blanks are analyzed for VOA analysis only if sample carryover is suspected.

Instrument and calibration blanks will also be analyzed throughout the analytical sequence. These will not contain target analytes at levels above the method detection limits for organic parameters or the reporting limit for inorganic parameters. If one or more analytes exceed the RL, an additional blank will be analyzed. If analyte levels are still above the method detection limits, the system will be inspected for malfunctions and the source of contamination will be identified. Sample analysis will not resume until instrument and calibration blank analyte levels are below the RL. Organic samples analyzed between acceptable and unacceptable blanks will be evaluated to determine the need for reanalysis per the following guidelines:

If no target analytes are detected in the samples, reanalysis will not be required.

If sample target analyte levels are above the method detection limits, samples will be reanalyzed at analyst discretion. Reanalysis will be dependent upon the analyte levels and whether or not there is likelihood that analytes detected are a direct result of system contamination.

If the analytes present at unacceptable levels in the instrument blank are not of interest or concern in the associated samples, reanalysis will not be required. This is often a consideration for ICP analyses where analytes of concern may be only a subset of the possible analytes.

Methods for the analysis of inorganic analytes require that all samples associated with an out of control blank be re-analyzed.

Method Blanks

Prior to sample analysis, method blanks will be evaluated for the presence of target analytes. Ideally, no target analytes should be present in the method blank. If analytes are detected at or above the Reporting Limit, the method blank will be reanalyzed to verify that the contamination is not a result of instrument carryover or malfunction. If the presence of target analytes is confirmed, the concentrations must be below the RL for those analytes.

Several volatile and semi-volatile compounds and certain elements are considered to be common laboratory contaminants. Concentrations of these common laboratory contaminants may exceed the method detection limits, but may not be present at concentrations greater than five times the method reporting limits. Target analytes considered to be common laboratory contaminants are:

Volatile Organic Compounds

Methylene Chloride
Acetone
2-Butanone

Semi-volatile Compounds

Dimethylphthalate
Diethylphthalate
Di-n-butylphthalate
Butylbenzylphthalate
bis-(2-Ethylhexyl) phthalate
Di-n-octylphthalate

If target analyte concentrations in the method blank exceed the acceptable levels and instrument malfunction or contamination has been ruled out, the method blank and all associated samples will be re-prepared and reanalyzed. If there is insufficient sample volume remaining for reprocessing, the Project Manager will be notified. If it is necessary to report results associated with an unacceptable method blank, the results will be qualified to indicate possible laboratory contamination.

In the event that an analyte detected in the samples ≥ 20 times the method blank levels re-preparation and reanalysis is not required. It is assumed that any contamination in the method blank is insignificant and will not affect final quantified results.

Laboratory Control Samples

Prior to sample analysis, the laboratory control sample (LCS) will be evaluated to verify that recovery values for all spiked compounds are within the specified acceptance limits. If LCS recoveries are out of control, corrective action is required. Corrective actions may include anything from a written explanation in the case narrative up to re-preparation and reanalysis of the entire sample batch.

Internal Standards

For volatile and semi-volatile organic analyses, internal standard results will be evaluated after each analytical run to verify that the values are within acceptance limits. Internal standard values will be within -50% to +100% of the internal standard values in the continuing calibration. If any internal standard does not meet the criteria, the system will be evaluated to confirm that all instrumentation is operating properly. The sample will then be reanalyzed. If the reanalysis results do not meet acceptance criteria, it will be assumed that the sample matrix is affecting internal standard values. Further reanalysis will not be required.

Surrogate

Surrogate recovery values will be evaluated after each analytical run to verify that the values are within acceptance limits. If recovery values are outside acceptance limits, the system will be evaluated to confirm that all instrumentation is operating properly. Documentation and bench sheets will be reviewed to verify that the concentrations of surrogate spike solutions added are accurate. For extractable organic analysis, bench sheets will be reviewed to determine if any additional dilutions or concentrations were performed. Bench sheets will also be reviewed for any explanatory notes about the sample.

If no system documentation, solution preparation or spiking errors are identified, the following considerations will be made:

When a volatile organic surrogate recovery value is outside of acceptable limits, the sample will be reanalyzed. If the reanalysis results are within acceptance limits, it will be assumed that the initial analysis was in error. If the reanalysis results are not within acceptance limits, it will be assumed that sample matrix is affecting surrogate recovery. Further reanalysis will not be required.

For semi-volatile organic analysis, one acid and one base/neutral surrogate recovery may be outside acceptance limits with no corrective action required provided the recoveries are at least 10%. If more than one acid or base surrogate standard is outside acceptance limits, or if any surrogate recovery value is less than 10%, the sample will be re-extracted and reanalyzed. If the reanalysis results are not within acceptance limits, it will be assumed that sample matrix is affecting surrogate recovery assuming all other QC analyses are acceptable. Further reanalysis will not be required. *Matrix spikes will not be re-extracted for unacceptable surrogate recovery values.*

For other extractable organic analysis, if a surrogate recovery value is outside of acceptance limits, the data will be reviewed to determine if the unacceptable surrogate is a result of matrix effect. If matrix interference is determined, the sample will be re-extracted or if re-extraction is not deemed useful, fully documented in the analytical narrative associated with the analyses. If a surrogate recovery is too low, based on the opinion of the final QA Data Reviewer, the sample will be re-extracted and reanalyzed.

Matrix Spikes

Matrix spikes will be evaluated to verify that recovery values for all spiked compounds are within the specified acceptance limits. If unacceptable results are obtained, the system will be evaluated to confirm that all instrumentation is operating properly. Documentation and bench sheets will be reviewed to verify that the concentrations of spike solutions added are accurate. Sample preparation bench sheets will be reviewed to determine if any additional dilutions or concentrations were performed. Bench sheets will also be reviewed for any explanatory notes about the sample.

If no system, documentation, solution preparation, or spiking errors are identified, the following considerations will be made:

Organic Analyses:

If a matrix spike recovery value is outside the acceptance limits, but the LCS meets recovery acceptance criteria, re-extraction will not be required. It will be assumed that the unacceptable recovery value is a result of matrix effect.

If both LCS and matrix spike recovery values are outside the acceptance limits, the sample batch will be re-extracted and reanalyzed. This indicates the possibility of a systematic error that may affect the accuracy of final results.

Inorganic analyses:

Matrix spikes with unacceptable recovery values will be re-prepared and reanalyzed. If the reanalysis results are not within acceptance limits, it will be assumed that the sample matrix is affecting the recovery values. Further reanalysis will not be required.

A post-digestion spike analysis will be performed for all metals analyses processed following EPA-CLP guidelines.

Sample and Matrix Spike Replicates

Sample and matrix spike replicates will be evaluated to verify that percent differences between the replicates are within acceptable limits. Percent differences for metals and inorganic sample replicates will be within ±20%. When percent difference criteria are not met, the system will be evaluated to confirm that all instrumentation is operating properly. Documentation and bench sheets will be reviewed to verify that the concentrations of spike solutions added are accurate. Sample preparation bench sheets will be reviewed to determine if any additional dilutions or concentrations were performed. Bench sheets will also be reviewed for any explanatory notes about the sample.

If no system, documentation, solution preparation, or spiking errors are identified, the following considerations will be made:

If percent difference values between sample replicates for metals and inorganic analyses do not meet acceptance criteria the Project Manager in consultation with ARI's client will determine whether to re-analyze the samples or flag the analytical results. If the samples are reanalyzed and results are not within acceptance limits, it will be assumed that the sample is not homogeneous, causing the poor analytical precision. Further re-analyses will not be required.

Replicate sample analyses are not routinely performed for organic parameters.

If percent difference values between matrix spike replicates do not meet acceptance criteria, but spike recovery values are acceptable, no re-extraction or analysis will be required. It will be assumed that the sample is not homogeneous, causing the poor analytical precision.

If percent difference values between matrix spike replicates do not meet acceptance criteria and recovery values in one or both replicates are not acceptable, the sample and associated matrix spike replicates will be re-prepared and reanalyzed. If the reanalysis results are not within acceptance limits, it will be assumed that the

sample is not homogeneous, causing the poor analytical precision. Further re-analyses will not be required.

Samples

In addition to monitoring sample quality control indicators, ARI evaluates samples to determine the need for reanalysis. Conditions considered while evaluating samples are:

If a target analyte detected in a sample exceeds the upper limit of the instrument calibration range, the sample is diluted and reanalyzed. Dilution and reanalysis continues until the analyte concentration falls within the linear range of calibration. If the sample requires dilution to such a level that surrogates are no longer detectable and analytical accuracy is questionable, the sample will be re-prepared using a smaller sample aliquot.

Samples will be evaluated for matrix interference that may affect analyte detection and quantification. Appropriate cleanup procedures will be employed to remove interference. Samples will be diluted and reanalyzed as required to minimize background interference. If it is not possible to remove all interference, reported results will be qualified as necessary.

If low-level analytes detected in a sample are suspected to be a result of instrument carryover, the sample will be reanalyzed. If analyte levels remain approximately the same the initial results will be considered valid. If analytes are not detected during reanalysis, it will be assumed that the initial detection was due to carryover, and the initial results will not be reported.

If an instrument malfunction or procedural error occurs during analysis, all affected samples will be reanalyzed. If the malfunction appears to be an isolated incident, it will not be necessary to inspect the analytical system. If the malfunction appears to be an ongoing problem, the system will be inspected and necessary maintenance/corrective actions will be taken prior to resuming analysis.

Sample Storage Temperatures

Every sample storage unit's temperature will be evaluated at the beginning of each day. Temperatures will be between 2 and 6 °C for refrigerators and < -10 °C for freezers. If a temperature is outside the specified range, the unit's temperature will be adjusted to bring the temperature back within limits. The Temperature Log will be annotated to document the adjustment.

If adjustment does not bring the temperature within range, or if adjustment is not possible, the Laboratory Supervisor will be notified and will take corrective action. The Temperature Log will be annotated to document the action. If the temperature fluctuation is chronic or extreme, the

samples will be removed from the unit and placed in another storage unit until the malfunctioning unit is repaired or replaced.

Balance Calibrations

Balances are serviced once a year by a certified technician. The service includes preventative maintenance and calibration.

Balance accuracy will be verified prior to balance use. The recorded weight will be within the acceptance criteria specified on the Calibration Log. If the recorded weight is not within the acceptance limits, the QAPM will be notified. The Calibration Log will be annotated to document the action. The balance will not be used until it can be verified that acceptance criteria can be met.

Water Supply System

The water supply for the volatile organic and inorganic laboratories will be monitored daily for the presence of contaminants through the analysis of method and/or instrument blanks. Organic contaminants, especially chloroform, are early indicators of the need for preventative maintenance. If organic or other contaminants are detected, the system filters will be changed. After filters have been changed, an additional aliquot of water will be analyzed to confirm that contaminants are no longer present.

The water supply for the metals laboratory will be monitored daily. When the resistivity falls below 18 megaohm, system maintenance will be performed.

Section 13: LABORATORY EVALUATION AND AUDITS

Routine evaluations of the laboratory ensure that all necessary quality control activities have been implemented and are being effectively utilized. It is the responsibility of the QAPM to ensure that quality control activities are periodically evaluated for compliance. Findings from these evaluations allow the laboratory to address and modify any procedures that are not in accordance with the laboratory Quality Assurance Program or accreditation program requirements.

A number of tools are available for monitoring laboratory performance. ARI evaluates the quality of laboratory performance through the use of

Internal QA Audits
Technical System Audits
Data Quality Reviews
Audits by Outside Agencies (External Audits)
Performance Evaluation Analyses
Annual Management Review

Each audit provides an objective evaluation of laboratory performance. All internal audits and reviews are conducted according to specified guidelines. In addition, a collective review of audit findings provides an overall evaluation of the laboratory. Deficiencies noted during the course of an audit or performance evaluation will be addressed, a root cause analysis performed, and appropriate corrective actions will be taken. Follow-up audits will be conducted to verify that corrective actions have been satisfactorily implemented.

Internal QA Audits

The Quality Assurance Officer regularly evaluates quality control activities within the laboratory to verify accuracy and compliance. The QAPM or designee routinely audits the following activities:

Balance verification records
Sample storage cooler temperature records
Oven, incubator and water bath temperature records
Chain of Custody records

Standard preparation records
Documentation and Response to Client Complaints
Chain of Custody Procedures
Documentation of Computer and Software Revisions

Checklists are utilized to ensure consistent and complete audits. The checklists are included in SOP 1005S. Internal QA audit results will be summarized and reported to both staff and management. Corrective actions will be initiated as necessary. A schedule of internal QA audits is provided in Appendix L.

When an audit finding indicates possible errors or deficiencies in analytical data, ARI will correct the error and notify all affected clients within 2 working days.

Technical System Audits

An audit of technical systems within the laboratory will be conducted at least annually. The audit will focus on the quality control and data generation/collection systems. The QAPM will conduct the audit with assistance from section managers and data reviewers. This evaluation will address areas such as:

Calibration records
Maintenance records
Control charts
Computer vs. hard copy data
Adherence to SOPs and methods
Support system records (DI water, balances, pipettes, etc.)

In addition, audit results from the past year will be reviewed to verify that all necessary corrective actions have been addressed and implemented.

Data Quality Reviews

Reviews of final data packages by the QAPM or his/her designee. The Data quality review verifies that the final data deliverables meet project and quality systems specifications

Audits by Outside Agencies (External Audits)

As a requirement for many accreditation programs, on-site review of laboratory facilities and operations are conducted by clients or other outside agencies. The laboratory may be periodically audited by the following agencies:

State of Washington Department of Ecology
A United States Department of Defense Agency (US Army, US Navy or US Air Force)
State of Oregon Environmental Laboratory Accreditation Program (ORELAP) as an Accrediting Body for The NELAP Institute.

External audits are beneficial in that they provide an independent evaluation of the laboratory without internal influence or bias. The laboratory will be available for evaluation at the convenience of the auditing agency. Laboratory personnel will be available during the audit to address questions or provide information regarding laboratory procedures. All comments, deficiencies, and areas of potential improvement noted by the auditor will be reviewed, and appropriate corrective actions will be taken to resolve the noted issues. A listing of laboratory accreditations is included as Appendix M.

Performance Evaluations

Performance Evaluation (PE) sample analysis is a means of evaluating individual performance as well as the overall analytical system. In addition to the external audit, PE sample (PES) analysis is a requirement of many certification and accreditation programs. The laboratory routinely participates in the following performance evaluation programs:

Analytical Standards, Inc.(ASI) Performance Evaluation Studies
USEPA Water Pollution (WP) Performance Evaluation Studies (Commercial Supplier)
USEPA Water Supply (WS) Performance Evaluation Studies (Commercial Supplier)
USEPA Contract Laboratory Program Quarterly Performance Evaluations (as required)
AASHTO (for geotechnical samples)

A PES is a sample containing specific analytes in concentrations unknown to analysts. Comparison of the laboratory result to the "true" value determines the accuracy of the

reported result and indicates the laboratory's ability to perform a given analysis. These results are also used to verify individual analyst proficiency. The QAPM will periodically submit internal “blind” performance evaluation samples to the laboratory sections for analysis. Values obtained by the laboratory will be compared to expected or true values. Parameters with reported values outside of the specified acceptable ranges will be evaluated by the analytical staff to determine the source of error. All necessary corrective actions will then be documented and implemented.

Quality Assurance Reports to Management and Staff

In order to ensure that laboratory managers are kept apprised of quality related activities and laboratory performance, a “Quality Assurance Report to Management” the QAPM will be produced annually and distributed to ARI management. The report will, at a minimum include:

1. Information concerning current and ongoing internal and external audits
2. Status and results of current or ongoing internal or external proficiency analyses
3. Identification of Quality Control problems in the laboratory
4. Information on all ongoing Corrective Actions
5. Current status of external certifications
6. Current status of the Staff Training Program
7. Outline of new and/or future Quality Assurance Program initiatives

The QAPM is responsible for follow-up and resolution of any deficiencies discussed in the report. Unresolved issues will remain on subsequent reports until addressed. Information such as performance evaluation results and audit reports will be distributed to the laboratory staff.

The application of these combined activities provides comprehensive monitoring and assessment of laboratory performance, and ensures that all data produced by ARI will be of the highest possible quality.

Annual Management Review

In the last quarter of each year, executive management will perform a comprehensive review of ARI quality system and analytical procedures to assess their continued suitability and effectiveness. Management will consider the following during the review process:

Suitability of policies and procedures

Reports fro management and supervisory personnel

Results of internal audits

Corrective and preventative actions

Results of recent external quality systems audits

PT results

Changes in volume and type of analyzes performed

Client Feedback

Complaints

Other relevant factors such as quality control activities, available resources and analyst training

Section 14: APPENDICES

A. Laboratory Organization and Key Personnel Resumes
B. Training and Demonstration of Proficiency
C. Laboratory Facilities
D. Laboratory Instrumentation and Computers
E. Standard Operating Procedures
F. Sample Collection Containers, Preservation and Holding Times
G. Laboratory Workflow
H. Analytical Methods
I. Method Detection Limits and Reporting Limits
J. Quality Control Recovery Limits
K. Internal Audit Schedule
L. Laboratory Accreditations
M. Data Reporting Qualifiers
N. Standards for Personal Conduct
O. QA Policies
P. Modifications to ARI's LQAP

Appendix A

Laboratory Organization Chart
and
Key Personnel Resumes

KEY PERSONNEL RESUMES

Mark Weidner

Laboratory Director

Profile

Mr. Weidner co-founded Analytical Resources, Inc., along with Brian Bebee, Sue Dunnihoo and David Mitchell. Prior to his co-founding of ARI in 1985, Mr. Weidner was the Head Mass Spectroscopist at Michigan State University and an instructor at the Finnigan Institute. As Laboratory Director, Mr. Weidner is responsible for overall laboratory performance, as well as facility expansion and major purchasing. Mr. Weidner is intimately familiar with all operational and analytical aspects of ARI and initiated many of the procedures currently in use.

Education:

M.S., Medicinal Chemistry, Purdue University, W. Lafayette, IN (1978).

B.S., Biochemistry, Michigan State University, E. Lansing, MI (1975).

Experience:

Laboratory Director/Co-founder, Analytical Resources, Inc., Seattle, WA (1985 to present).

Senior Chemist, City of Seattle, Seattle, WA (1981 to 1985).

Instructor, Finnigan Institute, Cincinnati, OH (1979 to 1981).

Mass Spectroscopist, Michigan State University (1978 to 1979).

Brian Bebee

Laboratory Manager

Administrative Services Manager

Profile:

Mr. Bebee co-founded Analytical Resources, Inc., along with Mark Weidner, Sue Dunnihoo, and David Mitchell. Prior to his co-founding of ARI, Mr. Bebee had gained extensive GC/MS experience as a GC/MS Chemist at the Municipality of Metropolitan Seattle, (METRO). When he co-founded ARI in 1985, Mr. Bebee became the Organics Division Manager until 1993, when he assumed the position of Laboratory Manager. As Laboratory Manager, Mr. Bebee is responsible for the day to day flow of all laboratory operations, including personnel, instrument, and procedural concerns. He is also responsible for the direct supervision of the Volatile and Semivolatile Laboratories.

Education:

A.A., Oceanography, Marine Biology, Biology, Shoreline Community College (1973).

Experience:

Laboratory Manager, Analytical Resources, Inc., Seattle, WA (1987 to present).

Organics Division Manager/Co-founder, Analytical Resources, Inc., Seattle, WA (1985 to 1987).

GC/MS/DS Operator, Municipality of Metropolitan Seattle, Seattle, WA (1980 to 1985).

Senior Water Quality Technician, Municipality of Metropolitan Seattle (METRO), Seattle, WA (1976 to 1980).

Water Quality Technician, Municipality of Metropolitan Seattle (METRO), Seattle, WA (1973 to 1976)

David Mitchell

Quality Assurance Program Manager

Profile:

Mr. Mitchell co-founded Analytical Resources, Inc., along with Mark Weidner, Sue Dunnihoo, and Brian Bebee. Prior to his co-founding of ARI, Mr. Mitchell had gained extensive experience in the environmental chemistry field as Senior Chemist and Trace Organics Laboratory Supervisor at the Municipality of Metropolitan Seattle (METRO). His responsibilities include the management of ARI's Quality Assurance/Quality Control Program.

Education:

Graduate Work in Chemistry (Organic/Biological), University of Wyoming, Laramie, WY (1970 to 1974).

B.S., Chemistry, Upper Iowa College, Fayette, IA (1970).

Experience:

Quality Assurance Manager, Analytical Resources Inc., Seattle, WA (1998 to Present)

Client Services Manager, Analytical Resources Inc., Seattle WA (1987 to 1998)

Vice President/Co-founder of Analytical Resources, Inc., Seattle, WA (1985 to 1987).

Senior Chemist, METRO Trace Organics Laboratory, Seattle, WA (1979 to 1985).

Research Associate, Northwestern University Medical School (1974 to 1979).

Susan Dunnihoo

Director, Client Services

Profile:

Ms. Dunnihoo co-founded Analytical Resources, Inc., along with Mark Weidner, Brian Bebee, and David Mitchell. Prior to her co-founding of ARI, Ms. Dunnihoo had gained extensive experience in the environmental chemistry field through her work at Laucks Testing Laboratories, the City of Tacoma, and the Municipality of Metropolitan Seattle (METRO). As Director of Client Services, Ms. Dunnihoo is responsible for assisting project managers in responding to the needs of ARI clients, and for communicating to the laboratory the analytical capabilities that should be added to satisfy future client needs. Ms. Dunnihoo also acts as project manager for a number of projects.

Education

Graduate work in Chemical Oceanography, University of Washington (1976-1980)
ACS Certified BA, Chemistry, Augsburg College, Minneapolis, MN (1976)

Experience

Director, Client Services, Analytical Resources, Inc., Seattle, WA (2007-present)
Client Services Manager, Analytical Resources, Inc., Seattle, WA (1998-2007)
Computer Services Manager, Analytical Resources, Inc., Seattle, WA (1985 to 2000)
Corporate Secretary, Analytical Resources, Inc., Seattle, WA (1985 to present)
Chemist, Laucks Testing Laboratories, Seattle, WA (1983 to 1985)
Chemist, City of Tacoma, Plant II, Tacoma, WA (1982 to 1983)
GC/MS/DS Operator, METRO TPSS Lab, Seattle, WA (1980 to 1982)

Jay Kuhn

Inorganic Division Manager

Profile:

Mr. Kuhn oversees ARI's Inorganic Division, which includes the Metals Sample Preparation, Metals Analysis, and Conventional Wet Chemistry sections. He has extensive experience in the environmental chemistry field, with an emphasis in inorganic analyses. Mr. Kuhn is experienced with in-house and EPA standard methods and protocols, as well as the operation, maintenance, and repair of ICP-MS, ICAP, CVAA, and Graphite Furnace instruments.

Education

Graduate work in Environmental Chemistry, University of Washington, Seattle, WA.

B.S. Chemistry, University of California at Santa Barbara (1980)

Experience

Inorganic Division Manager, Analytical Resources, Inc., Seattle, WA (1992 to present)

Metals Division Manager, Analytical Resources, Inc., Seattle, WA (1990 to 1992)

Research Technologist III and Laboratory Manager, UW College of Forest Resources Chemical Analysis Cost Center (1985-1990)

Research Technologist, UW College of Forest Resources Chemical Analysis Cost Center (1981 to 1985)

Appendix B

Training

Qualification Requirements

In addition to on-the-job training, ARI recommends a specific level of education and experience for the following positions:

GC/MS Laboratory Supervisor

A Bachelor's degree in chemistry or scientific/engineering discipline, three years experience operating GC/MS systems and one year supervisory experience.

GC Laboratory Supervisor

A Bachelor's degree in chemistry or scientific/engineering discipline, three years experience operating GC systems and one year supervisory experience.

Sample Preparation Laboratory Supervisor

A Bachelor's degree in chemistry or scientific/engineering discipline, three years experience in organic sample preparation and one year supervisory experience.

Data Systems/LIMS Manager

A Bachelor's degree with four or more computer-related courses and three years experience in systems management or programming. A minimum of one year experience with software utilized for laboratory report generation is also recommended.

Programmer Analyst

A Bachelor's degree with four or more computer-related courses and two years experience in systems or application programming. A minimum of one year experience with software utilized for laboratory report generation is also recommended.

Quality Assurance Officer

A Bachelor's degree in chemistry or a scientific/engineering discipline and three years of laboratory experience, including one year of applied experience with quality assurance.

Project Manager

A Bachelor's degree in chemistry or a scientific/engineering discipline and three years of laboratory experience, including one year of applied experience with quality assurance.

GC/MS Chemist

A Bachelor's degree in chemistry or a scientific/engineering discipline and at least one year experience operating a GC/MS system. Three years of GC/MS operations and spectral interpretation experience may be substituted in lieu of educational requirements.

Mass Spectral Interpretation Specialist

A Bachelor's degree in chemistry or a scientific/engineering discipline and participation in training course(s) in mass spectral interpretation. Also, at least two years of experience in mass spectral interpretation is recommended.

Purge and Trap Expert

A Bachelor's degree in chemistry or a scientific/engineering discipline and one year experience operating a purge and trap type liquid concentrator interfaced to a GC/MS system.

GC Chemist

A Bachelor's degree in chemistry or a scientific/engineering discipline and at least one year experience operating a GC system. Three years of GC operations and maintenance experience may be substituted in lieu of educational requirements.

Pesticide Analysis Expert

A Bachelor's degree in chemistry or a scientific/engineering discipline and at least one year experience operating a GC system. Three years of GC operations and spectral interpretation experience may be substituted in lieu of educational requirements.

ICP Spectroscopist

A Bachelor's degree in chemistry or a scientific/engineering discipline and Four years of applied experience with ICP analysis of environmental samples. Four years of ICP experience may be substituted in lieu of educational requirements.

ICP Operator

A Bachelor's degree in chemistry or a scientific/engineering discipline and one year of experience operating and maintaining ICP instrumentation. Three years of ICP experience may be substituted in lieu of educational requirements.

Atomic Absorption (AA) Operator

A Bachelor's degree in chemistry or a scientific/engineering discipline and one year of experience operating and maintaining graphite furnace and cold vapor AA instrumentation. Three years of AA experience may be substituted in lieu of educational requirements.

Conventionals (Classical Chemistry) Analyst

A Bachelor's degree in chemistry of a scientific/engineering discipline and one year of experience with classical chemistry procedures. Three years of classical chemistry experience may be substituted in lieu of educational requirements.

Sample Preparation Expert

A high school diploma and one college level course in chemistry. One year of experience in sample preparation is also recommended.

Appendix C

Laboratory Facilities

ANALYTICAL RESOURCES INC. occupies a total of 23,500 square feet of floor space located at 4611 S. 134th Place in Tukwila, Washington. The laboratory facility, constructed between September 2001 and June 2002, includes:

- State-of-the-art heating, ventilation and air conditioning (HVAC) systems to assure a clean comfortable working environment while maintaining air flow balance designed to minimize the possibility of sample cross contamination between laboratory areas.
- A central service area provides space for three walk-in coolers (356 sq. ft. total), two walk-in freezers (760 cubic ft.), metals archive storage, and sample cooler storage. A 400 sq. ft. walk-in freezer covered by a mezzanine for storage was added in 2005.
- A data network linking all workstations to a centralized server room. All connections are made to managed switches and hubs and are protected by the latest firewall technology and uninterruptible power supplies.
- Distribution systems to deliver pressurized Air, Zero Grade Air, Argon, Helium, Hydrogen, Nitrogen and Argon/Hydrogen to the laboratory areas from a central location.
- A system to deliver ASTM Type 1 water directly to sinks in each laboratory area. Water is purified by filtration, ion exchange and reverse osmosis and continuously re-circulated through a filtration + ion exchange + UV radiation polishing loop that delivers water directly to the laboratories.
- An isolated and ventilated hazardous waste storage area.
- An electronic repair shop and storage room.
- Alarm monitored fire sprinkler and intrusion detection systems

The facilities are divided into five functionally-distinct sections as detailed below:

1) The Organics Division features three main laboratory areas as described below:
   - The Organics Extraction Laboratory (2400 sq. ft.) is utilized to isolate and concentrate organic compounds from various environmental sample matrices. The laboratory contains approximately 200 linear feet of bench space and nine fume hoods. It is equipped with two gel permeation chromatographs, an accelerated solvent extractor (ASE) and a gas chromatograph for extract screening purposes. The laboratory includes a separate area for extraction of aqueous samples, a glassware cleaning area and individual workstations for the laboratory supervisor and analyst.
   - The Semivolatile Organics Analysis Laboratory (3000 sq. ft) has 124 linear feet of instrument bench space plus personal workstations. The Laboratory is equipped with seven Gas Chromatographs (GCs) with six GC-MS instruments, one High Resolution GC/MS (HRGC-MS) and a fume hood for preparation of standard solutions and dilution of samples. Each gas chromatograph is individually vented to the outside for removal of heat and potentially contaminated GC exhaust gases.
   - The Volatile Organics Analysis (VOA) Laboratory (2500 sq. ft) houses seven GC-MS and two GC-PID instruments dedicated to volatile organics analysis. Each instrument is vented to the outside. The laboratory area includes two fume hoods, a sample/standards preparation area, a TCLP preparation/tumbler room and sample holding refrigerators. The HVAC system maintains a positive air pressure in the laboratory using filtered air from outside of the building. This eliminates the possibility of cross contamination of samples with solvents from other areas of the laboratory.

2) The Inorganic Division includes a Trace Metals Laboratory and the Conventional Analyses Laboratory:
   - Trace Metals Laboratory (3000 square feet)
     - The Metals Preparation Laboratory (1200 sq. ft) contains five fume hoods including two 8-foot polypropylene. An additional eight foot polypropylene laminar flow fume hood is housed in a separate class 1000 clean room. The lab is equipped with tumblers, hot-plates, digestion blocks, facilities for glassware cleaning, and a spectrophotometer for cold vapor analysis of mercury, a TCLP tumbler room, and storage areas.
     - The Metals Instrument Laboratory (1300 sq. ft) features two atomic absorption spectrometers for graphite furnace analyses, two inductively coupled argon plasma spectrometers (ICP) for simultaneous analysis of metals species, and an ICP-mass spectrometer for analysis of metals species at low detection levels.
     - A 500 sq. ft. Office provides desk area for Trace Metals laboratory personnel.
   - The Conventional Analyses (Wet Chemistry) Laboratory (2500 sq. ft.) contains approximately 200 linear feet of bench space, eight fume hoods and includes a separate microbiology room. Instruments in this lab include two Rapid-Flow Analyzers, two TOC analyzers, an ion chromatograph, two uv/visible spectrophotometers, and various other equipment necessary for the evaluation of inorganic parameters.

3) The Geotechnical Laboratory includes 2500 square feet of space with special areas and equipment for soil testing, treatability studies, and soil/sediment leaching studies. The Laboratory includes approximately 50 feet of linear bench space and 5 fume hoods.

4) The Sample Receiving Facility consists of an area to accept and log-in samples to ARI's Laboratory Information Management System (LIMS) and an area to prepare and ship sampling supplies.
   - The Sample Receiving Facility (1000 sq. ft.) is equipped with two fume hoods, and 70 feet of bench space. Four computer terminals are available to log samples into ARI's LIMS.
   - The Sampling Containers Facility (500 sq. ft.) is used to prepare sampling containers for shipment to ARI's client designated locations.

4) Administrative Areas (8600 sq. ft.) include:
   - The Quality Assurance Section
   - Executive Offices
   - Project Management Section
   - The Human Resources Section
   - The Computer Services Section
   - One Conference Room
   - A Lunch Room
   - Several Storage Areas

Appendix D

Laboratory Instrumentation and Computers

LABORATORY INSTRUMENTATION and COMPUTERS

Organic Extractions Laboratory Equipment

(MARS 1) CEM MARS™ (2008) – Microwave extraction apparatus.

(MARS 2) CEM MARS™ (2010) – Microwave extraction apparatus.

(MARS 3) CEM MARS™ (2011) – Microwave extraction apparatus.

(GPC 1) Gel Permeation Chromatograph (1985) – Fluid Metering Inc. pump and ISCO UA-5 UV detector equipped with a 16 position autosampler used for clean-up of samples prior to final analysis.

(GPC 2) Gel Permeation Chromatograph (2003) – Fluid Metering Inc. pump and ISCO UA-5 UV detector equipped with a 16 position autosampler used for clean-up of samples prior to final analysis.

Zymark Turbo-Vap LV (1999) - 24 place

Zymark Turbo-Vap LV (2002) - 24 place

Zymark Turbo-Vap LV (2007) - 24 place

Zymark Rapid Trace Solid Phase Extraction Workstations (2007) - 5 each

Horizon Technology – DryVap Concentrator System Model 5000 – 2 each

Dioxin Extractions Laboratory Equipment

(MARS 1) CEM MARS™ Express (2010) – Microwave extraction apparatus.

Zymark Turbo-Vap LV (2010) - 24 place

Rotovap R-205 with V-805 Vacuum Controller (2010) – 2 each

Glas-Col Combo Heating Mantle (2010) – 6 place – 3 each

Vacuum Manifold – 6Place (2010) – for SPE

Gas Chromatograph - High Resolution Mass Spectrometer (GC/HRMS)

(HR1) Waters Autospec Premier (2009) – A GC-HRMS system with Masslynx Version 4.1 data acquisition & quantitation software. System includes an Agilent 7890A GC and 7683B autosampler.

Gas Chromatograph - Mass Spectrometers (GC/MS)

(FINN5) Finnigan MAT Incos 50 (1989) - A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. System includes an HP 5890 GC, a Tekmar LSC 2000 Purge & Trap and a Dynatech PTA-30 autosampler for VOA analysis of either aqueous or solid samples.

(NT2) Hewlett Packard (1999) – A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. System includes Agilent 6890 GC, 5973 MSD, and 7683 autosampler.

(NT3) Hewlett Packard (1999) – A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. System includes an HP 6890 Plus GC, an HP 5973 MSD, an OI Analytical Eclipse 4660 and a Varian Archon autosampler for VOA analysis of aqueous or solid samples.

(NT4) Hewlett Packard (2001) – A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. The system includes HP 6890-Plus GC, 5973 MSD and 6890 autosampler

(NT5) Hewlett Packard (2002) – A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. The system is equipped with an HP 6890N GC, an HP 5973N MSD, a Tekmar LCS 2000 Purge and Trap and a Dynatech PTA 30 autosampler for VOA analysis of aqueous or solid samples.

(NT6) Hewlett Packard (2002) – A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. The system includes an HP 6890 Plus GC, an HP 5973 MSD and an HP 7683 autosampler.

(NT7) Hewlett Packard (2007) – A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. The system is equipped with an HP 6890N GC, an HP 5973N MSD, a Tekmar LCS 2000 Purge and Trap and a Dynatech PTA 30 autosampler for VOA analysis of aqueous or solid samples.

(NT8) Agilent (2008) – A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. The system is equipped with Agilent 6890N GC, 5975C MSD, and 7683 autosampler.

(NT9) Agilent (2008) – A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. The system is equipped with Agilent 6890 GC and 5973 MSD, a Tekmar LSC 2000 Purge and Trap and a Dynatech PTA-30 autosampler for VOA analysis of either aqueous or solid samples.

(NT10) Agilent (2008) – A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. The system is equipped with Aglient 6850GC,an Agilent 5975C inert MSD GC, an OI Analytical Eclipse 4660 and a Varian Archon autosampler for VOA analysis of aqueous samples.

(NT11) Hewlett Packard (2009) - A GC-MS system networked with a Hewlett Packard Unix Server running Thruput Target 3.5 data analysis software. The system includes an Agilent 6890 N GC, an HP 5973 MSD and a Combi-pal SPME autosampler.

Gas Chromatographs

Hewlett Packard 5890 Series II (2003) – A GC system equipped with both FID and ECD detectors, capillary injectors, an autosampler and Chemstation. Used for screening samples before full extraction.

(ECD1) Hewlett Packard 5890 Series II (2004) - A GC system equipped with dual ECD detectors, an Agilent 6890 autosampler and HP Chem Station data system.

(ECD3) Hewlett Packard 5890 Series II (1991) – A GC system equipped with Dual ECD detectors, two Cool on column capillary injectors, an HP7673 autosampler and ChromPerfect data system.

(FID2) Hewlett Packard 5890 Series II (2004) – A GC system equipped with an FID detector, a capillary injector, an HP 7673A autosampler and HP Chem Station data system.

(FID3 A, B) Hewlett Packard 6890 (1996) – A GC system equipped with dual FID detectors, two capillary injectors, a dual tower HP 6890 autosampler, and HP Chem Station data system. A Restek GC Racer has been added to enhanced performance.

(FID4 A, B) Hewlett Packard 6890 (1996) – A GC system equipped with dual FID detectors, two capillary injectors, a dual tower HP 6890 autosampler, and HP Chem Station data system. A Restek GC Racer has been added to enhanced performance.

(PID1) Hewlett Packard 5890 Series II (2002) – A GC system equipped PID and FID detectors in series, an Dynatech PT30 autosampler and Tekmar LCS 2000 Sample Concentrator and Chemstation data system.

(PID2) Hewlett Packard 5890 Series II – (2005) –A GC system equipped with dual PID detectors, one in series with an FID, a Dynatech PT30 autosampler, a Tekmar 2000 sample concentrator and HP Chem Station data system.

(PID 3) Hewlett Packard 5890 Series II – (2006) –A GC system equipped with PID and FID detectors in series, a Dynatech PT30 WS autosampler, a Tekmar 2000 sample concentrator and HP Chem Station data system.

(ECD5) Hewlett Packard 6890 Plus Micro – (2002) – A GC system equipped with dual ECD detectors, an HP 7683 autosampler and an HP Chem Station data system.

(ECD6) Hewlett Packard 6890 Plus Micro – (2008) – A GC system equipped with dual ECD detectors, an Agilent 6890 autosampler and an HP Chem Station data system.

(FID5) Hewlett Packard 5890E Series II (2005) – A GC system equipped with dual FID detectors, an HP 7683 autosampler and HP Chem Station data acquisition system.

(FID6) Hewlett Packard 5890 Series II (2005) – A GC system equipped with an FID detector, an HP 7694 Headspace Sampler and HP Chem Station data acquisition system.

(FID7) Agilent 6850 (2008) – A GC system equipped with a single FID detectors, an Agilent 6850 autosampler and HP Chem Station data acquisition system.

(ECD7) Hewlett Packard 6890 Plus Micro – (2008) – A GC system equipped with dual ECD detectors, an Agilent 6890 autosampler, and HP Chem Station data system.

(FID8) Agilent 6890N (2008) – A GC system equipped with a dual FID detectors, an Agilent 7683B autosampler and HP Chem Station data acquisition system.

(FID9) Agilent 6850 (2009) – A GC system equipped with a single FID detector, an Agilent 6850 autosampler and HP Chem Station data acquisition system.

Inorganic Instrumentation

Perkin-Elmer SCIEX ELAN 6000 ICP-MS (1996) - A completely automated ICP-Mass Spectrometer with autosampler and multitasking software.

Perkin-Elmer NexIon 300 ICP-MS (2010) - A completely automated ICP-Mass Spectrometer with autosampler and multitasking software.

Perkin-Elmer Optima 7300DV ICP (2009) – Automated dual view simultaneous ICP with an Elemental Scientific SC-2 fast autosampler system

Perkin-Elmer Optima 4300 ICP (2001) - A completely automated dual view simultaneous ICP with auto-sampler and multitasking software.

Varian 300Z (1992) - A single channel atomic absorption graphite furnace instrument equipped with Zeeman background correction, and an auto-sampler

Varian 300Z (1991) - A single channel atomic absorption graphite furnace instrument with Zeeman background correction, equipped with an auto-sampler

CETAC M-6000A Mercury Analyzer (2000) – A fully automated high sensitivity cold vapor atomic absorption instrument dedicated to trace and ultratrace Mercury analysis. System is computer controlled with windows base software and an auto-sampler

Dionex Ion Chromatography DX 500 (1997) – A fully automated system with an auto-sampler for quantitative anion analyses. The system is computer controlled using Peaknet software.

Dionex Ion Chromatography 2100 (2009) – A fully automated system with an auto-sampler for quantitative anion analyses. The system is computer controlled using Chromeleon CHM-2 Version 7.0 software.

Thermo Genesys 10 (2003) - UV-VIS Spectrophotometer used for quantitative conventionals analysis.

Thermo Genesys 10 (2005) - UV-VIS Spectrophotometer used for quantitative conventionals analysis.

Lachat QuickChem 8000 Flow Injection Analyzer (2003) – Automated flow injection instrument dedicated to low level nutrient analysis

Lachat QuickChem 8500 Flow Injection Analyzer (2007) – Automated flow injection instrument dedicated to low level nutrient analysis

Dohrmann Apollo 9000 (2001) - Total Organic Carbon (TOC) Analyzer. Includes an autosampler for water analysis and a boat sampler for solids analysis.

Dohrmann Apollo 9000 (2009) - Total Organic Carbon (TOC) Analyzer. Includes an autosampler for water analysis and a boat sampler for solids analysis.

Kontes Midi-Vap Cyanide Distillation Systems (3 each)(1995-2008) – Each of the systems is capable of simultaneously distilling up to 10 samples for cyanide analysis using small sample aliquots.

Centrifuge (1987) - Beckman Model GP with swinging bucket rotor and inserts for 250 ml bottles and scintillation vials

Aim 500 Block Digestion System (2006) with Controller

Environmental Express Hot Block digestion blocks (10 ea) (1999-2008) for digestion of samples prior to trace metals analysis.

Hach COD Digestion Blocks (2)

Hach Ratio Nephelometer

Incubators: Lab-Line Ambi Hi-Lo Chamber and **Thermolyne 41900.**

GeoTech Laboratory Equipment

Trautwein Sigma 1 (2008) – Triaxial loading system

Sedigraph III Model 5120 (2007) – Automatic particle size analyzer

Beckman Coulter LS 13320 (2008) – Laser diffraction particle size analyzer with microliquid and universal liquid modules

Trautwein Soil Equipment – 12 position flexible wall permeability station

Soil Test Load Frame – with 500, 2,000 and 10,000 pound load cells for QU, UU, and CU triaxial tests, with pore pressure.

Soil Consolidation Apparatus – 16 tsf

Biosciences BI-1000 – 8 position electrolytic respirometer

Microtox – photo-luminescence toxicity test instrument

Beckman JP-21 – refrigerated centrifuge with 6 x 500 ml fixed angle head

IEC DRP-6000 – refrigerated centrifuge with a 4 x 1,000 ml swinging bucket head

Plas-Labs Anaerobic Test Chambers – 3 each

U.S. Army Corps of Engineers – column settling; column and batch leaching apparatus

Network Servers

ARI's central laboratory computer is a Dell PC Server, PowerEdge 2300/450, running Microsoft Windows NT 4.0 SP6. This system is home to ARI's Laboratory Information Management System (LIMS) database developed by Northwest Analytical of Portland, OR. The LIMS receives electronic data from all lab sections and produces hardcopy and electronic deliverables. In addition, the LIMS stores sample demographic data while providing a common tracking mechanism for all laboratory information.

The LIMS is connected to two sub-networks. Most data, with the notable exception of Conventionals and Geotech, is transferred electronically as text files from other data systems to the LIMS. This key process enhances data integrity by reducing manual entry and manipulation of instrument output.

The metals section uses an Intel PC Server with the Windows 2000 Server operating system. This system runs as a file server for dBASE IV and MS Access 2000 database applications.

Once data is collected by the metals instrument computers, dBASE is used to aggregate and process the results and transfer it to the LIMS. The MS Access software has been customized by ARI's metals data supervisor to generate metals CLP forms and other internal reports. This server also provides additional services such as DHCP, WSUS, and the corporate vacation calendar.

The organics section uses an HP-UX Server with the HP-UX 10.20 operating system. This system runs Target 3.4 data analysis software. All GC/MS and other GC instruments are networked to this system. In addition to providing one common platform for organics data processing, the Target software produces CLP forms for organics data packages.

The conventional analysis laboratory uses individual PC Workstations with MS Excel for data reduction. Filled spreadsheets are saved to Server3. Data is manually copied from the MS Excel spreadsheet into the LIMS systems using LIMS worklists specific to a test method.

Server2 is the primary internal/external interface and provides email, NTP, web (internet and intranet), DHCP, proxy, document (Geotech), CVS, database, and authentication services. Access to Server2 is limited to authorized users and only IT personal have access to the shell.

Server3, running Windows 2000 Advanced Server, is the primary document server for ARI and is used to warehouse all scanned (pdf) data packages. The hardware for Server3 consists of a generic box with a 2.4 MHz Intel Pentium 4 processor. Packages saved to this server are indexed using the CI service of Windows and are available for searching via the ARI intranet.

All servers are secured in a locked room where only management and IT staff have access. Some users have external access to the network but this is limited to current employees and only through an end-to-end encrypted VPN (OpenVPN).

Note: Extensive in-house replacement parts are available for lab instruments and computers, including spare circuit boards. A majority of all service maintenance is performed by ARI employees.

Appendix E

ARI Active Standard Operating Procedures (SOP)

A list of ARI's current Standard Operating Procedures (SOPs) is available on ARI's web site at:

http://www.arilabs.com/portal/downloads/ARI-SOPs.zip

SOPs are updated periodically. Assure that you have ARI's current SOPs by downloading the files at the time of use.

Appendix F

Sample Containers, Preservation and Holding Times

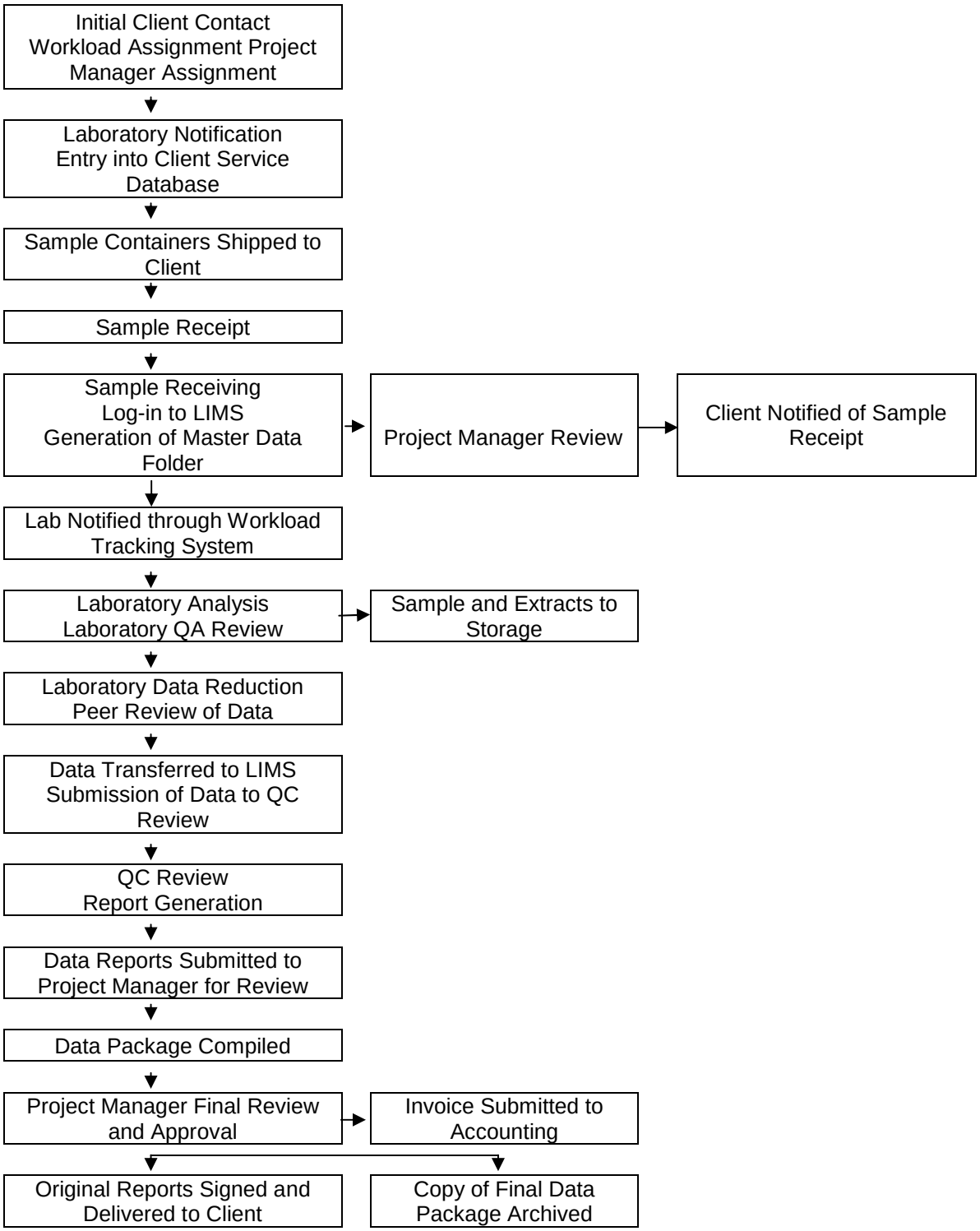
A summary of sample containers, preservatives and holding times is available on ARI's web site at:

http://www.arilabs.com/portal/downloads/

The summary is updated periodically. Assure that you have ARI's current document by downloading the files at the time of use.

Appendix G

Laboratory Workflow


Initial Client Contact
Workload Assignment Project Manager Assignment
Laboratory Notification
Entry into Client Service Database
Sample Containers Shipped to Client
Sample Receipt
Sample Receiving
Log-in to LIMS
Generation of Master Data Folder
Project Manager Review
Client Notified of Sample Receipt
Lab Notified through Workload Tracking System
Laboratory Analysis
Laboratory QA Review
Sample and Extracts to Storage
Laboratory Data Reduction
Peer Review of Data
Data Transferred to LIMS
Submission of Data to QC Review
QC Review
Report Generation
Data Reports Submitted to Project Manager for Review
Data Package Compiled
Project Manager Final Review and Approval
Invoice Submitted to Accounting
Original Reports Signed and Delivered to Client
Copy of Final Data Package Archived

Appendix H

Analytical Methods

ORGANIC ANALYSES

Parameter	Methods	Technique
Volatiles (GC/MS)	524.2/624/8260B	GC/MS
	Low Level Vinyl Chloride & 1,1 – Dichloroethene	GC-MS-SIM
Volatiles (GC)		
Volatile Aromatics	602/8021B	GC/PID
Semivolatiles (GC/MS)		
Semivolatile Organics	625/8270D	GC/MS
Polynuclear Aromatic Hydrocarbons (PNA/PAH)	625/8270D	GC/MS (SIM)
Isotope Dilution Semivolatiles	1625	GC/MS
Butyl Tin Species	Krone (1988)	GC/MS-SIM
Pesticides/GC Analyses		
Chlorinated Pesticides	608/8081A	GC/ECD
Aroclors/PCBs	608/8082	GC/ECD
PCB Congeners	ARI Method	GC/ECD
Phenols	604/8041	GC/FID
Chlorinated Phenols	8041 (mod)	GC/ECD
Pentachlorophenol	8151A (mod)	GC/ECD
Organophosphorous Pesticides	614/8141A	GC/NPD
Polynuclear Aromatic Hydrocarbons (PNA/PAH)	610/8100	GC/FID
Chlorinated Hydrocarbons	612/8121	GC/ECD
Herbicides	615/8151A	GC/ECD
Glycols	ARI Method(SOP 426S R2)	GC/FID
Hydrocarbon ID	NWTPH-HCID	GC/FID
Gasoline Range Hydrocarbons	(N)WTPH-G/AK101/WI-GRO	GC/FID
Diesel Range Hydrocarbons	(NWTPH-D/AK102/WI-DRO)	GC/FID
Extractable Petroleum Hydrocarbons	ARI Method	GC/FID
Volatile Petroleum Hydrocarbons	ARI Method	GC/PID
Organic Sample Preparation and Clean Up		
TCLP / SPLP Extraction		1311 / 1312
Sonication		3550B
Soxhlet		3540C
Accelerated Solvent Extraction (ASE)		3545B
Separatory Funnel		3510C
Continuous Liquid-Liquid		3520C
Alumina Clean-up		3610B

Florisil Clean-up	3620B
Gel Permeation (GPC)	3640A
Silica Gel	3630C
Sulfur Clean-up	3660B
Sulfuric Acid Clean-up	3665A

INORGANIC ANALYSES

Parameter	Methods	Technique
Wet Chemistry		
Acidity	2310/305.1	Titrimetric
Alkalinity	2320/310.1	Titrimetric
Ammonia	4500NH_3H/350.1	AutomatedPhenate/ISE
Biological Oxygen Demand-BOD		
Carbonaceous – BOD	5210.B/405.1	5-day Winkler Titration
Bromide	4500Br.B	Phenol Red Colorimetric
Anions	300.0	Ion Chromatography
Cation Exchange Capacity	9080	Neutral Ammonium Acetate
Chemical Oxygen Demand	5220.D/410.4	Closed Reflux, Colorimetric
Chromium Hexavalent (Cr6+)	3500Cr-D/7196A	Diphenylcarbazide
Chloride	4500CI.E/325.2	Automated Ferricyanide
Chlorophyll a	10200.H	Spectrophotometric
Coliform, Total / Fecal	9222.B/D	Membrane Filtration
Color	2120.B/110.2	Visual Comparison
Conductivity	2510/120.1	Electrometric
Corrosivity (CaCO3 Saturation)	2330	Calc. (pH, Alk, TDS, Ca)
Cyanide, Total	4500CN.C/335.2/9010	PBA, Colorometric
Cyanide, Amenable	4500CN.G/335.1	Alkaline Chlorination
Cyanide, WAD	4500CN.I	Weak Acid Distillation
Dissolved Oxygen	4500-O.C/360.2	Winkler Titration
Fats/Oils/Grease	5520.B/413.1/9070A	Gravimetric
Fluoride	4500F.C/340.2	Ion Specific Electrode
	300.0	Ion Chromatography
Formaldehyde	ASTM D-19 P216	Colorimetric
Hardness, Calculation	2340.B/6010B	Ca, Mg Calculation
Heterotrophic Plate Count	9215.D	Membrane Filtration
Iron (II) ferrous	3500Fe.D	Phenanthrolene
Nitrate + Nitrite	4500NO_3F/353.2	Automated Cd Reduction
Nitrate	4500NO_3F/353.2	Calculated
	300.0	Ion Chromatography
Nitrite	4500NO_3.F/353.2mod	Automated Colorimetric
	300.0	Ion Chromatography
Oil & Grease, Solids	5520.D/907	Gravimetric
Oil & Grease, Polar/Non Polar	5520.F	Gravimetric
PH	150.1	Electrometric
Phenols	5530.D/420.1/9065	4-AAP w/ Distillation
Phosphorous, Total	4500P.B/365.2	Colorimetric w/ digestion

Phosphorous, Ortho (SRP)	4500P.B/365.2	Colorimetric
	300.0	Ion Chromatography
Salinity	2520	Conductimetric
Silicate	4500Si.E/370.1	Heteropoly Blue
Total Kjeldahl Nitrogen (TKN)	4500N.org/351.4	Block Digest/ISE
Total Solids	2540.B/160.3	Gravimetric, 104^{o}C
Total Suspended Solids (TSS)	2540.D.160.2	Gravimetric, 104^{o}C
Total Dissolved Solids (TDS)	2540.C/160.1	Gravimetric, 180^{o}C
Total Volatile Solids (TVS)	2540.E/160.4	Gravimetric, 550^{o}C
Settleable Solids	2540.F	Volumetric
Streptococcus, Fecal	9230.C	Membrane Filtration
Sulfide	4500S^{2}.E/376.1/9034	Iodometric
Sulfide, Low Level	4500S^{2}.D/376.2	Methylene Blue
Sulfide, Acid Volatile	4500S^{2}.D/376.2	Methylene Blue
Sulfate	4500SO_4^{2}.F/375.2/9036	Auto. Methylthymol Blue
	300.0	Ion Chromatography
Sulfite	4500SO_3^{2}.B.377.1	Iodometric
Total Organic Carbon (TOC)	5310.B415.1/PSEP	Combustion NDIR
Turbidity	2130.B/180.1	Nephelometric
Total Lipids in Tissue	Bligh & Dyer (mod)	Gravimetric

Trace Metals Analyses

Inductively Coupled Plasma (ICP):

Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Si, Sn, Sr, Th, Ti, Tl, V, (Li, Th, U, W - special request only)	Zn200.7 / 6010B	ICP

Graphite Furnace (GFAA):

Ag, As, Cd, Sb, Pb, Se, Tl	200 Series / 7000 Series	GFAA

Cold Vapor (CVAA):

Hg	7470A/7471A	CVAA

Inductively Coupled Plasma/Mass Spectroscopy (ICP-MS):

Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Th, Tl, U, V, Zn	200.8/ 6020 Mod.	ICP/MS

Trace Metals Sample Preparation

Toxicity Characteristic Leaching Procedure	1311
Synthetic Precipitation Leaching Procedure	1312
Digestion for Total Recoverable or Dissolved Metals	3005A
Digestion of Aqueous Samples for Total Metals by ICP	3010A
Digestion of Aqueous Samples for Total Metals by GFAA	3020A
Digestion of Sediment, Sludge and Soil	3050B

Appendix I

Method Detection Limits and Reporting Limits

Summaries of method specific MDL studies and reporting limits are available on ARI's web site at:

http://www.arilabs.com/portal/downloads/ARI-MDLs.zip

MDL's and reporting are updated periodically. Assure that you have ARI's current detection limit data by downloading the files at the time of use.

Appendix J

Quality Control Recovery Limits

Method specific control limits are available on ARI's web site at:

http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use.

Appendix K

Internal Audit Schedule

Schedule of Laboratory Quality Assurance Audits

Process To Be Audited	Frequency
Verify Effectiveness of Corrective Actions	Monthly
Verify Refrigerator and Freezer Temperature Logs	Monthly*
Verify Oven and Incubator Temperature Logs	Monthly*
Verify That Balance Records Are Complete	Quarterly*
Verify That Standard Records are Complete	Monthly#
Verify That Logbooks Are Reviewed	Monthly#
Verify That SOPs Are Current and Available in Labs	Monthly#
Review Chain of Custody Documentation	Monthly#
Audit Internal Technical Systems	Annually
Post-Completion Project Review	Monthly**

* all sections will be audited

one section will be audited each month

** frequency may be contract specific i.e. 10% of NFESC projects must be audited

Appendix L

Laboratory Accreditations

Laboratory Accreditations

Analytical Resources Inc. is currently certified to perform environmental analysis by the National Environmental Laboratory Accreditation Program (NELAP), the State of Washington Department of Ecology and the State of Alaska Department of Environmental Conservation. ARI is approved to perform analyzes for the US Navy and the US Army Corps of Engineers following the Department of Defense Quality Systems Manual (DoD-QSM)

ARI's laboratory QA/QC Program has been audited and approved by The Boeing Company and Battelle Pacific Northwest Laboratories.

ARI analyzes drinking water, waste water and solid matrix performance testing (PT) samples semiannually.

List of Accreditations

1) National Environmental Laboratory Accreditation Conference (NELAC) – Accrediting authority is Oregon Environmental Laboratory Accreditation Program (ORELAP).
2) State of Washington, Department of Ecology - Environmental Laboratory Accreditation Program
3) The Alaska State Department of Environmental Conservation - Laboratory Approval Program
4) United States Army Corps of Engineers (USACE)
5) United States Naval Facilities Engineering Service Center (NFESC) (formerly known as NEESA)

Continuing Contracts Resulting from On-Site Laboratory Audits

1) The Boeing Company Corporate Environmental Affairs Division
2) The City of Seattle
3) The Port of Seattle

Appendix M

Data Reporting Qualifiers

Data Reporting Qualifiers

Effective 7/10/2009

Inorganic Data

U Indicates that the target analyte was not detected at the reported concentration

* Duplicate RPD is not within established control limits

B Reported value is less than the CRDL but ≥ the Reporting Limit

N Matrix Spike recovery not within established control limits

NA Not Applicable, analyte not spiked

H The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible

L Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U Indicates that the target analyte was not detected at the reported concentration

* Flagged value is not within established control limits

B Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.

J Estimated concentration when the value is less than ARI's established reporting limits

D The spiked compound was not detected due to sample extract dilution

E Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.

Q Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte

NA The flagged analyte was not analyzed for

NR Spiked compound recovery is not reported due to chromatographic interference

NS The flagged analyte was not spiked into the sample

M Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses

M2 The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.

N The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

Y The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

EMPC Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**

C The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column

P The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

X Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**

Z Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.

F Samples were frozen prior to particle size determination

SM Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations

SS Sample did not contain the proportion of “fines” required to perform the pipette portion of the grain size analysis

W Weight of sample in some pipette aliquots was below the level required for accurate weighting

Appendix N

Standards for Personal Conduct

Standards of Conduct

Since effective working relationships depend upon each of us, ARI expects certain minimum standards of personal conduct.

This list highlights general Company expectations and standards and does not include all possible offenses or types of conduct which may result in discipline or discharge. Management reserves the absolute right to determine the appropriate degree of discipline, including discharge, warranted in individual cases.

Employees engaged in the following activities, or similar activities deemed equally serious, will normally be terminated:

theft or embezzlement
disclosure of trade secrets or industrial espionage;
willful violation of safety or security regulations;
conviction of a felony;
working for a competitor or establishing a competing business.

In addition, dismissal may result from other serious offenses such as:

being intoxicated, under the influence or in possession of illegal drugs on the job;
falsification of records;
abuse, destruction, waste or unauthorized use of equipment, facilities or materials;
gambling on the premises;
chronic tardiness or absenteeism;
insubordination;
unwillingness to perform the job;
unauthorized requisition of materials from vendors.

There may be no alcoholic beverages on the Company premises, other than at times designated as Company functions. At such times, non-alcoholic beverages will be provided as well.

Personal and corporate honesty and integrity have built the character of ARI. This good character is fundamental to our well-being, future growth and progress. It is vitally important that we avoid both the fact and the appearance of conflicts of personal interest with that of the firm, its clients, and any other professional contacts.

This policy requires that ARI employees have no relationships or engage in any activities that might impair their independence of judgment. Employees must not accept gifts, benefits, or hospitality that might tend to influence them in the performance of their duties. It is expected that there will be no employment by any competing company, nor any employment by any outside interest or engagement in outside activity which might impair an employee's ability to render the full-time service to the company that employment involves.

If any possible conflict of interest situation arises, the individual concerned must make prior disclosure of the facts so that action may be taken to determine whether a problem exists and,

Standards of Personnel Conduct – continued

if so, how best to eliminate it. Likewise, any financial interest in an organization doing business with ARI or which competes with us should be revealed to Company management. (Excluded from this requirement is ownership of securities traded in major stock exchanges or other recognized trading markets.)

Our standards are those generally expected of employees in any well-regarded, ethical business organization.

ARI further expects that each employee will:

Be dressed and groomed appropriately for a business office. Employees in the laboratory areas are expected to dress in compliance with established safety procedures. Specific standards will be discussed with each employee during Health and Safety orientation. Your supervisor and the Administrative Services Manager always are available to answer questions.

Maintain the confidential nature of Company information. Removal of Company documents, records, stored materials, computer printouts, or any similar information, or copies of such material or information from the office without specific permission is prohibited. Likewise, revealing confidential information to an unauthorized person or using such information in an unauthorized way is prohibited. If there could be any possible question about the applicability of this requirement to a given circumstance, ask your supervisor.

Use Company computer capabilities and facilities only for authorized business at authorized times and locations; observe strictly all computer security measures and precautions; enter, alter or delete no computer instructions or stored material apart from that required by faithful performance of assigned duties; remove, copy, use or permit to be used no computer software developed for, purchased by, or otherwise used by ARI except as required by faithful performance of assigned duties.

Conduct business dealings with clients and members of the public in a courteous manner.

Appendix O

Quality Assurance Policies

QUALITY ASSURANCE POLICY

POLICY NUMBER: 1

SUBJECT: CORRECTIONS TO DATA/BENCHSHEETS

DATE: 8/2/96

Manual corrections made on any raw data, bench sheet, logbook or document used during sample processing will be made in the following manner:

1. Draw a single line through the information to be deleted or corrected. The original information must remain readable.

2. Enter any new information, preferably above the original information.

3. Initial and date the correction.

QUALITY ASSURANCE POLICY

POLICY NUMBER: 2

SUBJECT: LINING OUT UNUSED BENCHSHEET PORTIONS

DATE: 8/2/96

All unused portions of logbook pages and benchsheets will be lined through so that information cannot be added at a later date. This will be completed in the following manner:

1. Line out unused portions of a logbook page or benchsheet by drawing a single line or "Z" through the unused portions.

2. Initial and date the page beside the lineout.

3. Do not line out a page or section until it is certain that no additional information will be added to the unused portions.

QUALITY ASSURANCE POLICY

POLICY NUMBER: 3

SUBJECT: STOP WORK ORDERS

DATE: 8/28/96

It is the responsibility of all staff members to address situations that may require the issuance of a "stop work order". Potential and actual "stop work orders" will be handled as follows:

1. If an analyst or technician observes a situation which will or may have a negative impact on data quality, that person will notify her/his section supervisor immediately.

2. The section supervisor will assess the situation. If it appears that a "stop work order" may be required, the section supervisor will notify the appropriate manager (inorganic or organic).

3. The supervisor and manager will then decide if a "stop work order" should be issued. The manager will make a final decision on whether or not to issue a "stop work order". The incident will be reported to the Quality Assurance Program Manager using a Corrective Action Request form.

4. If a "stop work order" is issued, the manager will inform the Project Managers and the QA section. The section supervisor will notify section staff of the order.

5. The laboratory manager involved will oversee the development and implementation of a Corrective Action Plan (CAP). Upon completion of the CAP the "stop work order" may be rescinded.

6. Prior to rescinding a "stop work order", verification must be made that control has been regained and that work may begin. Only the inorganic or organic manager may rescind a "stop work order".

7. When the "stop work order" is rescinded, the Project Managers, analytical staff and QA section will be notified. The QA section will require documentation verifying that the procedure is back in control.

QUALITY ASSURANCE POLICY

POLICY NUMBER: **4**

SUBJECT: **SOP Review**

DATE: **9/3/96**

All Standard Operating Procedure (SOP) documents will be reviewed and updated at least annually by qualified staff members. Laboratory management will review and approve all modifications to the SOPs.

QUALITY ASSURANCE POLICY

POLICY NUMBER: 5

SUBJECT: Reporting Dilutions

DATE: 9/11/96

Dilution factors will be recorded as whole numbers followed by "X" (i.e., 5X, 10X, etc.). This reporting convention will be used on run logs, bench sheets, raw data and final reports for all diluted samples, extracts or digestates or standards.

QUALITY ASSURANCE POLICY

POLICY NUMBER: 6

SUBJECT: Formatting for SOPs – Computer Related

DATE: 1/31/00

Conventions for formatting computer-related instructions in SOPs

Commands should be indented and formatted as **`bold courier`** and one or two font sizes smaller:

```
USE PARAMS ORDER PARAMS
BROW
```

Many systems and languages are *case-sensitive*, and case should match the syntax and/or stylistic standards of the language.

If only one command, like ***SET CENTURY ON***, is needed, it can be included in the rest of the text, so long as it is also italicized.

If the user must substitute a particular value in place of a general descriptor, italicize the descriptor, make it lowercase, and *do not make it bold*:

```
USE PARAMS ORDER PARAMS
COPY TO TEMPARM FOR JOB = 'job' .AND. SAMPLE = 'sample'
```

In general, keywords, variable names, formatting codes, and descriptors should be in *courier* and *italicized*.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**7**
SUBJECT:	**Manual Adjustment of Data**
DATE of IMPLEMENTATION:	**1/1/01**

Modern chromatographic instruments include computer software to identify a detector response as a chromatographic peak, characterize that peak and determine the relative height or area of the signal. The software utilizes parameters (threshold, slope, etc) that are adjusted by the instrument operator to optimize the results.

A single set of operator controlled settings that determine peak characteristics for an entire data file is defined as an "automated procedure". An automated procedure often characterizes chromatographic peaks incorrectly. ARI requires that trained analysts identify and resolve these errors using an alternate automated procedure or a "manual adjustment" of the data. Manual adjustment is defined as the process used by an analyst to adjust an individual peak or a subset of data in a chromatographic file.

1. The settings for a routine automated procedure normally used to process chromatographic data must be described in the method Standard Operating Procedure (SOP).

2. Trained analysts may substitute one automated procedure for another in order to optimize peak characteristics. The use of an alternate automated procedure must be permanently documented using either a software generated log file or analyst notes.

3. Manual adjustment of chromatographic peak characteristics will be used to correct the results of an automated procedure that, in a trained analyst's opinion, are clearly incorrect and will result in erroneous peak identification, integration or quantification.

4. Manual adjustment will be implemented in a reasonable and consistent manner. Guidelines for performing manual adjustment will be documented in method SOPs.

5. All manually adjusted data will be clearly identified for approval in the data review process. A permanent record of all manual adjustments will be maintained in both electronic and hardcopy versions of the raw data.

6. Manual adjustment of chromatographic files will not be used to falsify data for any purpose. Falsification of data through the use of manual peak adjustment is unethical, unlawful and will result in termination of the offending analyst.

Approval:

_____

Quality Assurance Program Manager Date

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**8**
SUBJECT:	**Performance Evaluation Samples**
IMPLEMENTATION DATE:	**1/1/01**

Performance Evaluation Samples (PES) will be analyzed on a periodic basis to monitor laboratory performance and/or meet the requirements of an external accreditation program. PES samples contain target analytes in concentrations unknown to laboratory personnel. PES may be submitted by a third party or prepared internally under the direction of ARI's QA personnel.

PES will be submitted blind to the laboratory whenever possible.

PES will be logged-in, prepared, analyzed and reported as a routine sample without special consideration.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**9**
SUBJECT:	**Modifications to Analytical Methods Procedures or Reports**
DATE of IMPLEMENTATION:	**8/24/05**

This Policy defines the processes used to initiate and validate modifications to analytical processes, QA/QC protocol, data processing programs and algorithms, data reporting formats or other changes to analytical procedures or SOPs at Analytical Resources Inc. (ARI). The procedures outlined will also be used to validate project specific changes to analytical protocol and new analytical methods.

Changes to analytical procedures must be approved by ARI's Management (Managers and/or Supervisors) and be well documented using the following procedure:

1. Modification may be requested by any staff member. The modification must be requested using ARI's Corrective Actions Tracking System. Corrective Action requests for changes to analytical protocol or reports will assigned to the appropriate manager or supervisor by the initiator. As an alternative the request may be assigned to the QA Section. The Corrective Actions assignee may approve the project or re-assign the request for approval to a third party. The QA Section will monitor the progress of all requests.

2. The requestor must detail and justify the proposed modifications or additions when initiating a Corrective Action issue. Modifications must be approved by ARI management prior to any work performed to establish the modification.

3. The following must be in place before final approval and/or implementation of the proposed modification.

A. A new or revised SOP as appropriate including the modification or new protocol.
B. An Initial Demonstration of Proficiency as defined in ARI SOP 1018S for new or modified analytical procedures.
C. An MDL study following the procedure in ARI SOP 1018S for new or modified analytical procedure.
D. When appropriate, successful analysis of a blind Performance Evaluation Sample using new or modified procedures or data processing protocol.
E. Documentation that new or modified software provides the desired result.

4. ARI staff must have sufficient training to implement the procedural changes.

5. Notification of the modifications must be distributed to all affected personnel including appropriate client personnel.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**10**
SUBJECT:	**Reporting of Target and Spiked Analytes For Dual Column GC Analyses**
DATE of IMPLEMENTATION:	**8/24/05**

Analytical Resources Inc. uses single injection, dual column gas chromatographs to simultaneously identify and confirm the presence of target or spiked analytes in some GC analyses. Only one quantitative value is reported for each target or spiked analyte. ARI's policy for deciding which value to report is outlined as follows:

1. ARI considers each column equally valid for compound identification and quantification. Both GC columns must be compliant with all quality assurance parameters outlined in ARI's SOPs and LQAP. Both GC columns must produce valid initial and continuing calibrations using the same calibration model.

2. The analytical value reported will be determined by comparison of the quantitative results of confirmed analytes as follows.

a. The relative percent difference (RPD) between the results on the two columns (R_1 & R_2) is calculated using the formula:

$$RPD = \frac{|R_1 - R_2|}{\left(\frac{R_1 + R_2}{2}\right)} \times 100$$

b. If the RPD is less than 40% the greater of the two values is reported for both target analytes and spiked compounds. When required by specific QA protocol, by contract or client request the lower value will be reported for target analytes.

c. If the RPD is greater than 40%, ARI's analyst must examine the chromatogram for anomalies (overlapping peaks, incorrect integration, negative peaks) and either correct the anomalies (i.e. perform manual integrations) or report the most appropriate target analyte value. The higher value will be reported for spiked analytes. ARI's analyst must provide a written evaluation of all analyses where an RPD exceeds 40% and this information must be passed on to ARI's client or the data user.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**11**
SUBJECT:	**Calculation of Analytical Uncertainty**
DATE of IMPLEMENTATION:	**8/31/06**

Analytical Resources Inc. will use the procedure[1] proposed by Thomas Georgian, PhD to estimate analytical uncertainty. Dr. Georgian's proposes using the formulae below to calculate uncertainty:

For biased corrected analytical results:

100 (c/R)(1± L / R)
Where:
c = Measured concentration of the analyte
R = Average LCS spike recovery
L = ½ the warning or control range

And for unbiased results i.e. R = 100

c (± L / 100)

Example:

For a 10 ppb analytical result when the mean LCS recovery is 50% and the control limits are 20% to 80% an interval for the analytical results is calculated as follows:

100 (10 ppb / 50)(1±30 / 50) = 20 ± 12 ppb

[1] Estimation of Laboratory Analytical Uncertainty Using Laboratory Control Samples, Thomas Georgian, Ph.D., *Environmental Testing & Analysis*, November/December 2000.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**12**
SUBJECT:	**Rounding of Numbers and Reporting Limits**
DATE of IMPLEMENTATION:	**8/24/05**

I. ARI reports analytical results in concentration units as follows:

A. Values expressed as a concentration (mg/L, µg/Kg etc.)

1. Values less than or equal 10 are reported using 2 significant figures.
2. Values greater than 10 are reported using 2 or 3 significant figures.

B. Values expressed as percent (control limits, RSD etc.) are reported using the appropriate whole number. Examples: 6.38 rounds to 6, 9.95 rounds to 10, 99.93 rounds to 100, 145.48 rounds to 145.

II. ARI rounds numbers to the appropriate level of precision using the following rules:

A. If the figure following those to be retained is greater than or equal to 5, the absolute value of the result is to be rounded up: otherwise, the absolute value of the result is rounded down. Examples: -0.4365 rounds to -0.437 and 2.3564 rounds to -2.356; 11.443 is rounded down to 11.44 and 11.455 is rounded up to 11.46.

B. When a series of multiple operations is performed (add, subtract, divide, multiply), all significant figures are carried through the calculations and the final result is rounded to the appropriate number of significant figures.

III. ARI compares concentration values to reporting limits prior to rounding final concentration values. Example: with an RL of 0.50, 0.499 is undetected at 0.50 (0.50U) and 0.504 is detected at 0.50.

III. ARI will round quality control results prior to determining if the value is in control. Example: for spike recovery limits of ± 10% (90 – 110%), a recovery of 110.47is in control at 110% and a calculated recovery of 110.50 is out of control at 111%.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**12**
SUBJECT:	**Use of "J" Flag when Reporting Analytical Data**
DATE of IMPLEMENTATION:	**3/1/09**

1. ARI uses a "J" flag to indicate that a quantitative result chemical analysis is an estimated value. In general, "J" flags note positively identified compounds that are not in an instrument's verified calibrated range.
2. A "J" indicates quantitative values with a high degree of uncertainty. Data users must consider the greater uncertainty when using "J" flagged quantitative values.
3. ARI will not use "J" flags when reporting the results of metals analyses. Instrumental analysis of metals is subject to inter-element interference, non-specific absorption and sample-to-sample carryover that make quantification of elements below the reporting limit difficult. MDL studies performed on clean sample matrices are not subject to these interferences.
4. ARI will not report analytes below the RL ("J" flag is not used) for any single column GC analysis. (HCID, TPH-D, BTEX, TPH-G, RSK-175, Direct Aqueous Injection)
5. ARI uses "J" flags when reporting results of GC-MS (VOA and SVOA) and dual column GC analyses using the following criteria:
   A. All analyses must meet ARI established QA criteria for calibration and spike recovery.
   B. Analytes must meet method specific identification criteria (i.e. spectral match, retention time and/or relative retention time).
   C. The analyte concentration must exceed the greater of either the MDL or ½ the reporting limit before a "J" flag is applied.
   D. An analyte in a method blank will be "J" flagged only when any associated sample contains the same analyte.
   E. The application of a "J" flag is discretionary, depending on the professional judgment of ARI's data reviewers. GC-MS parameters such as ion ratios, spectral match, background contamination and instrument noise are weighted when considering the application of "J" flags.
6. Some typical circumstances that may warrant the use of a "J" flag:
   A. A compound identified at a concentration between the MDL or ½ RL and ARI's reporting limit (normally the low concentration used to calibrate the instrument).
   B. The quantified values in a dual column GC analysis differ by > 40% with obvious interference on one column. ARI may report the value with the lowest concentration or the least interference.
   C. The analyte is present at low concentration due to extract dilution and identified in a previous analysis of less dilute extract.
   D. Analytes < the RL and reported in previous analyses from the same sampling site.
   E. An analyte is < the RL in a sample and greater than the RL a duplicate or replicate analysis. This often applies to Matrix Spike and Laboratory Control Samples and their duplicates.

Appendix P

Modifications to ARI's LQAP

Modifications to ARI's LQAP

New Revision	Date	Modifications
		1. Updated Appendix D – Instrument/Equipment List 2. Specified length of data archive in Section 5.5
12-010	1/4/08	1. Edit Sections 4.4.1, 4.4.2, 4.4.3.2, 5.5, 6.3 (subcontracting), 8.3, 9.1 (MDLs) and 13 for Navy CAP. 2. Transferred Containers, Preservative & HT Table from Appendix F to Web
12-009	7/21/07	1. Updated SOP list in Appendix E 2. Updated Instrument List in Appendix D 3. Updated Accreditations Appendix L 4. Removed SOP table to web-site
12-008	12/20/06	1. Added Methane, Ethane & Ethene Info to Appendix F Table 2. Updated SOP Table in Appendix E 3. Modified Internal Audit Schedule 4. Archived SOP 355S and removed it from list in Appendix E 5. Updated Instrument / Equipment List in Appendix D
12-007	4/11/06	1. Removed Appendix J – Tuning Criteria are in the SOP 2. Changed BOD RL from 1 to 2 ppm 3. Integrated all SVOA Soil/Sediment MDLs into One Table 4. Added SIM Analysis to Soil/Sediment SVOA MDL Table 5. Added SIM Analysis to Water SVOA MDL Table 6. Updated MDL for SVOA in Water 7. Updated MDLV for Pesticides in Soil (25g to 5mL) 8. Updated MDLV for Pesticides in Soil (12g to 4mL) 9. Updated MDLV for PCB in Water (500 to 1mL) 10. Updated MDLV for PCB in Water (500 to 5mL) 11. Updated MDLV for Chlorinated Phenols in Water (500 to 50mL) 12. Removed Appendix I – MDL & RL Summaries 13. Updated MDL for SIM-PNA 14. Updated MDLV for SIM-PNA 15. Removed Appendix K – Control Limits
12-006	1/16/06	1. Updated MDL for TBT in Pore Water 2. Updated MDL and MDLV for Toxaphene in Soil/Sediment 3. Updated MDLV for VOA 8260B 20 mL Purge 4. Added IDL, MDL & RL for Low RL Mercury 5. Updated all Metals MDL Verifications 6. Updated MDLV for Water VOA using 5 mL purge 7. Updated MDLV for PCB in Soil with Soxhlet Extraction 8. Updated MDLV for SVOA (8270D) Analysis of Water using SepFunnel 9. Updated MDL for GC-MS-SIM Analysis of Skydrol & BHT in Water 10. Updated MDL for Chlorophenols (8041) in Soil 11. Modified RL for Chlorophenols in Soil & Tissue 12. Added Headspace GC (FID5) to Instrument List 13. Updated Footnotes on Glycols RL Table 14. Modified RL for 1,4-Dioxane in Water Method 8270D 15. Updated MDL for Analysis of Soil for VOA 16. Updated MDL for Analysis of Soil for JP-8 17. Updated MDL for Analysis of Sediment for TBT 18. Updated MDLV for Analysis of TBT in Water and Tissue 19. Added MDL for Analysis of PCB in Tissue with 4 ppb RL 20. Updated MDLV for PCB Analysis of Soil (Soxhlet) and Tissue (4 ppb) 21. Updated MDLV for Manchester Analysis of PCB in Water 22. Updated MDLV for Analysis of Gasoline in Soil and Water 23. Updated MDLV for Analysis of BTEX in Soil and Water 23. Updated MDLV for Analysis of Motor Oil in Soil and Water

		24. Updated MDLV for Analysis of VOA-SIM in Water 25. Updated MDLV for Analysis of VOA (20 mL) in Water 26. Updated MDL Table for Conventionals 27. Updated MDLV for Pesticides in Water (500 to .5 mL) 28. Updated MDLV for PCB Analysis of Soil 29. Updated MDLV for Chlorophenols (8041) in Soil 30. Updated MDLV for JP4 in Water and Soil 31. Updated MDLV for JP8 in Soil 32. Updated MDLV for VOA (8260B) in Water 5 mL & 20 mL Purge Volumes 33. Updated MDL for PCB in Soil – Standard Analysis & Medium Level 34. Updated MDL for Pesticides in Water – Standard Analysis 35. Updated MDL for SVOA in Water – Liq-Liq Extraction 36. Updated MDLV for Chlorophenols in Water
12-005	10/24/05	1. Added MDL for Chlorinated Phenol Analysis of Tissue (Method 8041) 2. Modified QA Policy 10 3. Established Implementation Date for QA Policies 09 & 10 4. Updated MDLV for TBT in Water 5. Corrected MDL Value for bis-(2-Ethylhexyl)-phthalate in SVOA Tissue 6. Updated MDL for Pesticides in Soil 7. Modified Title Format of Selected MDL Tables 8. References to 8270 or 8270C changed to 8270D 9. Deleted MDL Tables for SVOA Analyses of Tissue 10. Updated MDLs for SIM-PNA in Water (SepFunnel) and Soil 11. Updated MDLV for Metals 12. Updated MDLV for Manchester Pesticides 13. Updated MDLV for TPH-D In Soil 14. Updated MDLV for SIM-PNA in Water with Liq-Liq Extraction 15. Updated MDLV for JP-4 in Soil 16. Updated MDLV for VOA Water 5 mL Purge 17. Corrected MTCA RL for Methoxyclor & Manchester RL for all Pesticides 18. Updated MDL for Manchester Beta-BHC to reflect latest MDLV 19. Corrected Tissue Pesticide RLs 20. Updated MDLV for LVI-SIM-PNA in Water with Liq-Liq Extraction 21. Updated MDL for VOA-SIM Analysis of Aqueous Samples 22. Updated MDLV for PCB in Water (500 to 5 mL) 23. Updated MDLV for Diesel in Water (NWTPH-D & AK102) 24. Updated MDLV for Chlorophenols in Aqueous Samples 25. Updated MDLV for Chlorophenols in Tissue Samples 26. Removed & Archived Modifications to LQAP for 2002 & 2003 27. Updated MDL for Skydrol/BHT Analysis in Water Using 8270-SIM 28. Removed Direct Aqueous Injection MDLs RL Table. 29. Updated SOP Table (Appendix E)
12-004	8/19/05	1. Added “A” Flag for GeoTech to Appendix N. 2. Updated MDL for JP-4 in Soil 3. Updated MDL for Pesticides in Tissue 4. Updated MDLV for JP-4 in Soil 5. Updated MDLV for Pesticides in Soil 6. Updated MDLV for Pesticides in Water 7. Updated MDLV for PCB in Soil (25g to 1 mL) 8. Updated MDLV for PCB in Water (500 to 5 mL) 9. Updated MDLV for TPH-D in Water 10. Updated MDLV for PNA-SIM in Water (Liq-Liq Extraction) 11. Updated MDLV for VOA in Water (5 mL 8260B) 12. Updated MDLV for VOA in Water (20 mL 8260B) 13. Updated MDL for PSDDA SVOA in Sediment 14. Updated Appendix E – SOP List 15. Corrected MDL for Pesticides in Soil Information (IA-80 not GU-32)

		16. Corrected Reporting Limits for TBT in Water, Sediment & Tissue 17. Added Control Limits for 1,4-Dioxane to SVOA List 18. Added low level RLs for BTEX Compounds 19. Updated MDLV for TBT in Pore Water 20. Updated MDLV for BTEX Water & Soil 21. Updated MDLV for TPH-G in Water & Soil 22. Updated Appendix E SOP Table 23. Updated MDLV for Motor Oil in Soil Using ASE 24. Updated MDLV for Motor Oil in Soil Using MicroTip 25. Updated MDLV for Motor Oil in Water Using SepFunnel 26. Updated MDLV for JP-4 in Water Using SepFunnel
12-003	7/15/05	1. Added MDLV for 5 mL VOA Analysis of Water – Method 8260B 2. Updated MDL for MTCA PCB in Water Samples 3. Added MDL for Soxhlet Extraction of PCBs 4. Removed Aroclor 1242 from MDL Table 5. Control Limits for HEM Changed to Equal Those in SOP 648S 6. Updated MDL for PSDDA PCB Analysis. 7. Added MDL for TBT in Tissue 8. Updated MDL for 20 mL 8260B 9. Updated MDLV for SIM-VOA 10. Updated MDL for Pesticides in Soil 11. Updated MDLV for TPH-D in Soil 12. Added MDLV for PSEP Level Pesticides in Sediment 13. Updated (added missing compounds) PSDDA SVOA MDLs 14. Updated & Corrected Appendix F (Containers & Preservatives) 15. Added “A” Flag for GeoTech to Appendix N.
12-002	6/9/05	1. Updated Motor Oil MDL (NWTPH-Dext & AK103) for Soil 2. Documented MDLV for Gasoline in Soil (Methods NWTPH-G & AK101) 3. Corrected units for DRO & RRO MDL for water from mg/kg to mg/L 4. Added MDL for JP-4 in Water using Sep Funnel Extraction 5. Updated MDL for Sediment Analysis (Krone) of TBT using Sonication 6. Updated MDL for SVOA Water SepFunnel 7. Noted that BTEX –SIM MDL in Table was Medium Level Extraction 8. Added MDL Verification Information for ICP Metals 9. Updated MDL for TBT in Water and Pore Water – SepFunnel 10.Updated MDLV for TPH-D Water – SepFunnel 11. Added EPH and VPH RL Tables 12. Added MDLV for JP-4 Analysis of Water – Sep Funnel 13. Added MDLV for BTEX analysis of Soil 14. Added MDLV for SVOA Water - SepFunnel 15. Added MDLV for TBT Sediment 16. Updated MDL for PSEP Pesticides in Sediment/Soil 17. Updated MDL for Chlorinated Phenols in Water 18. Updated MDL for Pesticides in Water – SepFunnel 19. Added MDLV for 524.5 20. Added MDLV for Metals 21. Updated MDL for Manchester Pesticides 22. Added Appendices to the Table of Contents 23. Added MDL for PCB Analysis of Tissue
12-001	4/5/05	1. List of SOPs (Appendix E) Modified & Updated as Appropriate 2. MDL Verification for DRO in Soil Added 3. MDL Verification for PCB Water Standard Analysis (HO-24) Added 4. AK-101 Removed from BTEX MDL Table for Water 5. Metals IDLs & MDLs Updated 6. BTEX MDL for Analysis of Water and Soil Updated 7. RL for 1,4-Dioxane in SVOA Analysis of Water Changed from 1.0 to 5.0 8. Control Limits for BTEX and Gasoline updated

		9. MDL for Gasoline in Soil Updated 10.MDL for Diesel and Motor Oil in Soil Updated. 11. Split TPH-G Table into Aqueous and Soil Table & added MDLV for Water 12. Entered updated MDLs for SIM-LVI-PNA 13. Changed RL for 20 mL 1,2-Dibromo-3-Chloropropane from 2 to 0.5 ppb 14. Updated MDLs for 524.2 15. Updated Conventionals MDLs 16. Updated MDLs for 5 mL VOA analysis of Water Samples (8260B) 17. Modified MDL Table for TPH-D Analysis of Water 18. Updated TPH-D and TPH-Dext MDL for Water Analyses. 19. Removed EPH and VPH MDLs from the LQAP
11-028	12/31/04	1. Modified definition of "Y" flag in Appendix N 2. Updated MDL for TPH-D Soil 3. Updated Appendix M - Laboratory Certification and Accreditation
11-027	12/15/04	1. Updated SOP List in Appendix E. 2. Added AK-101 to BTEX/GRO Control Limit Table. 3. Lowered RL for Benzene in MDL Summary for Method 8021B 4. Added Additional Surrogates to VOA-SIM BTEX Control Limit Table 5. Corrected BTEX MDLs for 8260-SIM to Reflect Sample Conc. Not On-Column values 6. Updated SOP Table in Appendix E 7. Modified VOA 5 mL Water RLs - Acrylonitrile & 1,2,3-Trichloropropane 8. Modified VOA mL Soil RL – 4-Methyl-2-Pentanone 9. Corrected MDL Value for Methoxychlor in PSDDA Sediment Analysis. 10.Modified definition of "Y" Flag in Appendix N 11.Updated MDL for BTEX Water PID-2 12.Updated MDL for Pesticides MTCA Analysis of Water 13.Updated MDL for PSDDA SVOA Analysis 14.Updated MDL for VOA Soil 15.Updated MDL for SVOA, Water, Liq-Liq 16.Updated MDL for Various PCB (1660) Analyses 17.Updated MDL for TPH-G – Water & Soil 18.Updated MDL for SVOA Soil Micro Sonication 19.Added MDL for Manchester Aroclor 1254 20.Modified Control Limits for EPH Analyses 21.Deleted MDL Table for SVOA, Soil, MacroTIp Extraction 22.Deleted MDL for Soil Skydrol/BHT, GC-MS-SIM 23.Updated Instrumentation Listing (Appendix D)
11-026	11/02/04	1. Updated Control Limits for SIM-PNA 2. Added Control Limit Table for Full Scan PNA Analysis (Method 8270D) 3. Updated SIM-PNA Water MDL for NT-1 4. Updated Appendix E – SOPs 5. Modified PCB MDL Table –Remove Manchester & Combine PSEP/Low Level Sediment MDLs 6. Updated MDL for VOA SIM Water NT3 7. Updated MDL Table for SIM Skydrol/BHT in Water 8. Updated SOP Table in Appendix E.
11-025	9/16/04	1. Added new Appendix N listing Data Qualifiers & changed designations for Appendices N, O & P to O,P & Q respectively 2. Updated MDL Table for PCB Analyses. 3. Combined MDL tables for SVOA Water & Deleted Sep Funnel Table 4. Updated PCB & TPH-D MDL Tables 5. Updated Equipment List (Appendix D) & added GeoTech Equipment 6. Revised MDL Table for FID Analysis of Polar SVOA (EPA Method 8015) 7. Updated MDLs for Pesticide analysis of soil. 8. Sediment Pesticide MDLs added to Soil Table, Sediment Table Deleted 9. Control Limit for MS Recovery of Pyrene in Sediment Corrected

		10.Updated Cyclohexanone MDL (Finn 1, 20 mL purge) 11.Updated SIM-PNA Soil MDL for NT-1 12. Edited MDL Tables for SVOA for consistency and accuracy 13. Modified EPH Reporting Limits 14. Revised formatting on most MDL tables. 15. Corrected dates for VOA Control Limit data 16. Deleted analytes except cyclohexanone from VOA MDL Table for Project Specific Analytes. 17. Added BTEX in Soil to VOA-SIM MDL Table 18. Added Manchester MDL to PCB Table 19. Updated Skydrol/BHT Control Limits
11-024	7/19/04	1. Revised and Updated MDL Tables for TPH Analyses of Soil/Sediment. 2. Revised and Updated MDL Tables for PCB Analyses. Combined All PCB MDL into One Table. 3. Deleted all other MDL tables 4. Updated MDL for VOA analysis of Soil using ARI's In-house Method. 5. Added 1-Methylnaphthalene to SIM-PNA MDL Tables for Water & Soil 6. Updated Appendix D (Lab Equipment) and added GeoTech Section 7. Combined Water & Soil SIM-PNA MDL Tables into One Table 8. Deleted Water-SF & Soil SIM-PNA MDL Tables 9. Updated MDLs for Pesticide – Manchester Extraction 10. Revised VOA Water Control Limits Table 11. Updated MDLs for VOA analysis of Water-8260B-5mL purge
11-023	7/6/04	1. Corrected Conventionals MDL/RL Table 2. Corrected Control Limit for TPH-D MS Recovery in Water Samples. 3. Updated MDLs for NWTPH-D Soil ASE & MicroTip. 4. Removed HPLC MDL Table for analysis of PNA. 5. Removed MDL Table for HCID 6. Removed FID-3B from TPH MDL Tables 7. Updated MDLs & Modified Table for SVOA-PSEP analysis of Sediments 8. Revised Section 11 9. Updated MDL for VOA (524.2) analysis of Water 10. Removed MDLs for VOA-SIM analysis of Soil 11. Updated MDL Table for VOA-Water 20 mL 12. Updated MDL Table for VOA-Water 5 mL
11-022	5/17/04	1. Corrected Extract Final Volume in MDL table for Sediment PCB 2. Deleted FINN 8 from all MDL Tables 3. Corrected RL for Hg in Water.
11-021	5/07/04	1. Implemented default control limits for EPA Method 524.2 2. Decreased RL for Aroclor 1221 to level of other Aroclors 3. Eliminated Control Limits for VOA using ARI SOP 804S. 4 Updated VOA 8260B full scan control limits for water & sediment/soil 5. Updated 10 mL purge VOA-SIM control limits for water 6. Changed effective date for VOA-SIM BTEX control limits 7. Updated 8270-SIM-PNA control limits for water & sediment/soil 8. Updated BTS control limits for water & soil.
11-020	4/26/04	1. Updated MDL (PID1 & 2) for BTEX in water 2. Updated MDL (PID 1) for gasoline in water 3. Deleted MDL Table for ASE extraction of chlorinated pesticides 4. Updated MDL for VOA water 5 mL purge 8260B on NT3 5. Updated MDL for pesticide in water separatory funnel on ECD3 6. Added MDL Table for VPH in water and soil 7. Deleted Control Limit Table for HPLC PNA 8. Updated PCB control limits 9. Updated Herbicide control limits 10. RL for Sulfate to 2.0 & 20.0 ppm for water & solids respectively 11. Updated TPH-D Control Limits

		12. Updated Chlorinated Phenols Control Limits 13. Updated BTEX & TPH-G Control Limits 14. Corrected Pesticide MTCA MDL Table 15. Corrected RL for GC-ECD analyses of HCBD & HCB
11-019	3/11/04	1. Revised holding time for Total Solids in soil & sediment from 7 days to 14 days. 2. Updated MDLs for SVOA water L/L NT4 & NT 6. 3. Updated Metals IDLs and MDLs 4. Added QA Policy 9 – Modifications to method, protocol or reports 5. Updated Conventionals MDLs 6. Added QA Policy 10 – Reporting of dual column GC analytes
11-018	1/21/04	1. Revised Control Limits for GC-MS analysis of SVOA 2. Revised Control Limits for Chlorinated pesticides 3. Updated Appendix E – Table of SOPs 4. Updated and Revised Appendix F – Sample Containers, Preservation and Holding Times 5. Modified Sign-of Sheet to include only QA manager
11-017	1/4/04	1. Minor revisions to Section 13 2. Revisions to subcontracting language in Section 6.3

APPENDIX B

Project Laboratory Control Limits

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Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
1,1,1-Trichloroethane	SW-846 8260C	71-125	64-142	30
1,1,2,2-Tetrachloroethane	SW-846 8260C	71-123	40-152	30
1,1,2-Trichloroethane	SW-846 8260C	80-120	54-139	30
1,1-Dichloroethane	SW-846 8260C	80-120	63-142	30
1,1-Dichloroethene	SW-846 8260C	73-123	61-149	30
1,2-Dichloroethane	SW-846 8260C	71-129	68-131	30
1,2-Dichloropropane	SW-846 8260C	80-120	62-135	30
112Trichloro122trifluoroethane	SW-846 8260C	61-126	56-156	30
2-Butanone	SW-846 8260C	46-153	37-163	30
2-Hexanone	SW-846 8260C	45-155	32-160	30
4-Methyl-2-pentanone	SW-846 8260C	61-134	46-139	30
Acetone	SW-846 8260C	32-209	31-195	30
Benzene	SW-846 8260C	80-120	55-143	30
Bromodichloromethane	SW-846 8260C	78-120	53-136	30
Bromoform	SW-846 8260C	70-120	38-124	30
Bromomethane	SW-846 8260C	32-162	42-168	30
Carbon Disulfide	SW-846 8260C	67-122	48-146	30
Carbon Tetrachloride	SW-846 8260C	69-122	45-153	30
Chlorobenzene	SW-846 8260C	80-120	49-135	30
Chloroethane	SW-846 8260C	37-154	39-152	30
Chloroform	SW-846 8260C	80-120	61-142	30
Chloromethane	SW-846 8260C	54-132	51-163	30
Dibromochloromethane	SW-846 8260C	77-120	51-128	30
Ethylbenzene	SW-846 8260C	80-120	44-141	30
Methylene Chloride	SW-846 8260C	76-124	61-141	30
Styrene	SW-846 8260C	76-120	35-134	30
Tetrachloroethene	SW-846 8260C	77-120	42-149	30
Toluene	SW-846 8260C	80-120	50-146	30
Trichloroethene	SW-846 8260C	80-120	53-144	30
Trichlorofluoromethane	SW-846 8260C	58-133	47-163	30
Vinyl Acetate	SW-846 8260C	56-137	21-139	30
Vinyl Chloride	SW-846 8260C	53-120	50-154	30
cis-1,2-Dichloroethene	SW-846 8260C	80-120	60-136	30
cis-1,3-Dichloropropene	SW-846 8260C	80-120	51-131	30
m+p-Xylene	SW-846 8260C	80-120	44-137	30
o-Xylene	SW-846 8260C	80-120	42-137	30
trans-1,2-Dichloroethene	SW-846 8260C	79-120	59-142	30
trans-1,3-Dichloropropene	SW-846 8260C	77-120	49-129	30

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
Trichloroethene	SW-846 8260C SIM	70-130	70-130	30
Tetrachloroethene	SW-846 8260C SIM	70-130	70-130	30
Vinyl Chloride	SW-846 8260C SIM	70-130	70-130	30
1,1,1-Trichloroethane	SW-846 8260C	80-121	81-152	30
1,1,2,2-Tetrachloroethane	SW-846 8260C	80-125	70-125	30
1,1,2-Trichloroethane	SW-846 8260C	80-120	85-129	30
1,1-Dichloroethane	SW-846 8260C	80-120	89-128	30
1,1-Dichloroethene	SW-846 8260C	80-123	88-137	30
1,2-Dichloroethane	SW-846 8260C	80-127	83-143	30
1,2-Dichloropropane	SW-846 8260C	80-120	83-126	30
112Trichloro122trifluoroethane	SW-846 8260C	78-132	87-158	30
2-Butanone	SW-846 8260C	70-130	58-168	30
2-Hexanone	SW-846 8260C	75-124	63-145	30
4-Methyl-2-pentanone	SW-846 8260C	70-123	69-133	30
Acetone	SW-846 8260C	74-137	57-163	30
Benzene	SW-846 8260C	80-120	87-126	30
Bromodichloromethane	SW-846 8260C	80-120	82-133	30
Bromoform	SW-846 8260C	70-128	65-126	30
Bromomethane	SW-846 8260C	66-124	77-122	30
Carbon Disulfide	SW-846 8260C	73-133	82-147	30
Carbon Tetrachloride	SW-846 8260C	80-129	79-136	30
Chlorobenzene	SW-846 8260C	80-120	87-120	30
Chloroethane	SW-846 8260C	67-124	70-139	30
Chloroform	SW-846 8260C	80-120	86-136	30
Chloromethane	SW-846 8260C	55-135	55-152	30
Dibromochloromethane	SW-846 8260C	80-120	79-125	30
Ethylbenzene	SW-846 8260C	80-120	80-140	30
Methylene Chloride	SW-846 8260C	80-120	84-122	30
Styrene	SW-846 8260C	80-120	39-162	30
Tetrachloroethene	SW-846 8260C	80-120	86-129	30
Toluene	SW-846 8260C	80-120	83-127	30
Trichloroethene	SW-846 8260C	80-120	85-131	30
Trichlorofluoromethane	SW-846 8260C	71-126	81-149	30
Vinyl Acetate	SW-846 8260C	57-157	57-159	30
Vinyl Chloride	SW-846 8260C	55-126	74-132	30
cis-1,2-Dichloroethene	SW-846 8260C	80-120	82-129	30
cis-1,3-Dichloropropene	SW-846 8260C	74-120	63-127	30
m+p-Xylene	SW-846 8260C	80-120	84-125	30
o-Xylene	SW-846 8260C	80-120	84-125	30
trans-1,2-Dichloroethene	SW-846 8260C	80-120	88-127	30
trans-1,3-Dichloropropene	SW-846 8260C	80-120	71-128	30

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Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
1,2,4-Trichlorobenzene	SW-846 8270D	71-112	72-117	30
1,2-Dichlorobenzene	SW-846 8270D	55-118	71-107	30
1,3-Dichlorobenzene	SW-846 8270D	61-111	64-116	30
1,4-Dichlorobenzene	SW-846 8270D	53-119	69-116	30
1,4-Dioxane	SW-846 8270D	32-78	37-79	30
1-Methylnaphthalene	SW-846 8270D	78-105	79-111	30
2,2'-oxybis(1-Chloropropane)	SW-846 8270D	65-113	68-119	30
2,4,5-Trichlorophenol	SW-846 8270D	79-107	26-158	30
2,4,6-Trichlorophenol	SW-846 8270D	76-120	19-162	30
2,4-Dichlorophenol	SW-846 8270D	77-117	30-154	30
2,4-Dimethylphenol	SW-846 8270D	72-110	10-151	30
2,4-Dinitrophenol	SW-846 8270D	52-131	20-168	30
2,4-Dinitrotoluene	SW-846 8270D	76-119	70-124	30
2,6-Dinitrotoluene	SW-846 8270D	76-118	81-129	30
2-Chloronaphthalene	SW-846 8270D	43-132	49-141	30
2-Chlorophenol	SW-846 8270D	71-114	27-146	30
2-Methylnaphthalene	SW-846 8270D	69-108	80-111	30
2-Methylphenol	SW-846 8270D	58-110	10-146	30
2-Nitroaniline	SW-846 8270D	75-120	80-126	30
2-Nitrophenol	SW-846 8270D	76-118	55-142	30
3,3'-Dichlorobenzidine	SW-846 8270D	37-117	16-128	30
3-Nitroaniline	SW-846 8270D	74-113	73-119	30
4,6-Dinitro-2-methylphenol	SW-846 8270D	65-126	44-154	30
4-Bromophenyl-phenylether	SW-846 8270D	75-115	79-118	30
4-Chloro-3-methylphenol	SW-846 8270D	70-123	19-155	30
4-Chloroaniline	SW-846 8270D	43-116	43-116	30
4-Chlorophenyl-phenylether	SW-846 8270D	77-114	73-117	30
4-Methylphenol	SW-846 8270D	49-108	10-147	30
4-Nitroaniline	SW-846 8270D	59-100	46-117	30
4-Nitrophenol	SW-846 8270D	16-78	10-109	30
Acenaphthene	SW-846 8270D	75-114	78-107	30
Acenaphthylene	SW-846 8270D	80-122	75-124	30
Anthracene	SW-846 8270D	76-115	78-114	30
Benzo(a)anthracene	SW-846 8270D	75-116	76-114	30
Benzo(a)pyrene	SW-846 8270D	64-126	80-128	30
Benzo(b)fluoranthene	SW-846 8270D	66-125	65-125	30
Benzo(g,h,i)perylene	SW-846 8270D	66-132	72-122	30
Benzo(k)fluoranthene	SW-846 8270D	66-131	71-121	30
Benzoic acid	SW-846 8270D	Oct-69	Oct-88	30
Benzyl alcohol	SW-846 8270D	66-97	65-96	30
Butylbenzylphthalate	SW-846 8270D	77-115	68-122	30
Carbazole	SW-846 8270D	75-120	82-112	30
Chrysene	SW-846 8270D	76-116	78-116	30
Di-n-butylphthalate	SW-846 8270D	76-115	79-118	30
Di-n-octylphthalate	SW-846 8270D	68-128	77-139	30
Dibenz(a,h)anthracene	SW-846 8270D	67-131	73-133	30
Dibenzofuran	SW-846 8270D	75-117	71-116	30
Diethylphthalate	SW-846 8270D	66-116	74-118	30
Dimethylphthalate	SW-846 8270D	29-138	38-126	30
Fluoranthene	SW-846 8270D	76-119	73-110	30
Fluorene	SW-846 8270D	76-116	71-123	30
Hexachlorobenzene	SW-846 8270D	75-119	77-122	30
Hexachlorobutadiene	SW-846 8270D	57-124	68-123	30
Hexachlorocyclopentadiene	SW-846 8270D	36-118	23-149	30
Hexachloroethane	SW-846 8270D	52-113	54-119	30
Indeno(1,2,3-cd)pyrene	SW-846 8270D	69-121	69-120	30

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
Isophorone	SW-846 8270D	74-117	73-114	30
N-Nitroso-di-n-propylamine	SW-846 8270D	69-110	72-119	30
N-Nitrosodiphenylamine	SW-846 8270D	67-136	74-122	30
Naphthalene	SW-846 8270D	70-111	73-113	30
Nitrobenzene	SW-846 8270D	75-109	75-121	30
Pentachlorophenol	SW-846 8270D	53-110	23-133	30
Phenanthrene	SW-846 8270D	76-113	72-121	30
Phenol	SW-846 8270D	21-67	Oct-83	30
Pyrene	SW-846 8270D	75-119	77-117	30
bis(2-Chloroethoxy)methane	SW-846 8270D	74-124	80-117	30
bis(2-Chloroethyl)ether	SW-846 8270D	77-108	78-115	30
bis(2-Ethylhexyl)phthalate	SW-846 8270D	78-117	72-122	30

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
1,2,4-Trichlorobenzene	SW-846 8270D	81-119	31-139	30
1,2-Dichlorobenzene	SW-846 8270D	79-112	41-132	30
1,3-Dichlorobenzene	SW-846 8270D	79-113	32-134	30
1,4-Dichlorobenzene	SW-846 8270D	79-112	32-134	30
1,4-Dioxane	SW-846 8270D	38-75	31-77	30
1-Methylnaphthalene	SW-846 8270D	77-115	26-148	30
2,2'-oxybis(1-Chloropropane)	SW-846 8270D	59-127	38-134	30
2,4,5-Trichlorophenol	SW-846 8270D	84-109	41-141	30
2,4,6-Trichlorophenol	SW-846 8270D	81-123	41-142	30
2,4-Dichlorophenol	SW-846 8270D	81-123	54-135	30
2,4-Dimethylphenol	SW-846 8270D	83-120	49-134	30
2,4-Dinitrophenol	SW-846 8270D	28-131	20-143	30
2,4-Dinitrotoluene	SW-846 8270D	80-116	39-144	30
2,6-Dinitrotoluene	SW-846 8270D	79-115	44-140	30
2-Chloronaphthalene	SW-846 8270D	50-117	22-131	30
2-Chlorophenol	SW-846 8270D	83-119	54-139	30
2-Methylnaphthalene	SW-846 8270D	79-110	45-134	30
2-Methylphenol	SW-846 8270D	75-126	47-143	30
2-Nitroaniline	SW-846 8270D	83-118	46-146	30
2-Nitrophenol	SW-846 8270D	81-114	39-142	30
3,3'-Dichlorobenzidine	SW-846 8270D	17-116	10-143	30
3-Nitroaniline	SW-846 8270D	66-114	15-153	30
4,6-Dinitro-2-methylphenol	SW-846 8270D	60-113	10-148	30
4-Bromophenyl-phenylether	SW-846 8270D	79-117	46-131	30
4-Chloro-3-methylphenol	SW-846 8270D	74-119	50-137	30
4-Chloroaniline	SW-846 8270D	Oct-97	11-114	30
4-Chlorophenyl-phenylether	SW-846 8270D	79-110	42-130	30
4-Methylphenol	SW-846 8270D	74-116	36-149	30
4-Nitroaniline	SW-846 8270D	52-92	17-142	30
4-Nitrophenol	SW-846 8270D	57-131	25-142	30
Acenaphthene	SW-846 8270D	83-111	41-135	30
Acenaphthylene	SW-846 8270D	68-120	47-137	30
Anthracene	SW-846 8270D	83-111	40-147	30
Benzo(a)anthracene	SW-846 8270D	73-123	32-150	30
Benzo(a)pyrene	SW-846 8270D	63-138	30-150	30
Benzo(b)fluoranthene	SW-846 8270D	61-133	29-150	30
Benzo(g,h,i)perylene	SW-846 8270D	63-130	31-152	30
Benzo(k)fluoranthene	SW-846 8270D	71-135	35-148	30
Benzoic acid	SW-846 8270D	41-122	23-170	30
Benzyl alcohol	SW-846 8270D	68-111	52-137	30
Butylbenzylphthalate	SW-846 8270D	77-125	42-146	30
Carbazole	SW-846 8270D	83-111	36-148	30
Chrysene	SW-846 8270D	73-119	30-139	30
Di-n-butylphthalate	SW-846 8270D	79-112	44-143	30
Di-n-octylphthalate	SW-846 8270D	65-141	43-149	30
Dibenz(a,h)anthracene	SW-846 8270D	67-129	37-151	30
Dibenzofuran	SW-846 8270D	78-116	38-148	30
Diethylphthalate	SW-846 8270D	82-113	53-132	30
Dimethylphthalate	SW-846 8270D	80-120	26-141	30
Fluoranthene	SW-846 8270D	80-113	30-151	30
Fluorene	SW-846 8270D	81-117	44-137	30
Hexachlorobenzene	SW-846 8270D	79-115	38-143	30
Hexachlorobutadiene	SW-846 8270D	70-112	33-133	30
Hexachlorocyclopentadiene	SW-846 8270D	64-127	10-153	30
Hexachloroethane	SW-846 8270D	76-109	24-138	30
Indeno(1,2,3-cd)pyrene	SW-846 8270D	64-128	31-154	30

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
Isophorone	SW-846 8270D	72-107	54-122	30
N-Nitroso-di-n-propylamine	SW-846 8270D	70-113	46-128	30
N-Nitrosodiphenylamine	SW-846 8270D	79-124	42-144	30
Naphthalene	SW-846 8270D	77-115	35-141	30
Nitrobenzene	SW-846 8270D	78-122	51-130	30
Pentachlorophenol	SW-846 8270D	50-133	23-145	30
Phenanthrene	SW-846 8270D	77-119	34-147	30
Phenol	SW-846 8270D	69-126	39-151	30
Pyrene	SW-846 8270D	80-121	29-148	30
bis(2-Chloroethoxy)methane	SW-846 8270D	75-121	49-125	30
bis(2-Chloroethyl)ether	SW-846 8270D	77-115	45-139	30
bis(2-Ethylhexyl)phthalate	SW-846 8270D	75-124	38-151	30

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
PCB-1016	SW-846 8082	64-121	29-146	50
PCB-1221	SW-846 8082	NA	-	
PCB-1232	SW-846 8082	NA	-	
PCB-1242	SW-846 8082	75-125	-	
PCB-1248	SW-846 8082	NA	-	
PCB-1254	SW-846 8082	60-130	50-130	50
PCB-1260	SW-846 8082	72-123	39-149	50

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
Aroclor-1016	SW-846 8082 Low Level	51-128	48-125	30
Aroclor-1221	SW-846 8082 Low Level	NA	-	
Aroclor-1232	SW-846 8082 Low Level	NA	-	
Aroclor-1242	SW-846 8082 Low Level	NA	-	
Aroclor-1248	SW-846 8082 Low Level	NA	-	
Aroclor-1254	SW-846 8082 Low Level	-	50-130	30
Aroclor-1260	SW-846 8082 Low Level	56-135	54-127	30
PCB-1262	SW-846 8082 Low Level	NA	-	
PCB-1268	SW-846 8082 Low Level	NA	-	
Aroclor-1016	SW-846 8082	51-128	48-125	30
Aroclor-1221	SW-846 8082	NA	-	
Aroclor-1232	SW-846 8082	NA	-	
Aroclor-1242	SW-846 8082	NA	-	
Aroclor-1248	SW-846 8082	NA	-	
Aroclor-1254	SW-846 8082	60-130	50-130	30
Aroclor-1260	SW-846 8082	56-135	54-127	30
PCB-1262	SW-846 8082	NA	-	
PCB-1268	SW-846 8082	NA	-	

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
PCB-1016	SW-846 8082	65-113	48-150	50
PCB-1221	SW-846 8082	NA	-	50
PCB-1232	SW-846 8082	NA	-	50
PCB-1242	SW-846 8082	50-125	75-125	50
PCB-1248	SW-846 8082	75-125	-	50
PCB-1254	SW-846 8082	60-130	50-130	40
PCB-1260	SW-846 8082	69-134	50-148	50

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
Benzene	8021B	80-120	80-130	30
Ethylbenzene	8021B	80-120	80-133	30
Toluene	8021B	80-120	80-133	30
m,p- Xylene	8021B	80-120	80-148	30
o-Xylene	8021B	80-120	80-148	30

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
Benzene	8021B	76-118	52-135	30
Ethylbenzene	8021B	77-115	56-132	30
Toluene	8021B	80-120	59-129	30
m,p- Xylene	8021B	78-115	66-112	30
o-Xylene	8021B	78-115	66-112	30

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
Alkalinity to pH 4.5	Standard Method 2320	98-103	73-121	5
Hexavalent Chromium	US EPA 7199	89.5-110.4	59-135	20
Hexavalent Chromium	US EPA 7199 - soil	75-125	80-120	20
Sulfate	USEPA 300	90-110	90-110	20
Total Organic Carbon	US EPA 415.1	91-113	63-142	3
Total Organic Carbon	US EPA 415.1 - soil	22-139	24-149	13

Analyte	Water											
	EPA Method 6020			EPA Method 200.8			EPA Method 6010B			EPA Method 7470A		
	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %
Arsenic	86-111	75-125	20	85-115	70-130	20	89-115	81-123	20	--	--	--
Cadmium	90-114	79-118	20	85-115	79-118	20	90-112	83-116	20	--	--	--
Chromium	90-118	83-116	20	85-115	83-116	20	90-110	81-120	20	--	--	--
Copper	90-113	84-116	20	85-115	80-121	20	90-112	86-122	20	--	--	--
Lead	90-115	83-120	20	85-115	83-120	20	88-110	75-125	20	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	80-120	80-120	20
Selenium	85-114	75-125	20	85-115	70-130	20	80-120	75-125	20	--	--	--
Silver	90-115	82-116	20	85-115	82-116	20	83-120	75-125	20	--	--	--
Thallium	89-116	85-114	20	85-115	85-114	20	85-113	80-120		--	--	--
Zinc	90-119	75-125	20	85-115	70-130	20	90-110	75-125	20	--	--	--

Analyte	Soil / Sediment											
	EPA Method 6020			EPA Method 200.8			EPA Method 6010B			EPA Method 7471A		
	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %
Arsenic	80-120	75-125	20	--	--	--	80-120	75-125	20	--	--	--
Cadmium	80-120	75-125	20	--	--	--	80-120	75-125	20	--	--	--
Chromium	80-120	75-125	20	--	--	--	80-120	75-125	20	--	--	--
Copper	80-120	75-125	20	--	--	--	80-120	75-125	20	--	--	--
Lead	80-120	75-125	20	--	--	--	80-120	75-125	20	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	80-120	80-120	20
Selenium	80-120	75-125	20	--	--	--	80-120	75-125	20	--	--	--
Silver	80-120	75-125	20	--	--	--	80-120	75-125	20	--	--	--
Thallium	80-120	75-125	20	--	--	--	80-120	75-115	20	--	--	--
Zinc	80-120	75-125	20	--	--	--	80-120	75-125	20	--	--	--

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
>C10-C12 Aliphatic	ECY 97-602 WA EPH	30-137	31-118	30
>C10-C12 Aromatic	ECY 97-602 WA EPH	30-140	64-130	30
>C12-C16 Aliphatic	ECY 97-602 WA EPH	68-116	62-130	30
>C12-C16 Aromatic	ECY 97-602 WA EPH	30-149	67-130	30
>C16-C21 Aliphatic	ECY 97-602 WA EPH	81-116	70-130	30
>C16-C21 Aromatic	ECY 97-602 WA EPH	30-148	40-140	30
>C21-C34 Aliphatic	ECY 97-602 WA EPH	44-133	44-133	30
>C21-C34 Aromatic	ECY 97-602 WA EPH	57-127	40-140	30
Benzene	ECY 97-602 WA VPH	70-130	70-130	50
C5-C6 Aliphatic Hydrocarbons	ECY 97-602 WA VPH	70-130	70-130	50
C6-C8 Aliphatic Hydrocarbons	ECY 97-602 WA VPH	70-130	70-130	50
C8-C10 Aliphatic Hydrocarbons	ECY 97-602 WA VPH	70-130	70-130	50
C8-C10 Aromatic Hydrocarbons	ECY 97-602 WA VPH	70-130	70-130	50
Ethylbenzene	ECY 97-602 WA VPH	70-130	70-130	50
Methyl t-butyl ether	ECY 97-602 WA VPH	70-130	70-130	50
Toluene	ECY 97-602 WA VPH	70-130	70-130	50
m,p-Xylenes	ECY 97-602 WA VPH	70-130	70-130	50
o-Xylene	ECY 97-602 WA VPH	70-130	70-130	50
Acetylene	RSK-175	75-125	75-125	20
Ethane	RSK-175	80-120	34-153	20
Ethene	RSK-175	80-120	35-162	20
Methane	RSK-175	80-120	35-157	20

Compound	Method	LCS/LCSD Windows	MS/MSD Windows	Spike Max RPD
>C10-C12 Aliphatic	ECY 97-602 WA EPH	31-137	31-137	50
>C10-C12 Aromatic	ECY 97-602 WA EPH	22-119	22-119	50
>C12-C16 Aliphatic	ECY 97-602 WA EPH	42-146	42-146	50
>C12-C16 Aromatic	ECY 97-602 WA EPH	24-136	42-122	50
>C16-C21 Aliphatic	ECY 97-602 WA EPH	57-111	57-111	50
>C16-C21 Aromatic	ECY 97-602 WA EPH	34-143	53-132	50
>C21-C34 Aliphatic	ECY 97-602 WA EPH	50-124	38-120	50
>C21-C34 Aromatic	ECY 97-602 WA EPH	44-134	55-126	50
Benzene	ECY 97-602 WA VPH	70-130	70-130	50
C5-C6 Aliphatic Hydrocarbons	ECY 97-602 WA VPH	70-130	70-130	50
C6-C8 Aliphatic Hydrocarbons	ECY 97-602 WA VPH	70-130	70-130	50
C8-C10 Aliphatic Hydrocarbons	ECY 97-602 WA VPH	70-130	70-130	50
C8-C10 Aromatic Hydrocarbons	ECY 97-602 WA VPH	70-130	70-130	50
Ethylbenzene	ECY 97-602 WA VPH	70-130	70-130	50
Methyl t-butyl ether	ECY 97-602 WA VPH	70-130	70-130	50
Toluene	ECY 97-602 WA VPH	70-130	70-130	50
m,p-Xylenes	ECY 97-602 WA VPH	70-130	70-130	50
o-Xylene	ECY 97-602 WA VPH	70-130	70-130	50

LOD[1], LOQ[2] and Control Limits Summary for VOA Analysis of Water 10 mL Purge Volume (EPA Methods 8260C)

Analyte	DL[1] µg/L	LOD[1] µg/L	LOQ[1] µg/L	LCS Recovery[2]	Replicate RPD[3]
Chloromethane	0.095	0.25	**0.5**	69 – 122	≤ 40
Vinyl Chloride	0.057	0.1	**0.2**	**80** – **120**	≤ 40
Bromomethane	0.252	0.5	**1.0**	71 – 120	≤ 40
Chloroethane	0.086	0.1	**0.2**	**80** – **120**	≤ 40
Trichlorofluoromethane	0.037	0.1	**0.2**	**80** – **120**	≤ 40
Acrolein	2.476	2.5	**5.0**	69 – 126	≤ 40
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.043	0.1	**0.2**	**80** – 121	≤ 40
Acetone	2.057	2.5	**5.0**	71 – **120**	≤ 40
1,1-Dichloroethene	0.054	0.1	**0.2**	**80** – **120**	≤ 40
Bromoethane	0.041	0.1	**0.2**	**80** – **120**	≤ 40
Iodomethane	0.227	0.5	**1.0**	76 – 120	≤ 40
Methylene Chloride	0.485	0.5	**1.0**	**80** – **120**	≤ 40
Acrylonitrile	0.604	1.0	**1.0**	79 – **120**	≤ 40
Carbon Disulfide	0.037	0.1	**0.2**	**80** – **120**	≤ 40
trans-1,2-Dichloroethene	0.048	0.1	**0.2**	**80** – **120**	≤ 40
Vinyl Acetate	0.069	0.1	**0.2**	**80** – **120**	≤ 40
1,1-Dichloroethane	0.053	0.1	**0.2**	**80** – **120**	≤ 40
2-Butanone	0.814	2.5	**5.0**	**80** – **120**	≤ 40
2,2-Dichloropropane	0.052	0.1	**0.2**	**80** – **120**	≤ 40
cis-1,2-Dichloroethene	0.043	0.1	**0.2**	**80** – **120**	≤ 40
Chloroform	0.027	0.1	**0.2**	**80** – **120**	≤ 40
Bromochloromethane	0.061	0.1	**0.2**	**80** – **120**	≤ 40
1,1,1-Trichloroethane	0.041	0.1	**0.2**	**80** – **120**	≤ 40
1,1-Dichloropropene	0.034	0.1	**0.2**	**80** – **120**	≤ 40
Carbon Tetrachloride	0.044	0.1	**0.2**	**80** – **120**	≤ 40
1,2-Dichloroethane	0.072	0.1	**0.2**	**80** – **120**	≤ 40
Benzene	0.027	0.1	**0.2**	**80** – **120**	≤ 40
Trichloroethene	0.049	0.1	**0.2**	**80** – **120**	≤ 40
1,2-Dichloropropane	0.035	0.1	**0.2**	**80** – **120**	≤ 40
Bromodichloromethane	0.051	0.1	**0.2**	**80** – **120**	≤ 40
Dibromomethane	0.145	0.2	**0.2**	**80** – **120**	≤ 40
2-Chloroethylvinyl Ether	0.250	0.5	**1.0**	**80** – **120**	≤ 40
4-Methyl-2-Pentanone	0.974	2.5	**5.0**	**80** – **120**	≤ 40
cis 1,3-dichloropropene	0.061	0.1	**0.2**	**80** – **120**	≤ 40
Toluene	0.040	0.1	**0.2**	**80** – **120**	≤ 40
trans 1,3-Dichloropropene	0.081	0.1	**0.2**	**80** – **120**	≤ 40
2-Hexanone	0.902	2.5	**5.0**	**80** – **120**	≤ 40
1,1,2-Trichloroethane	0.129	0.2	**0.2**	**80** – **120**	≤ 40
1,3-Dichloropropane	0.062	0.1	**0.2**	**80** – **120**	≤ 40
Tetrachloroethene	0.047	0.1	**0.2**	**80** – **120**	≤ 40
Dibromochloromethane	0.048	0.1	**0.2**	**80** – **120**	≤ 40
1,2-Dibromoethane	0.075	0.1	**0.2**	**80** – **120**	≤ 40

LOD[1], LOQ[2] and Control Limits Summary for VOA Analysis of Water 10 mL Purge Volume (EPA Methods 8260C)

Analyte	DL[1] µg/L	LOD[1] µg/L	LOQ[1] µg/L	LCS Recovery[2]	Replicate RPD[3]
Chlorobenzene	0.023	0.1	**0.2**	**80 – 120**	≤ 40
Ethyl Benzene	0.037	0.1	**0.2**	**80 – 120**	≤ 40
1,1,1,2-Tetrachloroethane	0.040	0.1	**0.2**	**80 – 120**	≤ 40
m,p-xylene	0.052	0.2	**0.4**	**80 – 120**	≤ 40
o-Xylene	0.035	0.1	**0.2**	**80 – 120**	≤ 40
Styrene	0.045	0.1	**0.2**	**80 – 120**	≤ 40
Bromoform	0.062	0.1	**0.2**	**80 – 120**	≤ 40
1,1,2,2-Tetrachloroethane	0.060	0.1	**0.2**	**80 – 120**	≤ 40
1,2,3-Trichloropropane	0.131	0.25	**0.5**	**80 – 120**	≤ 40
trans-1,4-Dichloro 2-Butene	0.324	0.5	**1.0**	74 – 122	≤ 40
n-Propyl Benzene	0.023	0.1	**0.2**	**80 – 120**	≤ 40
Bromobenzene	0.060	0.1	**0.2**	**80 – 120**	≤ 40
iso-propyl Benzene	0.021	0.1	**0.2**	**80 – 120**	≤ 40
2-Chloro Toluene	0.024	0.1	**0.2**	**80 – 120**	≤ 40
4-Chloro Toluene	0.016	0.1	**0.2**	**80 – 120**	≤ 40
tert-Butyl Benzene	0.026	0.1	**0.2**	**80 – 120**	≤ 40
1,3,5-Trimethyl Benzene	0.015	0.1	**0.2**	**80 – 120**	≤ 40
1,2,4-Trimethylbenzene	0.024	0.1	**0.2**	**80 – 120**	≤ 40
sec-Butyl Benzene	0.024	0.1	**0.2**	**80 – 120**	≤ 40
4-Isopropyl Toluene	0.026	0.1	**0.2**	**80 – 120**	≤ 40
1,3-Dichlorobenzene	0.036	0.1	**0.2**	**80 – 120**	≤ 40
1,4-Dichlorobenzene	0.040	0.1	**0.2**	**80 – 120**	≤ 40
n-Butyl Benzene	0.025	0.1	**0.2**	**80 – 120**	≤ 40
1,2-Dichlorobenzene	0.036	0.1	**0.2**	**80 – 120**	≤ 40
1,2-Dibromo 3-Chloropropane	0.366	0.5	**0.5**	76 – **120**	≤ 40
1,2,4-Trichlorobenzene	0.107	0.25	**0.5**	77 – **120**	≤ 40
Hexachloro-1,3-Butadiene	0.073	0.25	**0.5**	77 – 120	≤ 40
Naphthalene	0.118	0.25	**0.5**	76 – **120**	≤ 40
1,2,3-Trichlorobenzene	0.110	0.25	**0.5**	79 – **120**	≤ 40
Dichlorodifluoromethane	0.052	0.1	**0.2**	69 – 122	≤ 40
Methyl-*tert*-butyl ether	0.073	0.25	**0.5**	**80 – 120**	≤ 40
Surrogate Standards			**MB / LCS**	**Samples**	**RPD**
Dibromofluoromethane			**80 – 120**	**80 – 120**	≤ 40
1,2-Dichlorobenzene-d_4			**80 – 120**	**80 – 120**	≤ 40
Toluene-d_8			**80 – 120**	**80 – 120**	≤ 40
4-Bromofluorobenzene			**80 – 120**	**80 – 120**	≤ 40

(1) Detection Limit (DL), Limit of Detection (LOD) and Limit of Quantitation (LOQ) are defined in ARI SOP 1018S
(2) Control limits calculated using all data from 7/1/09 through 6/30/10.
(3) Relative Percent Difference between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then

$$RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$$

Spike Recovery Control Limits for Extractable Petroleum Hydrocarbons (EPH) Washington Department of Ecology Interim Method[1,2]

Effective: 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

	ARI's Calculated Control Limits [3]	
Sample Matrix	Water	Soil / Sediment
Sample Amount / Final Volume:	500 mL / 1 mL	10 g / 1 mL
LCS Spike Recovery [4]		
C8-C10 Aliphatics	**10** - **100**	21 - **100**
C10-C12 Aliphatics	14 - **100**	23 - **100**
C12-C16 Aliphatics	43 - 110	30 - 120
C16-C21 Aliphatics	44 - 122	32 - 129
C10-C12 Aromatics	16 - 105	20 - 109
C12-C16 Aromatics	42 - 116	30 - 125
C16-C21 Aromatics	55 - 127	37 - 135
C21-C34 Aromatics	54 - 136	45 - 137
Method Blank/LCS Surrogate Recovery		
Ortho-Terphenyl	44 - 133	34 - 133
1-Chloro-octadecane	38 - 121	27 - 128
Sample Surrogate Recovery		
Ortho-Terphenyl	39 - 141	**10** - 143
1-Chloro-octadecane	42 - 120	39 - 131

(1) Control limits calculated using all available data for 1/1/08 through 11/30/08.
(2) Analytical method published in: *Washington State Department of Ecology, Analytical Methods for Petroleum Hydrocarbons, Publication No. ECY 97-602, June 1997*
(3) Highlighted control limits (**bold font**) adjusted to demonstrate that ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit.
(4) Laboratory Control Sample (LCS) spike recovery control limits also used as advisory control limits for sample matrix spike (MS) analyzes. MS recovery values are advisory and not used to assess the acceptability of an analytical batch.

Spike Recovery Control Limits for Volatile Petroleum Hydrocarbons (VPH) Washington Department of Ecology Method[1,2]

Effective 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

	ARI's Calculated Control Limits	
Sample Matrix	Water	Soil / Sediment
Sample Amount / Final Volume:	500 mL / 1 mL	10 g / 1 mL
LCS Spike Recovery [3,4]		
C8-10 Aromatics	70 - 130	70 - 130
>C10-C12 Aromatics	70 - 130	70 - 130
>C12-C13 Aromatics	70 - 130	70 - 130
C5-C6 Aliphatics	70 - 130	70 - 130
>C6-C8 Aliphatics	70 - 130	70 - 130
>C8-C10 Aliphatics	70 - 130	70 - 130
>C10-C12 Aliphatics	70 - 130	70 - 130
Surrogate Recovery [5]		
2,5-Dibromotoluene	60 - 140	60 - 140

(1) Analytical method published in: *Washington State Department of Ecology, Analytical Methods for Petroleum Hydrocarbons, Publication No. ECY 97-602, June 1997*, "Method for the Determination of Volatile Petroleum Hydrocarbons".
(2) Control limits specified in the published method.
(3) Laboratory Control Sample (LCS) spike recovery control limits also used as advisory control limits for sample matrix spike (MS) analyzes. MS recovery values are advisory and not used to assess the acceptability of an analytical batch.
(4) The published method refers to a "laboratory fortified blank" (LFB) instead of LCS
(5) Applies to all analyzes including blanks, samples and QA analyzes (MB, LFB, MS, etc.)

Spike Recovery Control Limits for Natural Attenuation Parameters (Methane, Ethane, Ethene) EPA Method RSK-175 [1,2]

Effective 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use.
http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Sample Matrix:	**Water**
LCS Spike Recovery [3]	
Methane	**80 - 120**
Ethane	**80 - 120**
Ethene	**80 - 120**
Acetylene	73 - 123
Method Blank/LCS Surrogate Recovery	
Propane	79 - 132
Sample Surrogate Recovery	
Propane	72 - 122

(1) ARI's Control limits calculated using all available spike recovery data from 1/1/08 to 3/31/09

(2) Highlighted control limits (bold font) are adjusted from the calculated values as follows:

a) Highlighted control limits (**bold font**) adjusted to demonstrate that ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit.

b) Control limits for analyzes with no separate preparation procedure are adjusted to reflect the minimum uncertainty in the calibration of the instrument allowed by the referenced analytical method.

(3) Laboratory Control Sample (LCS) spike recovery control limits also used as advisory control limits for sample matrix spike (MS) analyzes. MS recovery values are advisory and not used to assess the acceptability of an analytical batch.

Quality Control Parameters for Metals Analysis using ICP-MS

Analyte	Mass	Aqueous Samples[2]			Spike Recovery		RPD [4]	Solids[3]
		DL[1] µg/L	LOD[1] µg/L	LOQ[1] µg/L	Matrix Spike	LCS		LOQ[1] mg/kg
Aluminum	27	1.601	10	**20.0**	75 – 125	80 – 120	≤ 20	**20.0**
Antimony	121	0.010	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
	123	0.011	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Arsenic #1	75	0.048	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Arsenic #2	75	0.092	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Barium	135	0.020	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
	137	0.019	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Beryllium	9	0.021	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Cadmium	111	0.010	0.05	**0.1**	75 – 125	80 – 120	≤ 20	**0.1**
	114	0.005	0.05	**0.1**	75 – 125	80 – 120	≤ 20	**0.1**
Calcium	43	3.983	25	**50.0**	75 – 125	80 – 120	≤ 20	**50.0**
Chromium	52	0.045	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
	53	0.118	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Cobalt	59	0.011	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Copper	63	0.158	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
	65	0.236	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Iron	54	5.753	10	**20.0**	75 – 125	80 – 120	≤ 20	**20.0**
	57	3.876	10	**20.0**	75 – 125	80 – 120	≤ 20	**20.0**
Lead	208	0.046	0.05	**0.1**	75 – 125	80 – 120	≤ 20	**0.1**
Magnesium	24	0.297	10	**20.0**	75 – 125	80 – 120	≤ 20	**20.0**
Manganese	55	0.022	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Molybdenum	98	0.013	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Nickel	60	0.079	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
	62	0.089	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Potassium	39	2.944	10	**20.0**	75 – 125	80 – 120	≤ 20	**20.0**
Selenium	82	0.127	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
	78	0.324	0.25	**2.0**	75 – 125	80 – 120	≤ 20	**2.0**
Silver	107	0.008	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Sodium	23	2.833	50	**100.0**	75 – 125	80 – 120	≤ 20	**100.0**
Thorium	232	0.013	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Thallium	205	0.004	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Uranium	238	0.003	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Vanadium	51	0.043	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Zinc	66	0.497	2	**4.0**	75 – 125	80 – 120	≤ 20	**4.0**
	67	0.531	2	**4.0**	75 – 125	80 – 120	≤ 20	**4.0**
	68	0.524	2	**4.0**	75 – 125	80 – 120	≤ 20	**4.0**

(1) Detection Limit (DL), Limit of Detection Limit (LOD) and Limit of Quantitation (LOQ) as defined in ARI SOP 1018S
(2) 50 mL sample and 50 mL final volume
(3) Solids LOQ based on 100% solids using 1.0 g sample with 100 mL final volume.
(4) Relative Percent Difference between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then

$$RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$$

Quality Control Parameters for Mercury Analysis using CVAA

	Aqueous Samples[2]			Spike Recovery		RPD[5]
	DL[1] µg/L	LOD[1] µg/L	LOQ[1] µg/L	Matrix Spike	LCS	
Mercury	0.0069	0.05	**0.10**[2]	75 – 125	80 – 120	≤ 20
Mercury (low level)	0.0026	0.01	**0.02**[3]	75 – 125	80 – 120	≤ 20
	Soil / Sediment / Tissue[4] Samples			**Spike Recovery**		**RPD**[5]
	DL[1] mg/kg	**LOD[1] mg/kg**	**LOQ[1] mg/kg**	**Matrix Spike**	**LCS**	
Mercury	0.0021	0.0125	**0.025**[3,4]	75 – 125	80 – 120	≤ 20

(1) Detection Limit (DL), Limit of Detection Limit (LOD) and Limit of Quantitation (LOQ) as defined in ARI SOP 1018S
(2) 20 mL sample with 20 mL final volume
(3) 0.2 g sample with 50 mL final volume assuming 100% dry weight. Soil and sediment are reported on a dry weight basis.
(4) Tissue LOQ is 0.005 mg/kg as received (wet weight) based on 1 g sample with 50 mL final volume.
(5) Relative Percent Difference between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then

$$RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$$

Spike Recovery Control Limits for Conventional Wet Chemistry

Effective 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

	ARI's Control Limits	
Sample Matrix:	Water	Soil / Sediment
Matrix Spike Recoveries	% Recovery	% Recovery
Ammonia	75 - 125	75 - 125
Bromide	75 125	75 - 125
Chloride	75 125	75 - 125
Cyanide	75 - 125	75 - 125
Ferrous Iron	75 - 125	75 - 125
Fluoride	75 - 125	75 - 125
Formaldehyde	75 - 125	75 - 125
Hexane Extractable Material	-- - --	78 - 114
Hexavalent Chromium	75 - 125	75 - 125
Nitrate/Nitrite	75 - 125	75 - 125
Oil and Grease	75 - 125	75 - 125
Phenol	75 - 125	75 - 125
Phosphorous	75 - 125	75 - 125
Sulfate	75 - 125	75 - 125
Sulfide	75 - 125	75 - 125
Total Kjeldahl Nitrogen	75 - 125	75 - 125
Total Organic Carbon	75 - 125	75 - 125
Duplicate RPDs		
Acidity	±20%	±20%
Alkalinity	±20%	±20%
BOD	±20%	±20%
Cation Exchange	±20%	±20%
COD	±20%	±20%
Conductivity	±20%	±20%
Salinity	±20%	±20%
Solids	±20%	±20%
Turbidity	±20%	±20%

Spike Recovery Control Limits for Analysis of Solid Samples
Volatile Organic Compounds (VOA) EPA SW-846 Methods 8260C
5 mL Purge Volume [7]

Effective:5/18/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

	Low Level [1]	Low Level ME Limits [3]	Medium Level [2]	Medium Level ME Limits [3]
LCS Spike Recovery [8]				
Dichlorodifluoromethane	53 - 148	37 - 164	25 - 128	**10** - 145
Chloromethane	64 - 125	54 - 135	55 - 121	44 - 132
Vinyl Chloride	63 - 137	51 - 149	66 - 123	57 - 133
Bromomethane	57 - 136	44 - 149	40 - 154	21 - 173
Chloroethane	64 - 131	53 - 142	72 - 128	63 - 137
Trichlorofluoromethane	69 - 132	59 - 143	69 - 135	58 - 146
Acrolein	54 - 137	40 - 151	39 - 135	23 - 151
1,1,2-Trichloro-1,2,2-trifluoroethane	74 - 130	65 - 139	65 - 139	53 - 151
Acetone	60 - 131	48 - 143	55 - 130	43 - 143
1,1-Dichloroethene	75 - 126	67 - 135	73 - 133	63 - 143
Bromoethane	76 - 126	68 - 134	74 - 133	64 - 143
Methyl Iodide	65 - 139	53 - 151	47 - 155	29 - 173
Methylene Chloride	70 - 123	61 - 132	**80 - 120**	75 - 122
Acrylonitrile	67 - 125	57 - 135	62 - 129	51 - 140
Methyl tert-Butyl Ether	70 - 120	62 - 128	69 - 128	59 - 138
Carbon Disulfide	71 - 129	61 - 139	64 - 135	52 - 147
trans-1,2-Dichloroethene	80 - **120**	74 - 126	78 - 125	70 - 133
Vinyl Acetate	60 - 136	47 - 149	66 - 132	55 - 143
1,1-Dichloroethane	**80 - 120**	75 - 124	77 - 124	69 132
2-Butanone	70 - **120**	62 - 127	65 - 126	55 - 136
2,2-Dichloropropane	74 - 123	66 - 131	75 - 127	66 - 136
cis-1,2-Dichloroethene	**80 - 120**	76 - 123	**80** - 125	74 - 132
Chloroform	80 - **120**	74 - 123	**80** - 124	73 - 131
Bromodichloromethane	77 - 121	70 - 128	78 - 130	69 - 139
1,1,1-Trichloroethane	77 - 121	70 - 128	76 - 130	67 - 139
1,1-Dichloropropene	**80 - 120**	77 - 123	77 - 131	68 - 140
Carbon Tetrachloride	77 - 122	70 - 130	74 - 129	65 - 138
1,2-Dichloroethane	76 - **120**	69 - 123	73 - 123	65 - 131
Benzene	**80** - 120	80 - 126	**80 - 120**	75 - 130
Trichloroethene	**80 - 120**	77 - 123	**80** - 125	75 - 132
1,2-Dichloropropane	**80 - 120**	76 - 120	**80** - 122	74 - 129
Bromochloromethane	80 - 120	73 - 127	**80** - 127	73 - 135
Dibromomethane	80 - **120**	74 - 121	**80** - 121	76 - 128
2-Chloroethylvinylether	**10** - 191	**10** - 222	61 - 128	50 - 139

Spike Recovery Control Limits for Analysis of Solid Samples
Volatile Organic Compounds (VOA) EPA SW-846 Methods 8260C
5 mL Purge Volume [7]

Effective:5/18/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

	Low Level [1]	Low Level ME Limits [3]	Medium Level [2]	Medium Level ME Limits [3]
4-Methyl-2-Pentanone	67 - **120**	59 - 125	80 - 123	73 - 130
cis-1,3-Dichloropropene	74 - **120**	67 - 125	80 - 122	73 - 129
Toluene	**80** - **120**	79 - **120**	**80** - 122	**80** - 127
trans-1,3-Dichloropropene	65 - **120**	57 - 125	**80** - 123	79 - 129
2-Hexanone	65 - 130	54 - 141	58 - 129	46 - 141
1,1,2-Trichloroethane	**80** - **120**	75 - 122	**80** - 120	77 - 126
1,3-Dichloropropane	80 - **120**	74 - 122	**80** - 120	76 - 126
Tetrachloroethene	**80** - 121	79 - 127	**80** - 130	73 - 138
Dibromochloromethane	64 - **120**	55 - 128	77 - 120	70 - 127
Ethylene Dibromide	75 - **120**	68 - 124	**80** - **120**	**80** - 120
Chlorobenzene	**80** - **120**	82 - 120	**80** - 121	80 - 127
Ethylbenzene	**80** - 127	80 - 134	**80** - 126	**80** - 132
1,1,2,2-Tetrachloroethane	74 - 120	66 - 128	79 - **120**	73 - 123
m,p-Xylene	**80** - 125	**80** - 131	**80** - 130	**80** - 137
o-Xylene	78 - **120**	71 - 126	**80** - 124	**80** - 130
Styrene	**80** - 123	78 - 130	**80** - 132	77 - 140
Isopropylbenzene	**80** - 127	84 - 133	**80** - 130	**80** - 137
Bromoform	60 - **120**	50 - 128	68 - 129	58 - 139
1,1,1,2-Tetrachloroethane	69 - 121	60 - 130	**80** - 126	76 - 133
1,2,3-Trichloropropane	72 - 121	64 - 129	77 - **120**	71 - 121
trans-1,4-Dichloro-2-butene	65 - 126	55 - 136	66 - 127	56 - 137
n-Propylbenzene	**80** - 132	**80** - 139	**80** - 132	77 - 140
Bromobenzene	**80** - **120**	78 - 122	**80** - 121	80 - 127
1,3,5-Trimethylbenzene	**80** - 125	**80** - 131	78 - 137	68 - 147
2-Chlorotoluene	**80** - 125	77 - 132	**80** - 123	**80** - 129
4-Chlorotoluene	**80** - 127	77 - 134	**80** - 130	74 - 138
tert-Butylbenzene	87 - 122	**80** - 128	**80** - 133	78 - 141
1,2,4-Trimethylbenzene	**80** - 126	**80** - 132	**80** - 131	79 - 139
sec-Butylbenzene	**80** - 134	80 - 142	**80** - 136	76 - 146
4-Isopropyltoluene	**80** - 131	**80** - 138	**80** - 141	71 - 151
1,3-Dichlorobenzene	**80** - 120	**80** - 126	**80** 126	77 - 133
1,4-Dichlorobenzene	**80** - 120	79 - 126	**80** 121	77 - 127
n-Butylbenzene	**80** - 138	**80** - 146	**80** - 138	77 - 147
1,2-Dichlorobenzene	**80** - **120**	78 - 122	**80** - **120**	**80** - 121
1,2-Dibromo-3-chloropropane	59 - 120	49 - 130	67 - 121	58 - 130
1,2,4-Trichlorobenzene	78 - 130	69 - 139	**80** - 133	72 - 142

Spike Recovery Control Limits for Analysis of Solid Samples Volatile Organic Compounds (VOA) EPA SW-846 Methods 8260C 5 mL Purge Volume [7]

Effective:5/18/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

	Low Level [1]	Low Level ME Limits [3]	Medium Level [2]	Medium Level ME Limits [3]
Hexachloro-1,3-butadiene	76 - 129	67 - 138	62 - 148	48 - 162
Naphthalene	66 - **120**	58 - 126	74 - 133	64 - 143
1,2,3-Trichlorobenzene	73 - 123	65 - 131	80 - 126	72 - 134
MB/LCS Surrogate Recovery				
Dibromofluoromethane	**80 - 120**	(4)	**80 - 120**	(4)
d4-1,2-Dichloroethane	79 - 121	(4)	76 - **120**	(4)
d8-Toluene	**80 - 120**	(4)	**80 - 120**	(4)
4-Bromofluorobenzene	**80 - 120**	(4)	**80 - 120**	(4)
d4-1,2-Dichlorobenzene	**80 - 120**	(4)	**80 - 120**	(4)
Sample Surrogate Recovery				
Dibromofluoromethane	30 - 160[6]	(4)	30 - 160[6]	(4)
d4-1,2-Dichloroethane	75 - 152	(4)	69 - **120**	(4)
d8-Toluene	82 - 115	(4)	**80 - 120**	(4)
4-Bromofluorobenzene	64 - **120**	(4)	76 - 128	(4)
d4-1,2-Dichlorobenzene	**80 - 120**	(4)	**80 - 120**	(4)

(1) Control Limits calculated using all data generated 1/1/08 through 12/31/08.
(2) Control Limits calculated using all data generated 3/1/07 through 11/15/07.
(3) **ME** = A **marginal exceedance** defined in the NELAC Standard[5] as beyond the LCS-CL but still within the ME limits. ME limits are between 3 and 4 standard deviations around the mean. A maximum of four marginal exceedances are acceptable. Five or more marginal exceedances require corrective action.
(4) Marginal Exceedances not allowed for surrogate standards
(5) **2003 NELAC Standard (EPA/600/R-04/003), July 2003**, Chapter 5, pages 251-252.
(6) 30 – 160 are default, advisory control limits used when there is insufficient data to calculate historic control limits. **DO NOT** use these limits as the sole reason to reject the data from a batch of analyses
(7) Highlighted control limits (**bold font**) are adjusted from the calculated values as follows:
a) ARI does not use control limits < 10
b) Control limits for analyzes with no separate preparation procedure are adjusted to reflect the minimum uncertainty in the calibration of the instrument allowed by the referenced analytical method.
(8) Laboratory Control Sample (LCS) spike recovery control limits also used as advisory control limits for sample matrix spike (MS) analyzes. MS recovery values are advisory and not used to assess the acceptability of an analytical batch.

Volatile Organics Selected Ion Monitoring
DL, LOD, LOQ and Control Limit Summary [1]
EPA Method 8260C - SIM

Analyte	Aqueous Samples				Solid Samples				RPD[4]
	DL[2] ng/L	LOD ng/L	LOQ ng/L	LCS[5,6] Recovery	DL[3] µg/kg	LOD µg/kg	LOQ µg/kg	LCS[5,6] Recovery	
Acrylonitrile	15.8	**25**	**50**	75 – 125					≤ 40
Vinyl Chloride	2.25	**10**	**20**	76 – **120**					≤ 40
1,1-Dichloroethene	5.07	**10**	**20**	**80 – 120**					≤ 40
cis-1,2-Dichloroethene	3.89	**10**	**20**	**80 – 120**					≤ 40
trans-1,2-Dichloroethene	1.48	**10**	**20**	**80 – 120**					≤ 40
Trichloroethene	3.41	**10**	**20**	**80 – 120**					≤ 40
Tetrachloroethene	3.64	**10**	**20**	**80 –** 122					≤ 40
1,1,2,2-Tetrachloroethane	4.53	**10**	**20**	**80 –** 128					≤ 40
1,2-Dichloroethane	7.23	**10**	**20**	**80 –** 128					≤ 40
Benzene	1.98	**10**	**20**	**80 – 120**	0.082	**0.25**	**0.5**	75– 125	≤ 40
Toluene					0.137	**0.25**	**0.5**	75– 125	≤ 40
Ethyl Benzene					0.104	**0.25**	**0.5**	75– 125	≤ 40
m, *p* - Xylene					0.293	**0.50**	**1.0**	75– 125	≤ 40
o - Xylene					0.083	**0.25**	**0.5**	75– 125	≤ 40
Surrogate % Recovery	**MB / LCS**	**Sample**			**MB / LCS[6]**	**Sample[6]**			
d_4-1,2-Dichloroethane	78 – 126	**80 –** 129			75 – 125	75– 125			≤ 40
d_8-Toluene	**80 – 120**	**80 – 120**			75 – 125	75– 125			≤ 40

(1) Detection Limit (DL), Limit of Detection (LOD) and Limit of Quantitation (LOQ) are defined in ARI SOP 1018S
(2) MDL study QO44 (3/22/10)
(3) MDL study RI48 (6/25/10)
(4) Relative Percent Difference between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then

$$RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$$

(5) Highlighted control limits (**bold font**) are adjusted from the calculated values to reflect that:
a. ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit or
b. Control limits for analyzes with no separate preparation procedure are adjusted to reflect the minimum uncertainty in the calibration of the instrument allowed by the referenced analytical method.
(6) 75 – 125 are default values used when there is insufficient data to calculate historic control limits.

LOD[1], LOQ[2] and Control Limits Summary
GC - MS – SVOA Analysis of Aqueous Samples
EPA Method 8270D
ARI Analysis: BANWLI & BANWSI

Continuous Liquid-Liquid (EPA Method 3520C) or Separatory Funnel (EPA method 3510C) extraction using 500mL sample concentrated to 0.5 mL final extract volume

LOD Spike level = LOQ (unless otherwise noted)

Analyte	DL[1] µg/L	LOD[2] µg/L	LOQ[3] µg/L	LCS, MS Recovery[4]	Replicate RPD[5]
Phenol	**0.445**	**0.5**	**1**	26 – 112	≤ 40
Bis(2-Chloroethyl)ether	**0.257**	**0.5**	**1**	51 – **100**	≤ 40
2-Chlorophenol	**0.246**	**0.5**	**1**	50 – **100**	≤ 40
1,3-Dichlorobenzene	**0.499**	**0.5**	**1**	27 – **100**	≤ 40
1,4-Dichlorobenzene	**0.470**	**0.5**	**1**	29 – **100**	≤ 40
1,2-Dichlorobenzene	**0.436**	**0.5**	**1**	32 – **100**	≤ 40
Benzyl alcohol	**0.409**	**1.0**	**2**	**10** - 128	≤ 40
2,2'-oxybis(1-Chloropropane)	**0.221**	**0.5**	**1**	39 - 101	≤ 40
2-Methylphenol	**0.329**	**0.5**	**1**	47 – **100**	≤ 40
Hexachloroethane	**0.610**	**1.0**	**2**	19 – **100**	≤ 40
N-Nitroso-di-n-propylamine	**0.365**	**0.5**	**1**	46 – **100**	≤ 40
4-Methylphenol	**0.536**	**1.0**	**2**	46 – **100**	≤ 40
Nitrobenzene	**0.490**	**0.5**	**1**	46 – 103	≤ 40
Isophorone	**0.258**	**0.5**	**1**	62 – 105	≤ 40
2-Nitrophenol	**0.979**	**1.5**	**3**	32 – 116	≤ 40
2,4-Dimethylphenol	**0.627**	**1.5**	**3**	15 – **100**	≤ 40
Bis(2-Chloroethoxy)methane	**0.252**	**0.5**	**1**	44 – **100**	≤ 40
2,4-Dichlorophenol	**1.109**	**1.5**	**3**	35 – 114	≤ 40
1,2,4-Trichlorobenzene	**0.495**	**0.5**	**1**	34 – **100**	≤ 40
Naphthalene	**0.326**	**0.5**	**1**	48 – **100**	≤ 40
Benzoic acid	**8.647**	**10**	**20**	**10** - 172	≤ 40
4-Chloroaniline	**1.733**	**2.5**	**5**	**10** - 153	≤ 40
2,6-Dinitrotoluene	**1.300**	**1.5**	**3**	32 – 129	≤ 40
Hexachlorobutadiene	**0.604**	**1.5**	**3**	22 – **100**	≤ 40
4-Chloro-3-methylphenol	**0.919**	**1.5**	**3**	33 – 123	≤ 40
Hexachlorocyclopentadiene	**1.862**	**2.5**	**5**	**10** – **100**	≤ 40
2,4,6-Trichlorophenol	**1.235**	**1.5**	**3**	37 – 120	≤ 40
2,4,5-Trichlorophenol	**1.706**	**2.5**	**5**	37 – 124	≤ 40
2-Chloronaphthalene	**0.340**	**0.5**	**1**	49 – **100**	≤ 40
2-Nitroaniline	**0.784**	**1.5**	**3**	18 – 140	≤ 40
Acenaphthylene	**0.274**	**0.5**	**1**	47 – 110	≤ 40
Dimethylphthalate	**0.264**	**0.5**	**1**	60 – 106	≤ 40
Acenaphthene	**0.347**	**0.5**	**1**	55 – 101	≤ 40

LOD[1], LOQ[2] and Control Limits Summary
GC - MS – SVOA Analysis of Aqueous Samples
EPA Method 8270D
ARI Analysis: BANWLI & BANWSI

Continuous Liquid-Liquid (EPA Method 3520C) or Separatory Funnel (EPA method 3510C) extraction using 500mL sample concentrated to 0.5 mL final extract volume

LOD Spike level = LOQ (unless otherwise noted)

Analyte	DL[1] µg/L	LOD[2] µg/L	LOQ[3] µg/L	LCS, MS Recovery[4]	Replicate RPD[5]
3-Nitroaniline	**1.140**	**1.5**	**3**	**10** – 208	≤ 40
2-Methylnaphthalene	**0.241**	**0.5**	**1**	38 – **100**	≤ 40
2,4-Dinitrophenol	**5.474**	**10**	**20**	**10** – 224	≤ 40
Dibenzofuran	**0.198**	**0.5**	**1**	46 – 108	≤ 40
4-Nitrophenol	**2.895**	**5.0**	**10**	**10** – 103	≤ 40
2,4-Dinitrotoluene	**1.277**	**1.5**	**3**	33 – 134	≤ 40
Fluorene	**0.266**	**0.5**	**1**	59 – 108	≤ 40
4-Chlorophenyl-phenylether	**0.342**	**0.5**	**1**	54 – 104	≤ 40
Diethylphthalate	**0.407**	**0.5**	**1**	60 - 108	≤ 40
4-Nitroaniline	**1.366**	**1.5**	**3**	13 – 144	≤ 40
4,6-Dinitro-2-methylphenol	**4.928**	**5.0**	**10**	**10** – 190	≤ 40
N-Nitrosodiphenylamine	**0.392**	**0.5**	**1**	39 – 100	≤ 40
4-Bromophenyl-phenylether	**0.262**	**0.5**	**1**	56 – 105	≤ 40
Hexachlorobenzene	**0.335**	**0.5**	**1**	54 – 108	≤ 40
Pentachlorophenol	**2.746**	**5.0**	**10**	25 – 144	≤ 40
Phenanthrene	**0.283**	**0.5**	**1**	64 – 115	≤ 40
Anthrcene	**0.303**	**0.5**	**1**	59 – 107	≤ 40
Carbazole	**0.251**	**0.5**	**1**	36 – 123	≤ 40
Di-n-butylphthalate	**0.304**	**0.5**	**1**	62 – 110	≤ 40
Fluoranthene	**0.290**	**0.5**	**1**	63 – 119	≤ 40
Pyrene	**0.379**	**0.5**	**1**	57 – 117	≤ 40
Butylbenzylphthalate	**0.402**	**0.5**	**1**	49 – 118	≤ 40
Benzo(a)anthracene	**0.373**	**0.5**	**1**	61 – 113	≤ 40
3,3'-Dichlorobenzidine	**1.553**	**2.5**	**5**	**10** – 151	≤ 40
Chrysene	**0.397**	**0.5**	**1**	62 – 115	≤ 40
bis(2-Ethylhexyl)phthalate	**1.050**	**1.5**	**3**	47 – 127	≤ 40
Di-n-octylphthalate	**0.331**	**0.5**	**1**	60 – 106	≤ 40
Benzo(b)fluoranthene	**0.298**	**0.5**	**1**	61 – 120	≤ 40
Benzo(k)fluoranthene	**0.487**	**0.5**	**1**	59 – 120	≤ 40
Benzo(a)pyrene	**0.425**	**0.5**	**1**	46 – 105	≤ 40
Indeno(1,2,3-cd)pyrene	**0.435**	**0.5**	**1**	42 – 134	≤ 40
Dibenzo(a,h)anthracene	**0.437**	**0.5**	**1**	46 – 132	≤ 40
Benzo(g,h,i)perylene	**0.464**	**0.5**	**1**	33 – 135	≤ 40
N-Nitrosodimethylamine	**1.209**	**1.5**	**3**	17 - 106	≤ 40

LOD[1], LOQ[2] and Control Limits Summary
GC - MS – SVOA Analysis of Aqueous Samples
EPA Method 8270D
ARI Analysis: BANWLI & BANWSI

Continuous Liquid-Liquid (EPA Method 3520C) or Separatory Funnel (EPA method 3510C) extraction using 500mL sample concentrated to 0.5 mL final extract volume

LOD Spike level = LOQ (unless otherwise noted)

Analyte	DL[1] µg/L	LOD[2] µg/L	LOQ[3] µg/L	LCS, MS Recovery[4]	Replicate RPD[5]
Aniline	**0.470**	**0.5**	**1**	**10** – 113	≤ 40
1-methylnaphthalene	**0.199**	**0.5**	**1**	43 – **100**	≤ 40
Azobenzene (1,2-DP-Hydrazine)	**0.214**	**0.5**	**1**	52 - 111	≤ 40
Benzofluoranthenes, Total	**2.317**	**2.5**	**5**		≤ 40
1,4-Dioxane[6]				13 – 114	≤ 40
Surrogate Standards				**Samples**	**RPD**
2-Fluorophenol					≤ 40
Phenol-d_5					≤ 40
2-Chlorophenol-d_4					≤ 40
1,2-Dichlorobenzene-d_4					≤ 40
Nitrobenzene-d_5					≤ 40
2-Fluorobiphenyl					≤ 40
2,4,6-Tribromophenol					≤ 40
p-Terphenyl-d_{14}					≤ 40

(1) Detection Limit as defined in ARI SOP 1018S
(2) Limit of Detection as defined in ARI SOP 1018S
(3) Limit of Quantitation as defined in ARI SOP 1018S
(4) Control limits calculated using all data from 8/1/10 through 7/31/11.
(5) Relative Percent Difference between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then

$$RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$$

(6) Sample extracts for 1,4-Dioxane analysis are concentrated to 1 mL.

Spike Recovery Control Limits for Analysis of Soil & Sediment
Semi-Volatile Organic Compounds (SVOA)
EPA SW-846 Method 8270D with Microwave Extraction[1,8]

(Effective: 6/1/09)

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction / Analytical Method:	**8270D**	**8270D ME[2]**
Sample Weight / Final Volume:	7.5 g to 0.5 mL	7.5 g to 0.5 mL
LCS Spike Recovery [9]		
Phenol	37 - 116	24 - 129
Bis-(2-chloroethyl) ether	43 - 108	32 - 119
2-Chlorophenol	45 - 109	34 - 120
1,3-Dichlorobenzene	47 - 105	37 - 115
1,4-Dichlorobenzene	46 - 105	36 - 115
Benzyl Alcohol	16 - 108	**10** - 123
1,2-Dichlorobenzene	48 - 104	39 - 113
2-Methylphenol	45 - 112	34 - 123
2,2'-oxybis(1-chloropropane)	36 - 114	23 - 127
4-Methylphenol	47 - 114	36 - 125
N-Nitroso-di-n-propylamine	44 - 113	33 - 125
Hexachloroethane	43 - 104	33 - 114
Nitrobenzene	39 - 112	27 - 124
Isophorone	57 - 114	48 - 124
2-Nitrophenol	50 - 112	40 - 122
2,4-Dimethyphenol	40 - 110	28 - 122
Bis-(2-chloroethoxy) methane	49 - 111	39 - 121
Benzoic Acid [4]	**10** - 160	**10** - 185
2,4-Dichlorophenol	51 - 113	41 - 123
1,2,4-Trichlorobenzene	50 - 106	41 - 115
Naphthalene	50 - 108	40 - 118
4-Chloroaniline [4]	17 - 149	**10** - 171
2-Chloronaphthalene	48 - 116	37 - 127
Hexachlorobutadiene	46 - 112	35 - 123
4-Chloro-3-methylphenol	54 - 116	44 - 126
2-Methylnaphthalene	54 - 106	45 - 115
Hexachlorocyclopentadiene	23 - 149	**10** - 170
2,4,6-Trichlorophenol	51 - 114	41 - 125
2,4,5-Trichlorophenol	52 - 116	41 - 127
2-Nitroaniline	51 - 115	40 - 126
Dimethylphthalate	56 - 113	47 - 123
Acenaphthylene	56 - 115	46 - 125
2,6-Dinitrotoluene	54 - 124	42 - 136
3-Nitroaniline [4]	39 - 142	22 - 159
Acenaphthene	48 - 115	37 - 126

Spike Recovery Control Limits for Analysis of Soil & Sediment Semi-Volatile Organic Compounds (SVOA) EPA SW-846 Method 8270D with Microwave Extraction[1,8]

(Effective: 6/1/09)

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction / Analytical Method:	**8270D**	**8270D ME[2]**
Sample Weight / Final Volume:	7.5 g to 0.5 mL	7.5 g to 0.5 mL
2,4-Dinitrophenol	15 - 169	**10** - 195
Dibenzofuran	55 - 111	46 - 120
4-Nitrophenol	23 - 130	**10** - 148
2,4-Dinitrotoluene	57 - 127	45 - 139
Fluorene	55 - 117	45 - 127
Diethylphthlalate	54 - 116	44 - 126
4-Chlorophenyl-phenyl ether	52 - 117	41 - 128
4-Nitroaniline	47 - 124	34 - 137
4,6-Dinitro-2-Methylphenol	**10** - 157	**10** - 182
N-Nitrosodiphenylamine	54 - 138	40 - 152
4-Bromophenyl-phenyl ether	50 - 117	39 - 128
Hexachlorobenzene	50 - 121	38 - 133
Pentachlorophenol	40 - 123	26 - 137
Phenanthrene	55 - 116	45 - 126
Anthracene	57 - 115	47 - 125
Carbazole	60 - 121	50 - 131
Di-n-butylphthalate	60 - 119	50 - 129
Fluoranthene	52 - 129	39 - 142
Pyrene	49 - 134	35 - 148
Butylbenzylphthalate	44 - 144	27 - 161
Benzo(a)Anthracene	56 - 124	45 - 135
3,3'-Dichlorbenzidine [4]	37 - 140	20 - 157
Chrysene	53 - 124	41 - 136
Bis(2-Ethylhexyl) phthalate	63 - 128	52 - 139
Di-n-octylphthalate	59 - 114	50 - 123
Benzofluoranthene(s) (Total)	30 - 160[10]	30 - 160[10]
Benzo(a)Pyrene	53 - 109	44 - 118
Indeno(1,2,3-cd)Pyrene	40 - 128	25 - 143
Dibenz(a,h)anthracene	47 - 123	34 - 136
Benzo(g,h,i)Perylene	44 - 125	31 - 139
Aniline [4]	**10** - 129	**10** - 149
1,2-Diphenylhydrazine (Azobenzene)	56 - 118	46 - 128
N-Nitrosodimethylamine	43 - 119	30 - 132
1-Methylnaphthalene	55 - 116	45 - 126
Pyridine	15 - 118	**10** - 135

Spike Recovery Control Limits for Analysis of Soil & Sediment Semi-Volatile Organic Compounds (SVOA) EPA SW-846 Method 8270D with Microwave Extraction[1,8]

(Effective: 6/1/09)

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction / Analytical Method:	**8270D**	**8270D ME[2]**
Sample Weight / Final Volume:	7.5 g to 0.5 mL	7.5 g to 0.5 mL
MB/LCS Surrogate Recovery		
d4-2-Chlorophenol	50 - 103	(5)
d4-1,2-Dichlorobenzene	48 - 104	(5)
2,4,6-Tribromophenol	54 - 120	(5)
2-Fluorophenol	38 - 112	(5)
d5-Phenol [4]	44 - 110	33 - 121
d5-Nitrobenzene	46 - 102	(5)
2-Fluorobiphenyl	51 - 105	(5)
d14-p-Terphenyl	55 - 124	(5)
Sample Surrogate Recovery		
d4-2-Chlorophenol	36 - 104	(5)
d4-1,2-Dichlorobenzene	38 - 102	(5)
2,4,6-Tribromophenol	31 - 131	(5)
2-Fluorophenol	22 - 108	(5)
d5-Phenol [4]	27 - 112	13 - 126
d5-Nitrobenzene	32 - 106	(5)
2-Fluorobiphenyl	39 - 107	(5)
d14-p-Terphenyl	31 - 130	(5)

(1) Control Limits calculated using all data generated 7/1/08 through 6/30/09.
(2) **ME** = A **marginal exceedance** defined in the NELAC Standard [6] as beyond the CL but still within the ME limits. ARI defines ME limits as 4 standard deviations around the mean with upper limit ≥ 100%. A maximum of 4 marginal exceedances are acceptable. (≥ 5 marginal exceedances in an analysis require corrective action).
(3). Preparation includes Gel Permeation Chromatography (GPC) clean-up.
(4) These are "**poor performers**" defined in the DoD QSM [7] as compounds that "produce low mean recoveries and high standard deviations, resulting in wide LCS control limits with particularly low lower control limits (sometimes-negative values)". ARI does not control batch acceptance based on these compounds since there is a high level of uncertainty in their recovery."
(5) Marginal Exceedances not allowed for surrogate unless it is a "poor performer".
(6) **2003 NELAC Standard (EPA/600/R-04/003), July 2003**, Chapter 5, pages 251-252.
(7) Page 182 of: **Department of Defense Quality Systems Manual for Environmental Laboratories, Version 3 Final, March 2005** Prepared By Environmental Data Quality Workgroup, Department of Navy, Lead Service (Based NELAC Chapter 5 (Quality Systems) NELAC Voted Version − 5 June 2003
(8) Highlighted control limits (**bold font**) adjusted to demonstrate that ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit.
(9) Laboratory Control Sample (LCS) spike recovery control limits also used as advisory control limits for sample matrix spike (MS) analyzes. MS recovery values are advisory and not used to assess the acceptability of an analytical batch.
(10) Default limits pending generation of historic limits for total benzofluoranthrenes (7/29/10)

Spike Recovery Control Limits for Analysis of Soil & Sediment
Semi-Volatile Organic Compounds (SVOA)
EPA SW-846 Method 8270D with Ultrasonic Extraction [1,8]

Effective: 5/11/11

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction / Analytical Method:	**8270D**	**8270D ME[2]**	**PSEP [3]**	**PSEP ME[2,3]**
Sample Weight / Final Volume:	7.5 g to 0.5 mL	7.5 g to 0.5 mL	10 g to 1 mL	10 g to 1 mL
LCS Spike Recovery [9]				
Phenol	48 - **100**	41 - **100**	30 - 160	30 - 160
Bis-(2-chloroethyl) ether	32 - **100**	22 - 104	30 - 160	30 - 160
2-Chlorophenol	44 - **100**	37 - **100**	30 - 160	30 - 160
1,3-Dichlorobenzene	39 - **100**	33 - **100**	30 - 160	30 - 160
1,4-Dichlorobenzene	40 - **100**	34 - **100**	30 - 160	30 - 160
Benzyl Alcohol	**10** - **100**	**10** - **100**	30 - 160	30 - 160
1,2-Dichlorobenzene	42 - **100**	36 - **100**	30 - 160	30 - 160
2-Methylphenol	44 - **100**	37 - **100**	30 - 160	30 - 160
2,2'-oxybis(1-chloropropane)	21 - **100**	**10** - 107	30 - 160	30 - 160
4-Methylphenol	45 - **100**	37 - 100	30 - 160	30 - 160
N-Nitroso-di-n-propylamine	36 - **100**	27 - 101	30 - 160	30 - 160
Hexachloroethane	35 - **100**	28 - **100**	30 - 160	30 - 160
Nitrobenzene	27 - 102	15 - 115	30 - 160	30 - 160
Isophorone	47 - **100**	39 - 105	30 - 160	30 - 160
2-Nitrophenol	46 - **100**	40 - **100**	30 - 160	30 - 160
2,4-Dimethyphenol	41 - **100**	34 - **100**	30 - 160	30 - 160
Bis-(2-chloroethoxy) methane	40 - **100**	32 - **100**	30 - 160	30 - 160
Benzoic Acid [4]	**10** - 138	**10** - 159	30 - 160	30 - 160
2,4-Dichlorophenol	48 - **100**	41 - **100**	30 - 160	30 - 160
1,2,4-Trichlorobenzene	43 - **100**	35 - **100**	30 - 160	30 - 160
Naphthalene	44 - **100**	38 - **100**	30 - 160	30 - 160
4-Chloroaniline [4]	16 - **100**	**10** - 113	30 - 160	30 - 160
2-Chloronaphthalene	48 - **100**	42 - **100**	30 - 160	30 - 160
Hexachlorobutadiene	40 - **100**	33 - **100**	30 - 160	30 - 160
4-Chloro-3-methylphenol	50 - **100**	42 - 104	30 - 160	30 - 160
2-Methylnaphthalene	48 - **100**	42 - **100**	30 - 160	30 - 160
Hexachlorocyclopentadiene	20 - 114	**10** - 130	30 - 160	30 - 160
2,4,6-Trichlorophenol	51 - **100**	44 - 100	30 - 160	30 - 160
2,4,5-Trichlorophenol	50 - **100**	43 - 103	30 - 160	30 - 160
2-Nitroaniline	45 - **100**	36 - 106	30 - 160	30 - 160
Dimethylphthalate	53 - **100**	46 - 103	30 - 160	30 - 160
Acenaphthylene	50 - **100**	43 - 100	30 - 160	30 - 160
2,6-Dinitrotoluene	54 - 100	46 - 108	30 - 160	30 - 160
3-Nitroaniline [4]	22 - 117	**10** - 133	30 - 160	30 - 160
Acenaphthene	48 - **100**	41 - **100**	30 - 160	30 - 160

Spike Recovery Control Limits for Analysis of Soil & Sediment
Semi-Volatile Organic Compounds (SVOA)
EPA SW-846 Method 8270D with Ultrasonic Extraction [1,8]

Effective: 5/11/11

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction / Analytical Method:	**8270D**	**8270D ME[2]**	**PSEP [3]**	**PSEP ME[2,3]**
Sample Weight / Final Volume:	7.5 g to 0.5 mL	7.5 g to 0.5 mL	10 g to 1 mL	10 g to 1 mL
2,4-Dinitrophenol	12 - 147	**10** - 170	30 - 160	30 - 160
Dibenzofuran	53 - **100**	47 - **100**	30 - 160	30 - 160
4-Nitrophenol	18 - 107	**10** - 122	30 - 160	30 - 160
2,4-Dinitrotoluene	57 - 106	49 - 114	30 - 160	30 - 160
Fluorene	54 - **100**	48 - 100	30 - 160	30 - 160
Diethylphthlalate	52 - 100	44 - 108	30 - 160	30 - 160
4-Chlorophenyl-phenyl ether	54 - **100**	48 - **100**	30 - 160	30 - 160
4-Nitroaniline	27 - 110	13 - 124	30 - 160	30 - 160
4,6-Dinitro-2-Methylphenol	21 - 122	**10** - 139	30 - 160	30 - 160
N-Nitrosodiphenylamine	44 - 145	27 - 162	30 - 160	30 - 160
4-Bromophenyl-phenyl ether	52 - **100**	45 - 101	30 - 160	30 - 160
Hexachlorobenzene	50 - **100**	42 - 104	30 - 160	30 - 160
Pentachlorophenol	45 - **100**	36 - 108	30 - 160	30 - 160
Phenanthrene	53 - **100**	46 - 101	30 - 160	30 - 160
Anthracene	49 - **100**	41 - 105	30 - 160	30 - 160
Carbazole	45 - 111	34 - 122	30 - 160	30 - 160
Di-n-butylphthalate	55 - 106	47 - 115	30 - 160	30 - 160
Fluoranthene	54 - 105	46 - 114	30 - 160	30 - 160
Pyrene	48 - 106	38 - 116	30 - 160	30 - 160
Butylbenzylphthalate	46 - 111	35 - 122	30 - 160	30 - 160
Benzo(a)Anthracene	51 - 101	43 - 109	30 - 160	30 - 160
3,3'-Dichlorbenzidine [4]	**10** - 112	**10** - 129	30 - 160	30 - 160
Chrysene	56 - **100**	50 - 102	30 - 160	30 - 160
Bis(2-Ethylhexyl) phthalate	57 - 114	48 - 124	30 - 160	30 - 160
Di-n-octylphthalate	56 - 100	49 - 107	30 - 160	30 - 160
Benzofluoranthene(s) (Total)	30 - 160[10]	30 - 160[10]	30 - 160	30 - 160
Benzo(a)Pyrene	51 - **100**	43 - 105	30 - 160	30 - 160
Indeno(1,2,3-cd)Pyrene	38 - 104	27 - 115	30 - 160	30 - 160
Dibenz(a,h)anthracene	41 - 107	30 - 118	30 - 160	30 - 160
Benzo(g,h,i)Perylene	36 - 107	24 - 119	30 - 160	30 - 160
Aniline [4]	**10** - **100**	**10** - 103	30 - 160	30 - 160
1,2-Diphenylhydrazine (Azobenzene)	48 - 101	39 - 110	30 - 160	30 - 160
N-Nitrosodimethylamine	31 - **100**	21 - 101	30 - 160	30 - 160
1-Methylnaphthalene	48 - **100**	41 - **100**	30 - 160	30 - 160
Pyridine	**10** - **100**	**10** - **100**	30 - 160	30 - 160
MB/LCS Surrogate Recovery				

Spike Recovery Control Limits for Analysis of Soil & Sediment
Semi-Volatile Organic Compounds (SVOA)
EPA SW-846 Method 8270D with Ultrasonic Extraction (1,8)

Effective: 5/11/11

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction / Analytical Method:	**8270D**	**8270D ME(2)**	**PSEP (3)**	**PSEP ME(2,3)**
Sample Weight / Final Volume:	7.5 g to 0.5 mL	7.5 g to 0.5 mL	10 g to 1 mL	10 g to 1 mL
d4-2-Chlorophenol	43 - **100**	(5)	30 - 160	(5)
d4-1,2-Dichlorobenzene	34 - **100**	(5)	30 - 160	(5)
2,4,6-Tribromophenol	47 - 109	(5)	30 - 160	(5)
2-Fluorophenol	14 - 100	(5)	30 - 160	(5)
d5-Phenol (4)	39 - **100**	**10** - 133	30 - 160	30 -160
d5-Nitrobenzene	39 - **100**	(5)	30 - 160	(5)
2-Fluorobiphenyl	44 - **100**	(5)	30 - 160	(5)
d14-p-Terphenyl	55 - 106	(5)	30 - 160	(5)
Sample Surrogate Recovery				
d4-2-Chlorophenol	33 - **100**	(5)	30 - 160	(5)
d4-1,2-Dichlorobenzene	30 - **100**	(5)	30 - 160	(5)
2,4,6-Tribromophenol	28 - 116	(5)	30 - 160	(5)
2-Fluorophenol	**10** - **100**	(5)	30 - 160	(5)
d5-Phenol (4)	31 - **100**	21 - 101	30 - 160	30 -160
d5-Nitrobenzene	32 - **100**	(5)	30 - 160	(5)
2-Fluorobiphenyl	36 - **100**	(5)	30 - 160	(5)
d14-p-Terphenyl	35 - 113	(5)	30 - 160	(5)

(1) Control Limits calculated using all data generated 1/1/08 through 12/1/08.
(2) **ME** = A **marginal exceedance** defined in the NELAC Standard (6) as beyond the CL but still within the ME limits. ARI defines ME limits as 4 standard deviations around the mean with upper limit ≥ 100% A maximum of 4 marginal exceedances are acceptable. (≥ 5 marginal exceedances in an analysis require corrective action).
(3). Preparation = Microwave Extraction (EPA method 3546) & Gel Permeation Chromatography (GPC) clean-up.
(4) These are "**poor performers**" defined in the DoD QSM (7) as compounds that "produce low mean recoveries and high standard deviations, resulting in wide LCS control limits with particularly low lower control limits (sometimes-negative values). ARI does not control batch acceptance based on these compounds since there is a high level of uncertainty in their recovery."
(5) Marginal Exceedances not allowed for surrogate unless it is a "poor performer".
(6) **2003 NELAC Standard (EPA/600/R-04/003), July 2003**, Chapter 5, pages 251-252.
(7) Page 182 of: **Department of Defense Quality Systems Manual for Environmental Laboratories, Version 3 Final, March 2005** Prepared By Environmental Data Quality Workgroup, Department of Navy, Lead Service (Based NELAC Chapter 5 (Quality Systems) NELAC Voted Version − 5 June 2003
(8) Highlighted control limits (**bold font**) adjusted to demonstrate that ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit.
(9) Laboratory Control Sample (LCS) spike recovery control limits also used as advisory control limits for sample matrix spike (MS) analyzes. MS recovery values are advisory and not used to assess the acceptability of an analytical batch.
(10) Default limits pending generation of historic limits for total benzofluoranthrenes (7/29/10)

Analytical Resources,Incorporated
Analytical Chemists and Consultants

Quality Control Criteria for Analysis of Aqueous and Tissue Samples for Aroclors (Polychlorinated Biphenyls – PCB) EPA Method 8082B

Analysis Code	Extraction	DL[1]	LOD[1]	LOQ[1]	Analyte	Spike Recovery Control Limits (%)[2,3]			RPD[4]
						LCS	MB/LCS Surrogate	Sample Surrogate	
Aqueous Samples (Separatory Funnel Extraction – EPA Method 3510C)									
PCBWSI 01-3018F	500 to 5 mL	0.130 µg/L	0.5 µg/L	1 µg/L	Aroclor 1016	45 – 121	--	--	≤ 40
		0.147 µg/L	0.5 µg/L	1 µg/L	Aroclor 1260	54 – 129	--	--	
		--	--	--	TCMX	--	40 – 118	38 – 118	
		--	--	--	DCBP	--	41 – 111	29 – 118	
PCBWSM 02-3021F	500 to 1 mL	0.0175 µg/L	0.05 µg/L	0.1 µg/L	Aroclor 1016	36 – **100**	--	--	≤ 40
		0.0174 µg/L	0.05 µg/L	0.1 µg/L	Aroclor 1260	41 – 113	--	--	
		--	--	--	TCMX	--	29 – **100**	25 – **100**	
		--	--	--	DCBP	--	39 – 116	**10** – 128	
PCBWLS	1000 to 0.5 mL[5]	0.00248 µg/L	0.005 µg/L	0.01 µg/L	Aroclor 1016	44 – 117	--	--	≤ 40
		0.00276 µg/L	0.005 µg/L	0.01 µg/L	Aroclor 1260	46 – 131	--	--	
		--	--	--	TCMX	--	31 – **100**	21 – **100**	
		--	--	--	DCBP	--	32 – 108	19 – 111	
TCLP Extract (Separatory Funnel Extraction – EPA Method 3510C)									
PCBWST	100 to 10 mL	0.130 µg/L[8]	5 µg/L	10 µg/L	Aroclor 1016	30 – 160	--	--	≤ 40
		0.147 µg/L[8]	5 µg/L	10 µg/L	Aroclor 1260	30 – 160	--	--	
		--	--	--	TCMX	--	30 – 160	30 – 160	
		--	--	--	DCBP	--	30 – 160	30 – 160	
Tissue Samples (Tissuemizer / Blender Extraction – EPA Method 3550C Modified) – Concentrations in µg/kg as received (wet weight)									
PCBUZI 09-3029F	10 g to 5 mL	2.92 µg/kg[6]	25 µg/kg	50 µg/kg	Aroclor 1016	30 – 160			≤ 40
		3.91 µg/kg[6]	25 µg/kg	50 µg/kg	Aroclor 1260	30 – 160			
		--	--	--	TCMX		30 – 160	30 – 160	
		--	--	--	DCBP		30 – 160	30 – 160	
PCBUZM 10-3027F	25 g to 5 mL	2.37 µg/kg[7]	10 µg/kg	20 µg/kg	Aroclor 1016	30 – 160			≤ 40
		1.06 µg/kg[7]	10 µg/kg	20 µg/kg	Aroclor 1260	30 – 160			
		--	--	--	TCMX		30 – 160	30 – 160	
		--	--	--	DCBP		30 – 160	30 – 160	
PCBUZL 11-3030F	25 g to 1 mL	2.37[7] µg/kg	2 µg/kg	4 µg/kg	Aroclor 1016	30 – 160			≤ 40
		1.06[7] µg/kg	2 µg/kg	4 µg/kg	Aroclor 1260	30 – 160			
		--	--	--	TCMX		30 – 160	30 – 160	
		--	--	--	DCBP		30 – 160	30 – 160	

(1) Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) are defined in ARI SOP 1018S.
(2) Highlighted control limits (**bold font**) are adjusted from the calculated values to reflect that ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit.
(3) 30 – 160 are default limits used when there is insufficient data to calculate historic control limits
(4) Acceptance criteria for the relative percent difference (RPD) between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then

$$RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$$

(5) Low level extraction solvent is hexane instead of Methylene Chloride.
(6) LOD Study SM10
(7) MDL Study QZ25
(8) Based on PCBWSI until sufficient TCLP data is collected to calculate LOD.

Analytical Resources,Incorporated
Analytical Chemists and Consultants

Quality Control Criteria for Analysis of Solid Matrix Samples for Aroclors (Polychlorinated Biphenyls – PCB) EPA Method 8082B

Analysis Code	Extraction	DL[1] (ppb)	LOD[1] (ppb)	LOQ[1] (ppb)	Analyte	Spike Recovery Control Limits (%)[2,3,8]			RPD[4]
						LCS	MB/LCS Surrogate	Sample Surrogate	
Soil / Sediment Samples (Microwave Extraction – EPA Method 3546)									
PCBSMI 15-3067F	12g to 4 mL	9.83	17	33	Aroclor 1016	55 – 109	--	--	≤ 40
		7.06	17	33	Aroclor 1260	50 – 125	--	--	
PCBSCI 08-3025F		--	--	--	TCMX	--	53 – 108	39 – 122	
		--	--	--	DCBP	--	49 – 126	31 – 140	
PCBDMP20 05-3017F	12.5 g to 2.5 mL[6]	9.33	10	20[6]	Aroclor 1016	46 – 110	--	--	≤ 40
		10.82	15	20[6]	Aroclor 1260	47 – 124	--	--	
PCBDCP20 06-3026F		--	--	--	TCMX	--	43 – 107	34 – 109	
		--	--	--	DCBP	--	48 – 123	24 – 127	
PCBDMP10 05-3017F	12.5 g to 2.5 mL[6]	0.759	5	10[6]	Aroclor 1016	46 – 110	--	--	≤ 40
		1.066	5	10[6]	Aroclor 1260	47 – 124	--	--	
PCBDCP10 06-3026F		--	--	--	TCMX	--	43 – 107	34 – 109	
		--	--	--	DCBP	--	48 – 123	24 – 127	
PCBDMP4 05-3017F	12.5 g to 2.5 mL[6]	0.577	2	4[6]	Aroclor 1016	46 – 110	--	--	≤ 40
		0.610	2	4[6]	Aroclor 1260	47 – 124	--	--	
PCBDCP4 06-3026F		--	--	--	TCMX	--	43 – 107	34 – 109	
		--	--	--	DCBP	--	48 – 123	24 – 127	
Soil / Sediment Samples Medium Level (Vortex Extraction – EPA Method 3546)									
PCBSVX 12-3019F	5 g to 40 mL	109[7]	400	800	Aroclor 1016	30 – 160	--	--	≤ 40
		192[7]	400	800	Aroclor 1260	30 – 160	--	--	
		--	--	--	TCMX	--	30 – 160	30 – 160	
		--	--	--	DCBP	--	30 – 160	30 – 160	

(1) Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) are defined in ARI SOP 1018S.
(2) Highlighted control limits (**bold font**) are adjusted from the calculated values to reflect that ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit.
(3) 30 – 160 are default limits used when there is insufficient data to calculate historic control limits
(4) Acceptance criteria for the relative percent difference (RPD) between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then

$$RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$$

(6) LOQ determined by lowest concentration used to calibrate the GC-ECD instrument.
(7) MDL Study PC66 6/24/09
(8) Control Limits calculated using all data generated between 1/1/11 and 11/30/11

Analytical Resources,Incorporated
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Quality Control Criteria
Gasoline and BTEX

Method	Analyte	DL[1]	LOD[1]	LOQ[1]	Spike % Recovery Control Limits[3]			RPD[3]
					LCS	MB/LCS Surrogate	Sample Surrogate	
Aqueous Samples (DL, LOD & LOQ values in µg/L (ppb) for BTEX and mg/L (ppm) for gasoline								
NWTPH-G	Toluene – Naphthalene	0.057	0.125	0.25	75 – 124	--	--	≤ 40
8015B	2-methylpentane – 1,2,4-Trimethylbenzene	0.031	0.125	0.25	75 – 124	--	--	
WA-TPH-G	Toluene – nC_{12})	0.087	0.125	0.25	75 – 124	--	--	
AK-101	nC_6 – nC_{12}	0.032	0.050	0.10	75 – 124	--	--	
	Trifluorotoluene (TFT)	--	--	--	--	**80** - **120**	**80** - 120	
	Bromobenzene	--	--	--	--	**80** - **120**	**80** - 120	
8021B	Benzene	0.094	0.5	1.0	73 – **120**	--	--	≤ 40
8021B	Toluene	0.113	0.5	1.0	73 – **120**	--	--	
8021B	Ethylbenzene	0.117	0.5	1.0	69 – **120**	--	--	
8021B	m/p-Xylene	0.265	1.0	2.0	72 – **120**	--	--	
8021B	o-Xylene	0.136	0.5	1.0	73 – **120**	--	--	
8021B	MTBE	0.412	0.5	1.0	30 – 182	--	--	
	Trifluorotoluene (TFT)	--	--	--	--	79 – **120**	**80** - **120**	
	Bromobenzene	--	--	--	--	79 – **120**	**80** - **120**	
Solid Samples - (DL, LOD & LOQ values in µg/kg (ppb) for BTEX and mg/kg (ppm) for gasoline								
NWTPH-G	Toluene – Naphthalene	1.66	2.5	5	74 – 124	--	--	≤ 40
8015B	2-methylpentane – 1,2,4-Trimethylbenzene	1.57	2.5	5	74 – 124	--	--	
WA-TPH-G	Toluene – nC_{12})	1.54	2.5	5	74 – 124	--	--	
AK-101	nC_6 – nC_{12}	1.84	2.5	5	74 – 124	--	--	
	Trifluorotoluene (TFT)	--	--	--	--	**80** - **120**	66-123	
	Bromobenzene	--	--	--	--	**80** - **120**	62-130	
8021B	Benzene	4.59	12.5	25	72 – **120**	--	--	≤ 40
8021B	Toluene	7.13	12.5	25	72 – **120**	--	--	
8021B	Ethylbenzene	4.98	12.5	25	71 – **120**	--	--	
8021B	m/p-Xylene	11.9	25.0	50	72 – **120**	--	--	
8021B	o-Xylene	6.23	12.5	25	72 – **120**	--	--	
8021B	MTBE	3.82	12.5	25	40 – 163	--	--	
	Trifluorotoluene (TFT)	--	--	--	--	80 – **120**	68 – 124	
	Bromobenzene	--	--	--	--	77 – **120**	62 – 134	

(1) Detection Limit (DL), Limit of Detection (LOD) and Limit of Quantitation (LOQ) as defined in ARI SOP 1018S.
(2) Highlighted control limits (bold font) are adjusted from the calculated values as follows:
a) Highlighted control limits (**bold font**) adjusted to demonstrate that ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit.
b) Control limits for analytes with no separate preparation procedure are adjusted to reflect the minimum uncertainty in the calibration of the instrument allowed by the referenced analytical method.
(3) Acceptance criteria for the relative percent difference (RPD) between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then

$$RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$$

Analytical Resources,Incorporated
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Quality Control Criteria
Total Petroleum Hydrocarbons
(Diesel & Motor Oil)

Analysis Code	Analyte[5]	LOD[1]	LOQ[2] ppm	Spike % Recovery Control Limits[3]			RPD[4]
				LCS	MB/LCS Surrogate	Sample Surrogate	
HCIWVX	NWTPH-HCID – Water Samples	--	0.50 [7]	--	--	50-150	≤ 40
HCISVX	NWTPH-HCID – Solid Samples	--	50 [7]	--	--	50-150	
Aqueous Samples – No Extract Clean-up – Separatory Funnel Extraction – 500 to 1.0 mL							
DIESWI	DRO – NWTPH-Dext (C_{12}-C_{24})	0.022	0.1	64-112	50-150	50-150	≤ 40
AK2WSI	DRO – AK102 (C_{10}-C_{25})	0.022	0.1	75-125 [6]	60-120	50-150	
OILWSI	RRO – NWTPH-Dext (C_{24}-C_{38})	0.044	0.2	64-112	50-150	50-150	
AK3WSI	RRO – AK103 (C_{25}-C_{36})	0.030 [8]	0.2	60-120 [6]	60-120	50-150	
Aqueous Samples – With Acid and/or Silica Gel Clean-up – Separatory Funnel Extraction – 500 to 1.0 mL							
DIESWI	DRO – NWTPH-Dext (C_{12}-C_{24})	0.039	0.1	61-104	50-150	50-150	≤ 40
AK2WSI	DRO – AK102 (C_{10}-C_{25})	0.042	0.1	75-125 [6]	60-120	50-150	
OILWSI	RRO – NWTPH-Dext (C_{24}-C_{38})	0.010	0.2	61-104	50-150	50-150	
AK3WSI	RRO – AK103 (C_{25}-C_{36})	0.030 [8]	0.2	60-120 [6]	60-120	50-150	
Solid Matrix Samples – No Extract Clean-up – Microwave Extraction – 10 g to 1 mL							
DIESMI	DRO – NWTPH-Dext (C_{12}-C_{24})	1.35	5	62-119	50-150	50-150	≤ 40
AK2SMI	DRO – AK102 (C_{10}-C_{25})	2.43	5	75-125 [6]	60-120	50-150	
OILSMI	RRO – NWTPH-Dext (C_{24}-C_{38})	2.48	10	62-119	50-150	50-150	
AK3SMI	RRO – AK103 (C_{25}-C_{36})	0.665 [9]	10	60-120 [6]	60-120	50-150	
Solid Matrix Samples – With Acid and/or Silica Gel Clean-up – Microwave Extraction – 10 g to 1 mL							
DIESMI	DRO – NWTPH-Dext (C_{12}-C_{24})	1.28	5	60-108	50-150	50-150	≤ 40
AK2SMI	DRO – AK102 (C_{10}-C_{25})	2.06	5	75-125 [6]	60-120	50-150	
OILSMI	RRO – NWTPH-Dext (C_{24}-C_{38})	1.57	10	60-108	50-150	50-150	
AK3SMI	RRO – AK103 (C_{25}-C_{36})	0.665 [9]	10	60-120 [6]	60-120	50-150	

(1) Limit of Detection as defined in ARI SOP 1018S.
(2) Limit of Quantitation as defined in ARI SOP 1018S. The spike concentration used to determine the LOD and the concentration of the lowest standard used to calibrate the GC-FID instrument.
(3) All surrogate recovery limits are specified in the published methods (AK102, AK103 & NWTPH-Dext). The surrogate standard is *o*-Terphenyl.
(4) Acceptance criteria for the relative percent difference (RPD) between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then

$$RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$$

(5) DRO = Diesel Range Organics and RRO = Residual Range Organics as defined in the methods referenced in footnote 3.
(6) Method specified LCS acceptance limits.
(7) Method specified reporting limits
(8) MDL study QD55 completed 2/12/10
(9) MDL study QD35 completed 1/29/10

Analytical Resources,Incorporated
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Spike Recovery Control Limits for Analysis of Aqueous Samples Semi-Volatile Organic Compounds (SVOA) EPA SW-846 Methods 8270D [9]

Effective: 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction Method:	Liquid-Liquid Extract [1]	Liquid-Liquid ME [1,2]	Separatory Funnel [1]	Separatory Funnel - ME [1,2]
Sample Weight / Final Volume:	500 to 0.5 mL	500 to 0.5 mL	500 to 0.5 mL	500 to 0.5 mL
LCS Spike Recovery [8]				
Phenol [3]	50 - **100**	43 - 103	16 - **100**	6 - **100**
Bis-(2-chloroethyl) ether	52 - **100**	45 - 105	41 - 112	29 - 124
2-Chlorophenol	56 - **100**	49 - 103	43 - 111	32 - 122
1,3-Dichlorobenzene	23 - **100**	15 - **100**	32 - **100**	22 - 103
1,4-Dichlorobenzene	25 - **100**	17 - **100**	32 - **100**	22 - 103
Benzyl Alcohol	19 - 100	**10** - 114	22 - 100	9 - 113
1,2-Dichlorobenzene	30 - **100**	22 - **100**	34 - **100**	24 - 104
2-Methylphenol	52 - **100**	44 - 106	36 - 110	24 - 122
2,2'-oxybis(1-chloropropane)	32 - 111	19 - 124	29 - 118	14 - 133
4-Methylphenol	53 - 102	45 - 110	38 - 104	27 - 115
N-Nitroso-di-n-propylamine	43 - 104	33 - 114	38 - 115	25 - 128
Hexachloroethane	12 - **100**	**10** - **100**	24 - **100**	13 - 100
Nitrobenzene	33 - 125	18 - 140	45 - 106	35 - 116
Isophorone	57 - 115	47 - 125	55 - 119	44 - 130
2-Nitrophenol	56 - 102	48 - 110	46 - 118	34 - 130
2,4-Dimethyphenol	29 - **100**	20 - **100**	28 - 105	15 - 118
Bis-(2-chloroethoxy) methane	54 - 101	46 - 109	44 - 118	32 - 130
Benzoic Acid [3]	**10** - 131	**10** - 151	11 - **100**	**10** - **100**
2,4-Dichlorophenol	56 - 104	48 - 112	43 - 121	30 - 134
1,2,4-Trichlorobenzene	27 - **100**	18 - **100**	35 - **100**	25 - 107
Naphthalene	45 - **100**	38 - **100**	36 - 111	24 - 124
4-Chloroaniline [3]	**10** - 139	**10** - 161	10 - 174	**10** - 201
2-Chloronaphthalene	45 - **100**	37 - 105	39 - 118	26 - 131
Hexachlorobutadiene	**10** - **100**	**10** - **100**	24 - **100**	12 - 108
4-Chloro-3-methylphenol	53 - 109	44 - 118	45 - 122	32 - 135
2-Methylnaphthalene	46 - **100**	38 - 100	45 - 103	35 - 113
Hexachlorocyclopentadiene	**10** - **100**	**10** - **100**	23 - 108	**10** - 122
2,4,6-Trichlorophenol	58 - 108	50 - 116	48 - 122	36 - 134
2,4,5-Trichlorophenol	58 - 107	50 - 115	48 - 122	36 - 134
2-Nitroaniline	50 - 107	41 - 117	48 - 118	36 - 130
Dimethylphthalate	58 - 107	50 - 115	50 - 120	38 - 132
Acenaphthylene	57 - 100	50 - 107	50 - 119	39 - 131
2,6-Dinitrotoluene	58 - 112	49 - 121	48 - 133	34 - 147
3-Nitroaniline [3]	21 - 150	**10** - 172	54 - 140	40 - 154
Acenaphthene	51 - **100**	43 - 106	41 - 120	28 - 133
2,4-Dinitrophenol	12 - 169	**10** - 195	23 - 176	**10** - 202

Spike Recovery Control Limits for Analysis of Aqueous Samples Semi-Volatile Organic Compounds (SVOA) EPA SW-846 Methods 8270D [9]

Effective: 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction Method:	Liquid-Liquid Extract [1]	Liquid-Liquid ME [1,2]	Separatory Funnel [1]	Separatory Funnel - ME [1,2]
Sample Weight / Final Volume:	500 to 0.5 mL	500 to 0.5 mL	500 to 0.5 mL	500 to 0.5 mL
Dibenzofuran	57 - 100	50 - 107	51 - 114	41 - 125
4-Nitrophenol [3]	35 - 119	21 - 133	13 - **100**	**10** - **100**
2,4-Dinitrotoluene	58 - 117	48 - 127	51 - 134	37 - 148
Fluorene	56 - 104	48 - 112	50 - 120	38 - 132
Diethylphthlalate	52 - 111	42 - 121	48 - 122	36 - 134
4-Chlorophenyl-phenyl ether	55 - 104	47 - 112	50 - 118	39 - 129
4-Nitroaniline	49 - 112	39 - 123	42 - 136	26 - 152
4,6-Dinitro-2-Methylphenol	13 - 139	**10** - 160	32 - 121	17 - 136
N-Nitrosodiphenylamine	60 - 136	47 - 149	58 - 141	44 - 155
4-Bromophenyl-phenyl ether	55 - 103	47 - 111	50 - 122	38 - 134
Hexachlorobenzene	54 - 106	45 - 115	47 - 125	34 - 138
Pentachlorophenol	46 - 114	35 - 125	35 - 130	19 - 146
Phenanthrene	56 - 102	48 - 110	49 - 120	37 - 132
Anthracene	56 - 101	49 - 109	53 - 116	43 - 127
Carbazole	60 - 108	52 - 116	57 - 122	46 - 133
Di-n-butylphthalate	56 - 112	47 - 121	57 - 121	46 - 132
Fluoranthene	57 - 110	48 - 119	56 - 119	46 - 130
Pyrene	48 - 119	36 - 131	37 - 143	19 - 161
Butylbenzylphthalate	51 - 114	41 - 125	34 - 152	14 - 172
Benzo(a)Anthracene	55 - 105	47 - 113	49 - 129	36 - 142
3,3'-Dichlorbenzidine [3]	**10** - 128	**10** - 148	50 - 128	37 - 141
Chrysene	55 - 104	47 - 112	45 - 128	31 - 142
bis(2-Ethylhexyl) phthalate	28 - 164	**10** - 187	57 - 133	44 - 146
Di-n-octylphthalate	57 - 107	49 - 115	52 - 120	41 - 131
Benzofluoranthene(s) (Total)	30 - 160[10]	30 - 160[10]	30 - 160[10]	30 - 160[10]
Benzo(a)Pyrene	45 - 103	35 - 113	46 - 109	36 - 120
Indeno(1,2,3-cd)Pyrene	35 - 118	21 - 132	34 - 136	17 - 153
Dibenz(a,h)anthracene	42 - 119	29 - 132	41 - 134	26 - 150
Benzo(g,h,i)Perylene	39 - 123	25 - 137	41 - 133	26 - 148
Aniline [3]	**10** - **100**	**10** - **100**	28 - 126	12 - 142
1,2-Diphenylhydrazine /Azobenzene	57 - 109	48 - 118	55 - 119	44 - 130
N-Nitrosodimethylamine	49 - **100**	41 - 104	31 - **100**	21 - 105
1-Methylnaphthalene	46 - **100**	37 - 107	43 - 115	31 - 127
1,4-Dioxane	40 - **100**	30 - 108	30 - 160 [4]	30 - 160 [4]
Pyridine	-	-	25 - **100**	15 - **100**
Tributyl Phosphate	30 - 160 [4]	30 - 160 [4]	30 - 160 [4]	30 - 160 [4]
Dibutyl Phenyl Phosphate	30 - 160 [4]	30 - 160 [4]	30 - 160 [4]	30 - 160 [4]

Spike Recovery Control Limits for Analysis of Aqueous Samples Semi-Volatile Organic Compounds (SVOA) EPA SW-846 Methods 8270D [9]

Effective: 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction Method:	Liquid-Liquid Extract [1]	Liquid-Liquid ME [1,2]	Separatory Funnel [1]	Separatory Funnel - ME [1,2]
Sample Weight / Final Volume:	500 to 0.5 mL	500 to 0.5 mL	500 to 0.5 mL	500 to 0.5 mL
Butyl Diphenyl Phosphate	30 - 160 [4]	30 - 160 [4]	30 - 160 [4]	30 - 160 [4]
Triphenyl Phosphate	30 - 160 [4]	30 - 160 [4]	30 - 160 [4]	30 - 160 [4]
Butylated Hydroxytoluene (BHT)	30 - 160 [4]	30 - 160 [4]	30 - 160 [4]	30 - 160 [4]
MB / LCS Surrogate Recovery				
d4-2-Chlorophenol	53 - 100	(5)	49 - 101	(5)
d4-1,2-Dichlorobenzene	38 - **100**	(5)	40 - **100**	(5)
2,4,6-Tribromophenol	52 - 123	(5)	51 - 122	(5)
2-Fluorophenol	46 - **100**	(5)	31 - **100**	(5)
d5-Phenol [3]	50 - 100	52 - 108	19 - **100**	12 - **100**
d5-Nitrobenzene	46 - 100	(5)	46 - 101	(5)
2-Fluorobiphenyl	49 - **100**	(5)	49 - 103	(5)
d14-p-Terphenyl	53 - 119	(5)	49 - 130	(5)
d8-1,4-Dioxane	45 - **100**	(5)	30 - 160 [4]	(5)
Sample Surrogate Recovery				
d4-2-Chlorophenol	44 - **100**	(5)	23 - 104	(5)
d4-1,2-Dichlorobenzene	32 - **100**	(5)	22 - **100**	(5)
2,4,6-Tribromophenol	48 - 118	(5)	22 - 125	(5)
2-Fluorophenol	38 - **100**	(5)	18 - **100**	(5)
d5-Phenol	41 - **100**	32 - 104	**10** - **100**	17 - **100**
d5-Nitrobenzene	39 - **100**	(5)	21 - 106	(5)
2-Fluorobiphenyl	42 - **100**	(5)	26 - 104	(5)
d14-p-Terphenyl	26 - 114	(5)	11 - 132	(5)
d8-1,4-Dioxane	32 - **100**	(5)	30 - 160 [4]	(5)

(1) Control Limits calculated using all data generated 1/1/07 through 12/1/07.
(2) **ME** = A **marginal exceedance** defined in the NELAC Standard [6] as beyond the CL but still within the ME limits. ARI defines ME limits as between 3 and 4 standard deviations around the mean with upper limit ≥ 100%. A maximum of four marginal exceedances are acceptable. Five or more marginal exceedances in an analysis require corrective action.
(3) These are "**poor performers**" defined in the DoD QSM[7] as compounds that "produce low mean recoveries and high standard deviations, resulting in wide LCS control limits with particularly low lower control limits (sometimes-negative values). ARI does not control batch acceptance based on these compounds since there is a high level of uncertainty in their recovery."
(4) 30 – 160 are default, advisory control limits used when there is insufficient data to calculate historic control limits. **DO NOT** use these limits as the sole reason to reject the data from a batch of analyses.
(5) Marginal Exceedances not allowed for surrogate unless it is a "poor performer".
(6) **2003 NELAC Standard (EPA/600/R-04/003), July 2003**, Chapter 5, pages 251-252.
(7) Page 182 of: **Department of Defense Quality Systems Manual for Environmental Laboratories, Version 3 Final, March 2005** Prepared By Environmental Data Quality Workgroup, Department of Navy, Lead Service (Based On National Environmental Laboratory Accreditation Conference (NELAC) Chapter 5 (Quality Systems) NELAC Voted Version − 5 June 2003
(8) Laboratory Control Sample (LCS) spike recovery control limits also used as advisory control limits for sample matrix spike (MS) analyzes. MS recovery values are advisory and not used to assess the acceptability of an analytical batch.
(9) Highlighted control limits (**bold font**) adjusted to demonstrate that ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit.
(10) Default limits pending generation of historic limits for total benzofluoranthrenes (7/29/10)

Analytical Resources,Incorporated
Analytical Chemists and Consultants

Spike Recovery Control Limits for Analysis of Drinking Water Volatile Organic Compounds (VOA) EPA Method 524.2 [1,5]

Effective: 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

LCS Spike Recovery [6]	ARI Control Limits
Dichlorodifluoromethane	64 - 136
Chloromethane	72 - **120**
Vinyl Chloride	76 - **120**
Bromomethane	72 - 122
Chloroethane	75 - **120**
1,1,2-Trichloro-1,2,2-trifluoroethane	77 - **120**
1,1-Dichloroethene	79 - **120**
Methylene Chloride	74 - **120**
trans-1,2-Dichloroethene	78 - **120**
1,1-Dichloroethane	79 - **120**
2,2-Dichloropropane	79 - **120**
cis-1,2-Dichloroethene	80 - **120**
Chloroform	79 - **120**
Bromodichloromethane	78 - **120**
1,1,1-Trichloroethane	79 - **120**
1,1-Dichloropropene	80 - **120**
Carbon Tetrachloride	56 - 144
1,2-Dichloroethane	77 - **120**
Benzene	80 - **120**
Trichloroethene	78 - **120**
1,2-Dichloropropane	80 - **120**
Bromochloromethane	79 - **120**
Dibromomethane	79 - **120**
cis-1,3-Dichloropropene	78 - **120**
Toluene	80 - **120**
trans-1,3-Dichloropropene	74 - **120**
1,1,2-Trichloroethane	78 - **120**
1,3-Dichloropropane	79 - **120**
Tetrachloroethene	78 - **120**
Dibromochloromethane	76 - **120**
Ethylene Dibromide	79 - **120**
Chlorobenzene	**80** - **120**
Ethylbenzene	78 - 126
1,1,2,2-Tetrachloroethane	77 - **120**
m,p-Xylene	**80** - 122
o-Xylene	79 - **120**
Styrene	76 - 124
Isopropylbenzene	80 - 122

Spike Recovery Control Limits for Analysis of Drinking Water Volatile Organic Compounds (VOA) EPA Method 524.2 [1,5]

Effective: 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

LCS Spike Recovery [6]	**ARI Control Limits**
Bromoform	75 - **120**
1,1,1,2-Tetrachloroethane	79 - **120**
1,2,3-Trichloropropane	80 - **120**
n-Propylbenzene	**80** - 127
Bromobenzene	77 - 124
1,3,5-Trimethylbenzene	78 - **120**
2-Chlorotoluene	79 - 120
4-Chlorotoluene	79 - 122
tert-Butylbenzene	**80** - 122
1,2,4-Trimethylbenzene	**80** - 124
sec-Butylbenzene	**80** - 127
4-Isopropyltoluene	80 - 127
1,3-Dichlorobenzene	80 - **120**
1,4-Dichlorobenzene	80 - **120**
n-Butylbenzene	78 - 129
1,2-Dichlorobenzene	79 - **120**
1,2-Dibromo-3-chloropropane	73 - **120**
1,2,4-Trichlorobenzene	**80** - **120**
Hexachloro-1,3-butadiene	80 - **120**
Naphthalene	54 - **122**
1,2,3-Trichlorobenzene	**80** - **120**
MB/LCS Surrogate Recovery	
d4-1,2-Dichloroethane	**80** - **120**
4-Bromofluorobenzene	69 - 121
d4-1,2-Dichlorobenzene	71 - 120
Sample Surrogate Recovery	
d4-1,2-Dichloroethane	**80** - **120**
4-Bromofluorobenzene	64 - **120**
d4-1,2-Dichlorobenzene	66 - **120**

(1) Control Limits calculated using all data generated 1/1/08 through 12/31/08.
(2) **ME** = A **marginal exceedance** defined in the NELAC Standard [3] as beyond the LCS-CL but still within the ME limits. ME limits are between 3 and 4 standard deviations around the mean. A maximum of four marginal exceedances are acceptable. Five or more marginal exceedances require corrective action.
(3) **2003 NELAC Standard (EPA/600/R-04/003), July 2003**, Chapter 5, pages 251-252.
(4) Marginal Exceedances are not allowed for surrogate standards.
(5) Highlighted control limits (**bold font**) are adjusted from the calculated values as follows:
a) ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit.
b) Control limits for analyzes with no separate preparation procedure are adjusted to reflect the minimum uncertainty in the calibration of the instrument allowed by the referenced analytical method.
(6) Laboratory Control Sample (LCS) spike recovery control limits also used as advisory control limits for sample matrix spike (MS) analyzes. MS recovery values are advisory and not used to assess the acceptability of an analytical batch.

Analytical Resources,Incorporated
Analytical Chemists and Consultants

Spike Recovery Control Limits for Analysis of Aqueous Samples Volatile Organic Compounds (VOA) EPA SW-846 Methods 8260C 5 mL Purge Volume [9]

Effective: 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction Method:	ARI[1] Control Limits	ARI[1,2] ME Limits	DoD[6] Control Limits	DoD[2,6] ME Limits
LCS Spike Recovery [8]				-
Dichlorodifluoromethane	48 - 147	32 - 164	30 - 155	10 - 175
Chloromethane	66 - 130	55 - 141	40 - 125	25 - 140
Vinyl Chloride	73 - 130	64 - 140	50 - 145	35 - 165
Bromomethane	60 - 138	47 - 151	30 - 145	10 - 165
Chloroethane	52 - 151	36 - 168	60 - 135	50 - 145
Trichlorofluoromethane	36 - 175	13 - 198	60 - 145	45 - 160
Acrolein	34 - 164	12 - 186	(4)	(4)
1,1,2-Trichloro-1,2,2-trifluoroethane	69 - 132	59 - 143	(4)	(4)
Acetone	60 - 144	46 - 158	40 - 140	20 - 160
1,1-Dichloroethene	73 - 124	65 - 133	70 - 130	55 - 140
Bromoethane	70 - 133	60 - 144	(4)	(4)
Methyl Iodide	57 - 149	42 - 164	(4)	(4)
Methylene Chloride	74 - 121	66 - 129	55 - 140	40 - 155
Acrylonitrile	75 - 141	64 - 152	(4)	(4)
Methyl tert-Butyl Ether	79 - 127	71 - 135	65 - 125	55 - 135
Carbon Disulfide	67 - 133	56 - 144	35 - 160	15 - 185
trans-1,2-Dichloroethene	80 - **120**	74 - 126	60 - 140	45 - 150
Vinyl Acetate	61 - 145	47 - 159	(4)	(4)
1,1-Dichloroethane	80 - 123	73 - 130	70 - 135	60 - 145
2-Butanone	64 - 149	50 - 163	30 - 150	10 - 170
2,2-Dichloropropane	72 - 136	61 - 147	70 - 135	60 - 150
cis-1,2-Dichloroethene	**80** - **120**	78 - 125	70 - 125	60 - 135
Chloroform	80 - 121	73 - 128	65 - 135	50 - 150
Bromodichloromethane	80 - 122	73 - 129	75 - 120	70 - 130
1,1,1-Trichloroethane	80 - 124	73 - 131	65 - 130	55 - 145
1,1-Dichloropropene	**80** - 123	76 - 130	75 - 130	65 - 140
Carbon Tetrachloride	77 - 123	69 - 131	65 - 140	55 - 150
1,2-Dichloroethane	78 - 121	71 - 128	70 - 130	60 - 140
Benzene	**80** - **120**	80 - 124	80 - 120	75 - 130
Trichloroethene	**80** - **120**	76 - 124	70 - 125	60 - 135
1,2-Dichloropropane	**80** - 120	76 - 126	75 - 125	65 - 135
Bromochloromethane	**80** - 120	77 - 126	65 - 130	55 - 140
Dibromomethane	**80** - **120**	76 - 122	75 - 125	65 - 135
2-Chloroethylvinylether	59 - 136	46 - 149	(4)	(4)
4-Methyl-2-Pentanone	68 - 138	56 - 150	60 - 135	45 - 145
cis-1,3-Dichloropropene	74 - 127	65 - 136	70 - 130	60 - 140

Spike Recovery Control Limits for Analysis of Aqueous Samples Volatile Organic Compounds (VOA) EPA SW-846 Methods 8260C 5 mL Purge Volume [9]

Effective: 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction Method:	ARI[1] Control Limits	ARI[1,2] ME Limits	DoD[6] Control Limits	DoD[2,6] ME Limits
Toluene	**80 - 120**	78 - 122	75 - 120	70 - 130
trans-1,3-Dichloropropene	68 - 131	58 - 142	55 - 140	40 - 155
2-Hexanone	70 - 136	59 - 147	55 - 130	45 - 140
1,1,2-Trichloroethane	**80 - 120**	79 - 120	75 - 125	65 - 135
1,3-Dichloropropane	**80** - 120	76 - 126	75 - 125	65 - 135
Tetrachloroethene	79 - **120**	73 - 125	45 - 150	25 - 165
Dibromochloromethane	77 - 123	69 - 131	60 - 135	45 - 145
Ethylene Dibromide	**80** - 121	76 - 128	(4)	(4)
Chlorobenzene	**80 - 120**	77 - 121	80 - 120	75 - 130
Ethylbenzene	83 - 122	77 - 129	75 - 125	65 - 135
1,1,2,2-Tetrachloroethane	**80** - 121	74 - 128	65 - 130	55 - 140
m,p-Xylene	**80** - 123	79 - 129	75 - 130	65 - 135
o-Xylene	**80** - 125	75 - 132	80 - 120	75 - 130
Styrene	72 - 130	62 - 140	65 - 135	55 - 145
Isopropylbenzene	**80** - 129	78 - 136	75 - 125	65 - 135
Bromoform	71 - **120**	63 - 126	70 - 130	60 - 140
1,1,1,2-Tetrachloroethane	77 - 122	70 - 130	80 - 130	75 - 135
1,2,3-Trichloropropane	**80** - 120	76 - 126	75 - 125	65 - 130
trans-1,4-Dichloro-2-butene	62 - 146	48 - 160	(4)	(4)
n-Propylbenzene	**80** - 128	78 - 135	70 - 130	65 - 140
Bromobenzene	**80 - 120**	78 - 122	75 - 125	70 - 130
1,3,5-Trimethylbenzene	**80** - 129	77 - 137	75 - 130	65 - 140
2-Chlorotoluene	**80** - 124	75 - 131	75 - 125	65 - 135
4-Chlorotoluene	**80** - 124	75 - 131	75 - 130	65 - 135
tert-Butylbenzene	**80** - 128	76 - 136	70 - 130	60 - 140
1,2,4-Trimethylbenzene	**80** - 130	75 - 138	75 - 130	65 - 140
sec-Butylbenzene	**80** - 129	78 - 136	70 - 125	65 - 135
4-Isopropyltoluene	**80** - 133	75 - 141	75 - 130	65 - 140
1,3-Dichlorobenzene	**80 - 120**	76 - 124	75 - 125	65 - 130
1,4-Dichlorobenzene	**80 - 120**	75 - 122	75 - 125	65 - 130
n-Butylbenzene	78 - 140	68 - 150	70 - 135	55 - 150
1,2-Dichlorobenzene	**80 - 120**	77 - 121	70 - 120	60 - 130
1,2-Dibromo-3-chloropropane	72 - 131	62 - 141	50 - 130	35 - 145
1,2,4-Trichlorobenzene	75 - 130	66 - 139	65 - 135	55 - 145
Hexachloro-1,3-butadiene	73 - 129	64 - 138	50 - 140	35 - 160
Naphthalene	66 - 140	54 - 152	55 - 140	40 - 150
1,2,3-Trichlorobenzene	74 - 130	65 - 139	55 - 140	45 - 155

Spike Recovery Control Limits for Analysis of Aqueous Samples Volatile Organic Compounds (VOA) EPA SW-846 Methods 8260C 5 mL Purge Volume [9]

Effective: 5/1/09

Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. http://www.arilabs.com/portal/downloads/ARI-CLs.zip

Extraction Method:	ARI[1] Control Limits	ARI[1,2] ME Limits	DoD[6] Control Limits	DoD[2,6] ME Limits
MB/LCS Surrogate Recovery				
Dibromofluoromethane	**80 - 120**	(3)	85 - 115	(3)
d4-1,2-Dichloroethane	**80** - 122	(3)	70 - 120	(3)
d8-Toluene	**80 - 120**	(3)	85 - 120	(3)
4-Bromofluorobenzene	**80 - 120**	(3)	75 - 120	(3)
d4-1,2-Dichlorobenzene	**80 - 120**	(3)	(4)	(3)(4)
Sample Surrogate Recovery				
Dibromofluoromethane	30 - 160 [7]	(3)	85 - 115	(3)
d4-1,2-Dichloroethane	**80** - 125	(3)	70 - 120	(3)
d8-Toluene	**80 - 120**	(3)	85 - 120	(3)
4-Bromofluorobenzene	**80 - 120**	(3)	75 - 120	(3)
D4-1,2-Dichlorobenzene	**80 - 120**	(3)	(4)	(3) (4)

(1) Control Limits calculated using all data generated 1/1/08 through 12/31/08.
(2) **ME** = A **marginal exceedance** defined in the NELAC Standard[5] as beyond the LCS-CL but still within the ME limits. ME limits are between 3 and 4 standard deviations around the mean. A maximum of four marginal exceedances are acceptable. Five or more marginal exceedances require corrective action.
(3) Marginal Exceedances not allowed for surrogate standards.
(4) The DoD-QSM [6] does not list recovery limits for these compounds.
(5) **2003 NELAC Standard (EPA/600/R-04/003), July 2003**, Chapter 5, pages 251-252.
(6) Page 182 of: **Department of Defense Quality Systems Manual for Environmental Laboratories, Version 3 Final, March 2005** Prepared By Environmental Data Quality Workgroup, Department of Navy, Lead Service (Based On National Environmental Laboratory Accreditation Conference (NELAC) Chapter 5 (Quality Systems) NELAC Voted Version − 5 June 2003
(7) 30 – 160 are default, advisory control limits used when there is insufficient data to calculate historic control limits. **DO NOT** use these limits as the sole reason to reject the data from a batch of analyses
(8) Laboratory Control Sample (LCS) spike recovery control limits also used as advisory control limits for sample matrix spike (MS) analyzes. MS recovery values are advisory and not used to assess the acceptability of an analytical batch.
(9) Highlighted control limits (**bold font**) are adjusted from the calculated values as follows:
a) ARI does not use control limits < 10 for the lower limit or < 100 for the upper limit.
b) Control limits for analyzes with no separate preparation procedure are adjusted to reflect the minimum uncertainty in the calibration of the instrument allowed by the referenced analytical method.