APPENDIX E

Quality Assurance Project Plan

Quality Assurance Project Plan
Boeing Auburn Facility
Auburn, Washington

February 9, 2017

Prepared for

The Boeing Company
Seattle, Washington

LANDAU ASSOCIATES

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Quality and Assurance Project Plan
Boeing Auburn Facility
Auburn, Washington

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LIST OF ABBREVIATIONS AND ACRONYMS

Boeing ..... The Boeing Company
DQO ..... daily quality objective
Ecology ..... Washington State Department of Ecology
EPA ..... U.S. Environmental Protection Agency
facility ..... Boeing Auburn facility
LAI ..... Landau Associates, Inc.
LCS ..... laboratory control sample
LCSD ..... laboratory control sample duplicate
LLI ..... Eurofins Lancaster Laboratories, Inc.
LOQ ..... limits of quantitation
MQO ..... measurement quality objective
MS ..... matrix spike
MSD ..... matrix spike duplicate
QA ..... quality assurance
QAPP ..... Quality Assurance Project Plan
QC ..... quality control
RI ..... remedial investigation
RL ..... reporting limit
RPD ..... relative percent difference
SAP ..... Sampling and Analysis Plan
TPH-D ..... diesel-range total petroleum hydrocarbon
TPH-G ..... gasoline-range total petroleum hydrocarbon
TPH-O ..... oil-range total petroleum hydrocarbon
VOC ..... volatile organic compound

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1.0 INTRODUCTION

The Boeing Company (Boeing) is currently undergoing corrective action at their Auburn Fabrication Division facility (facility) located at 700 15th Street Southwest in Auburn, Washington (Figure 1). The facility is used to manufacture airplane parts. Corrective action requirements are documented in an Agreed Order (Order; No. DE 01HWTRNR-3345) dated August 14, 2002 and the First Amended Agreed Order dated February 21, 2006, both with Washington State Department of Ecology (Ecology). This quality assurance project plan (QAPP) presents the project quality assurance objectives, laboratory analytical methods, quality assurance/quality control (QA/QC) requirements, and data management procedures in support of corrective actions taking place at the facility and at downgradient properties (Site). This QAPP was prepared using the Ecology Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology 2004). This QAPP is intended to be used in conjunction with the project Sampling and Analysis Plan (SAP; LAI 2016). Specific work plans provide additional details related to Site setting and specific investigative work to be conducted.

2.0 PROJECT TEAM ORGANIZATION AND RESPONSIBILITIES

The project team organizational structure was developed based on the requirements of the field and laboratory activities. The key positions/contractors and associated responsibilities are described below:

- Boeing Project Manager — Responsible for overseeing the implementation of the Order and remedial investigation (RI) at the Boeing Auburn facility and communicating status and issues related to the RI to the Ecology Project Coordinator. The Boeing Project Manager is the contact for the LAI Project Manager.
- Landau Associates, Inc. (LAI) Project Manager — Responsible for implementation of all aspects of the RI Work Plans, SAP, and QAPP. Specific responsibilities include review and approval of revisions to RI documentation, overseeing that all technical procedures are followed, reporting of deviations from the Ecology-approved RI Work Plans, SAP, and QAPP to the Boeing Project Manager, and overseeing that data collected will satisfy the QA objectives discussed in Section 3.0 of this document.
- LAI Quality Assurance Manager – Responsible for insuring that data is of sufficient quality to achieve the Data Quality Objectives (DQOs) presented in this QAPP.
- Ecology Project Managers — Responsible for overseeing the implementation of the Order and the First Amended Agreed Order dated February 21, 2006, both with Boeing.
- Analytical Laboratory Project Manager — Responsible for providing sample bottles, performing chemical analyses per the QAPP and reporting of data as required by the QAPP. Boeing's contracted laboratory at the date of this report is Eurofins Lancaster Laboratories, Inc. (LLI), located in Lancaster, Pennsylvania; however, the contracted laboratory may change in the future.

3.0 QUALITY ASSURANCE OBJECTIVES

QA objectives consist of DQOs and Measurement Quality Objectives (MQOs). DQOs are established when the data will be used to make a critical decision, such as selecting between two alternative conditions or to determine compliance with a standard. MQOs specify how good the data must be in order to fulfill the project's objectives; they are the acceptance thresholds for data quality indicators. Data quality indicators are precision, bias, and sensitivity.

3.1 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an actual condition or characteristic of a population. Representativeness can be evaluated using replicate samples, representative sampling locations, and blanks. Representativeness for the RI sampling will be accomplished using appropriate selection of sampling locations for each media of potential concern (groundwater, surface water, soil, soil vapor, and air). To determine that the analytical results are representative of the sampled item and not influenced by cross-contamination, method blanks will be analyzed with each analysis as described in Section 5.5.6.

3.2 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this work, comparability of data will be established through the use of standard analytical methodologies with analytical limits of quantitation (LOQs) that can meet screening level criteria to the extent practicable, standard reporting formats, and common traceable calibration and reference materials. Methods to be used for analysis of groundwater, surface water, soil, soil vapor, and air samples are discussed in Section 4.0.

3.3 Measurement Quality Objectives

MQOs for the project specify how good the data must be in order to meet the objectives of the project and are based on precision and accuracy, as described in this section.

3.3.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD) and/or through laboratory control sample/laboratory control sample duplicate (LCS/LCSD) for organic analysis and through laboratory duplicate samples for inorganic analyses.

Analytical precision measurements will be carried out on project-specific samples when possible as described in Section 5.0. Laboratory precision will be evaluated against quantitative relative percent difference (RPD) performance criteria provided by the laboratory.

Field precision will be evaluated by the collection of blind field duplicate samples as described in Section 5.0. Control limits for the groundwater field duplicates will be 20 percent unless the duplicate sample values are within five times the LOQ, in which case the control limit interval will be plus or minus the LOQ.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit (MDL), where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$RPD = \left| \frac{C_1 - C_2}{(C_1 + C_2)/2} \right| x\,100$$

where: C1 = first sample value

C2 = second sample value (duplicate)

RPD = relative percent difference.

3.3.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Field accuracy is controlled by adherence to sample collection procedures as outlined in the SAP.

Analytical accuracy may be assessed by analyzing "spiked" samples with known standards (surrogates, LCS, and/or MS) and measuring the percent recovery. Accuracy measurements on MS samples will be carried out as described in Section 5.0. Because MS/MSDs measure the effects of potential matrix interferences of a specific matrix, the laboratory will perform MS/MSDs only on samples from this investigation and not from other projects. Surrogate recoveries will be determined for every sample analyzed for organics.

Laboratory accuracy will be evaluated against quantitative MS and surrogate spike recovery performance criteria provided by the laboratory. Accuracy can be expressed as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\frac{Percent}{Recovery} = \frac{(Spiked\ Sample\ Result - Unspiked\ Sample\ Result)}{Amount\ of\ Spike\ Added}\ x\ 100$$

Control limits for percent recovery for groundwater, soil, and vapor samples will be laboratory acceptance limits generated according to U.S. Environmental Protection Agency (EPA) guidelines.

3.3.3 Bias

Bias is the systematic or persistent distortion of a measured process that causes errors in one direction. Bias of the laboratory results will be evaluated based on analysis of method blanks and MS samples as described in Section 5.0.

3.3.4 Sensitivity

Sensitivity is the ability to discern the difference between very small amounts of a substance. For the purposes of this project, sensitivity is the lowest concentration that can be accurately detected by the analytical method. The analytical method will be considered sufficiently sensitive if the LOQs are below project screening levels. Proposed analytical methods and LOQs are discussed in Section 4.0.

3.3.5 Completeness

Completeness is a measure of the proportion of data obtained from a task sampling plan that is determined to be valid. It is calculated as the number of valid data points divided by the total number of data points requested. The QA objective for completeness during this project will be 95 percent. Completeness will be routinely determined and compared to this control criterion.

4.0 LABORATORY METHODS

Groundwater samples are routinely analyzed for volatile organic compounds (VOCs), dissolved metals (arsenic, cadmium, and nickel), total organic carbon, sulfate, ethane, ethene, methane, and diesel-range and motor oil-range petroleum hydrocarbons (TPH-D and TPH-O, respectively). Surface water samples will be analyzed for VOCs. Soil samples may be analyzed for VOCs, semi-volatile organic compounds, metals (arsenic, lead, cadmium, chromium, and nickel), polychlorinated biphenyls, and TPH-D, TPH-O, and gasoline-range petroleum hydrocarbons (TPH-G). Soil vapor and air samples will be analyzed for VOCs only.

Laboratory methods, LLI target LOQs, and screening levels for the analysis of the above constituents in water (groundwater and surface water[1]), soil, soil vapor, and air samples are summarized in Tables 1, 2, 3, and 4, respectively. Other laboratories were used in the past to analyze groundwater, soil, and soil vapor samples; therefore, the reporting limits (RLs) from the former laboratories are presented in Tables 1, 2, and 3 for comparison purposes. For all groundwater analyses except dissolved metals, any suspended material in the sample will be allowed to settle and the sample will not be agitated prior to analysis of the supernatant. For the dissolved metals analyses, the samples will be filtered in the field to remove any suspended material. A silica gel cleanup will be applied to all soil samples analyzed for TPH-D and TPH-O. Sample containers, preservation, and holding times are provided in Table 5.

Analytes where laboratory target LOQs exceed screening levels are presented in Table 6. If new or modified analytical procedures become available that result in the RLs meeting the respective screening levels, Boeing will submit a technical memorandum and a revised Table 6 to Ecology (Ecology 2012).

[1] Only groundwater screening levels for constituents in water are shown, as they are typically more conservative than surface water screening levels.

5.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

This section describes the procedures that will be implemented to:

1) Ensure sample integrity from the time of sample collection to the time of analysis in the laboratory;
2) Obtain the appropriate chemical and physical data;
3) Collect field and laboratory QC samples;
4) Monitor performance of the laboratory and field measurement systems;
5) Correct any deviations from the methods or QA requirements established in this QAPP; and
6) Report and validate the data.

5.1 Laboratory Instrument Calibration

The analytical laboratory project manager is responsible for maintaining laboratory instruments in proper working order including routine maintenance and calibration, and training of personnel in maintenance and calibration procedures. Laboratory instruments will be properly calibrated with appropriate check standards and calibration blanks for each parameter before beginning each analysis. Instrument performance check standards, where required, and calibration blank results will be recorded in a laboratory logbook dedicated to each instrument. At a minimum, the preventive maintenance schedules contained in the EPA methods and in the equipment manufacturer's instructions will be followed. Laboratory calibration procedures and schedules will be as described in the laboratory QAPP.

5.2 Field Equipment Calibration

Field meters, including pH, conductivity, dissolved oxygen (DO), temperature probes, and photoionization detector (PID) will be calibrated and maintained in accordance with the manufacturer’s specifications. All routine maintenance will be recorded in the field equipment logs.

5.3 Field Documentation

A complete record of all field activities will be maintained for the duration of the field phase of the work. Documentation will include the following:

- Daily recordkeeping by field personnel of all field activities
- Recordkeeping of all samples collected for analysis (field sampling forms)
- Use of sample labels and tracking forms for all samples collected for analysis.

The field logs will provide a description of all sampling activities, sampling personnel, weather conditions, and a record of all modifications to the procedures and plans identified in the SAP. The field logs are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

Sample possession and handling will also be documented so that it is traceable from the time of sample collection to the laboratory and data analysis. All field logs, sample collection forms, and chain-of-custody forms will be electronically scanned and copies placed in the electronic project file.

5.4 Sample Handling Procedures and Transfer of Custody

Samples submitted to the analytical laboratories will be collected in the appropriate sample containers and preserved as specified in Table 5. The storage temperatures and maximum holding times for physical/chemical analyses are also presented in Table 5.

The transportation and handling of samples will be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to release of samples. Samples will be logged on a chain-of-custody form and will be kept in coolers on ice until delivery to the analytical laboratory. The project laboratory is located in Pennsylvania and; therefore, samples must be shipped by air courier. The laboratory will provide appropriate packing material for shipping the samples so that damage to the samples is avoided. Samples will be sent to the project analytical laboratory in batches. The chain-of-custody will accompany each cooler in a shipment of samples to the laboratory. Each cooler will also have custody seals placed on the outside to indicate if tampering has taken place during shipment. Cooler receipt forms will be filled out by LLI. Upon receipt by LLI, custody seals will be inspected and the COC form signed and dated by laboratory personnel. Laboratory personnel will verify sample numbers and the condition of each sample. Shipping manifests and COC forms signed and dated by laboratory personnel will be considered sufficient documentation of sample custody transfer from the sampler, through the shipping agent, to the analysts at LLI. A copy of each COC form will be retained by the sampling team for the project file and the duplicate copies will be sent with the samples. Bills of lading will also be retained as part of the documentation for the COC records. In conjunction with data reporting, LLI will return the original COC forms to the LAI Project Manager for inclusion into the central project file.

5.5 Field and Laboratory Quality Control Samples

Field and analytical laboratory QC samples will be collected to evaluate data precision, accuracy, representativeness, completeness, bias, and comparability of the analytical results for the RI. The quality control samples and the frequency at which they will be collected and/or analyzed are described below.

5.5.1 Blind Field Duplicates

A blind field duplicate will be collected at a frequency of at least 1 per 20 groundwater samples per chemical analysis, not including laboratory and field QC samples, but not less than one field duplicate per sampling event (any continuous sampling period not interrupted by more than 2 days). The blind field duplicate will consist of a split sample collected at a single sample location. Groundwater blind field duplicates will be collected by alternately filling sample containers for both the original and the corresponding duplicate sample at the same location to decrease variability between the duplicates.

No soil blind field duplicate samples will be collected due to the inherent heterogeneity of the samples. Soil vapor and air blind field duplicates will be collected at a frequency of at least 1 per 20 samples, but no less than one field duplicate per sampling event. The blind field duplicate will be collected by concurrently filling a second Summa canister at the same location. Blind field duplicate sample results will be used to evaluate data precision.

5.5.2 Field Trip Blanks

Field trip blanks will consist of de-ionized or distilled water sealed in a sample container provided by the analytical laboratory. The trip blank will accompany samples collected for the analysis of VOCs and TPH-G during transportation to and from the field, and then will be returned to the laboratory with each shipment. The trip blank will remain unopened until submitted to the laboratory for analysis. One trip blank per cooler containing water and/or soil samples for VOCs and TPH-G analysis will be evaluated to determine possible sample contamination during transport.

5.5.3 Laboratory Matrix Spike

A minimum of one project sample per 20 samples per analyses will be spiked by the laboratory to evaluate potential matrix interference. These analyses will be performed to provide information on accuracy and to verify that extraction and concentration levels are acceptable. The laboratory spikes will follow EPA guidance for MS and MSDs.

5.5.4 Laboratory Matrix Spike Duplicate

A minimum of one project sample per 20 samples per analyses will be spiked by the laboratory as a MSD. The analysis of MSD samples will be performed to provide information on the precision of chemical analyses. The laboratory spikes will follow EPA guidance for MS and MSDs.

5.5.5 Laboratory Duplicates

A minimum of one laboratory duplicate per 20 samples, or one laboratory duplicate sample per batch of samples if fewer than 20 samples are contained in a batch, will be analyzed for metals. These analyses will be performed to provide information on the precision of chemical analyses. The laboratory duplicate will follow EPA guidance in the method.

5.5.6 Laboratory Method Blanks

A minimum of one laboratory method blank per 20 samples, one every 12 hours, or one per batch of samples analyzed (if fewer than 20 samples are contained in a batch) will be analyzed for all parameters to assess possible laboratory contamination. Dilution water will be used whenever possible. Method blanks will contain all reagents used for analysis. The generation and analysis of additional method, reagent, and glassware blanks may be necessary to verify that laboratory procedures do not contaminate samples.

5.5.7 Laboratory Control Sample

A minimum of one LCS per 20 samples, or one LCS per sample batch if fewer than 20 samples are contained in a batch, will be analyzed for all parameters.

5.5.8 Surrogate Spikes

All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined by the analytical methods.

5.6 Laboratory Quality Assurance/Quality Control

QA/QC for chemical testing includes laboratory instrument and analytical method QA/QC. Instrument QA/QC monitors the performance of the instrument and method QA/QC monitors the performance of sample preparation procedures. The analytical laboratory will be responsible for instrument and method QA/QC. QA/QC procedures to be performed by the laboratory for analysis of water, soil, soil vapor, and air samples will be in accordance with methods specified in Tables 1, 2, 3, and 4, respectively.

When an instrument or method control limit is exceeded, the laboratory will contact the project manager immediately. The laboratory will be responsible for correcting the problem and will re-analyze the samples within the sample holding time if sample re-analysis is appropriate. Corrective actions are described further in Section 6.0.

6.0 CORRECTIVE ACTIONS

Corrective actions will be needed for two categories of non-conformance:

- Deviations from the methods or QA requirements established in this QAPP
- Equipment or analytical malfunctions.

Corrective action procedures to be implemented based on detection of unacceptable data are developed on a case-by-case basis. Such actions may include one or more of the following:

- Altering procedures in the field
- Using a different batch of sample containers
- Performing an audit of field or laboratory procedures
- Re-analyzing samples (if holding times allow)
- Resampling and analyzing
- Evaluating sampling and analytical procedures to determine possible causes of the discrepancies
- Accepting the data without action, acknowledging the level of uncertainty
- Rejecting the data as unusable.

During field operations and sampling procedures, the field personnel will be responsible for conducting and reporting required corrective actions. A description of any action taken will be entered in the daily field notebook. The project manager will be consulted immediately if field conditions are such that conformance with this QAPP is not possible. The field coordinator will consult with the LAI's project manager, who may authorize changes or exceptions to the QA/QC portion of the QAPP, as necessary and appropriate.

During laboratory analysis, the laboratory QA officer will be responsible for taking required corrective actions in response to equipment malfunctions. If an analysis does not meet data quality objectives outlined in this QAPP, corrective action will follow the guidelines in the noted EPA analytical methods and the EPA guidelines for data validation for organics and inorganics analyses (EPA 1999, 2004). At a minimum, the laboratory will be responsible for monitoring the following:

- Calibration check compounds must be within performance criteria specified in the EPA method or corrective action must be taken prior to initiation of sample analysis. No analyses may be performed until these criteria are met.
- Before processing any samples, the analyst should demonstrate, through analysis of a reagent blank that interferences from the analytical system, glassware, and reagents are within acceptable limits. Each time a set of samples is extracted or there is a change in reagents, a reagent blank should be processed as a safeguard against chronic laboratory contamination. The blank samples should be carried through all stages of the sample preparation and measurement steps.

- Method blanks should, in general, be below instrument detection limits. If contaminants are present, then the source of contamination must be investigated, corrective action taken and documented, and all samples associated with a contaminated blank re-analyzed. If, upon re-analysis, blanks do not meet these requirements, LAI project manager will be notified immediately to discuss whether analyses may proceed.
- Surrogate spike analysis must be within the specified range for recovery limits for each analytical method utilized or corrective action must be taken and documented. Corrective action includes: 1) reviewing calculations, 2) checking surrogate solutions, 3) checking internal standards, and 4) checking instrument performance. Subsequent action could include recalculating the data and/or re-analyzing the sample if any of the above checks reveal a problem. If the problem is determined to be caused by matrix interference, re-analysis may be waived if so directed following consultation with LAI project manager. If the problem cannot be corrected through re-analysis, the laboratory will notify LAI project manager prior to data submittal so that additional corrective action can be taken, if appropriate.
- If the recovery of a surrogate compound in the method blank is outside the recovery limits, the blank will be re-analyzed along with all samples associated with that blank. If the surrogate recovery is still outside the limits, LAI project manager will be notified immediately to discuss whether analyses may proceed.
- If quantitation limits or MS control limits cannot be met for a sample, LAI project manager will be notified immediately to discuss corrective action required.
- If holding times are exceeded, all positive and undetected results may need to be qualified as estimated concentrations. If holding times are grossly exceeded, LAI project manager may determine the data to be unusable.

If analytical conditions are such that nonconformance with this QAPP is indicated, LAI project manager will be notified as soon as possible so that any additional corrective actions can be taken. The laboratory project manager will then document the corrective action by a memorandum submitted to LAI project manager. A narrative describing the anomaly; the steps taken to identify and correct the anomaly; and any recalculation, re-analyses, or re-extractions will be submitted with the data package in the form of a cover letter.

7.0 DATA VERIFICATION AND VALIDATION

All RI data will be verified and validated to determine the results are acceptable and meet the quality objectives described in Section 3.0. Prior to submitting a laboratory report, the laboratory will verify that all the data are consistent, correct, and complete, with no errors or omissions.

LAI will perform an EPA Level IIa equivalent validation, following the guidelines in the appropriate sections of the EPA Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review (EPA 1999, 2004). The Level IIa equivalent data validation will include evaluations of the following:

- Chain-of-custody records
- Holding times
- Laboratory method blanks
- Surrogate recoveries
- Laboratory MS/MSD
- Blank spikes/LCS
- Laboratory duplicates
- Corrective action records
- Completeness
- Overall assessment of data quality.

In the event that a portion of the data is outside the DQO limits or the EPA guidance (EPA 1999, 2004), or sample collection and/or documentation practices are deficient, corrective action(s) will be initiated. Corrective action, as described in Section 6.0, will be determined by the field coordinator and LAI's QA officer in consultation with the LAI's project/task manager and may include any of the following:

- Rejection of the data and resampling
- Qualification of the data
- Modified field and/or laboratory procedures.

Data qualification arising from data validation activities will be described in the data validation report, rather than in individual corrective action reports. Boeing PM will notify Ecology PM of all variances of the QAPP and applicable project plans through status reports, data reports, quarterly reports, or other written correspondences, so that the variances are communicated to Ecology as quickly as possible (Ecology 2012).

8.0 DATA MANAGEMENT PROCEDURES

All laboratory analytical results, including QC data, will be submitted electronically to LAI. Electronic format will include a scanned PDF of the original laboratory data package and an EQuIS 4-file format Electronic Data Deliverable (EDD), which will be uploaded to the project database. Following validation of the data, any qualifiers will be added to the Excel spreadsheets and imported to the project database. All survey data will be provided electronically in a format that can be downloaded into an Excel spreadsheet. All field data (groundwater field parameter data and water levels measurements) will be entered into an Excel spreadsheet and verified to determine all entered data is correct and without omissions and errors. Following receipt of all RI data and all survey data, water level measurements, field parameters, and analytical results will be formatted electronically and uploaded to Ecology's Environmental Information Management (EIM) system.

This document has been prepared under the supervision and direction of the following key staff:

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DJR/JWW/jrc
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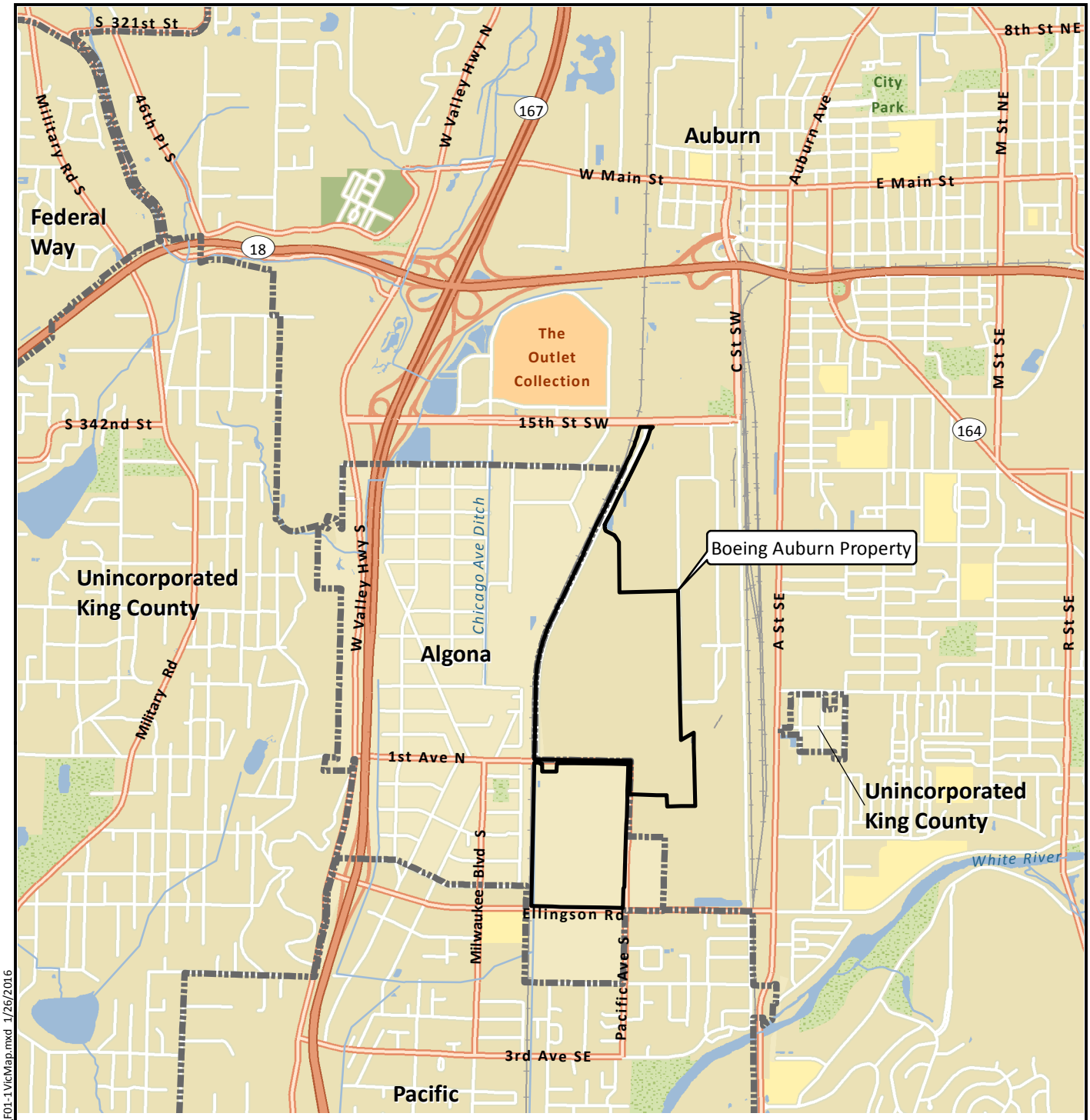

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Boeing Auburn Auburn, Washington	**Vicinity Map**	Figure **E-1**

Table E-1
Water Sample Laboratory Analytical Methods and Target Limits of Quantitation
Boeing Auburn Facility
Auburn, Washington

Analyte	Analytical Method (a)	Former Target Reporting Limits-ARI	Target LOQs - LLI (b)	Groundwater Screening Level
VOCs	**EPA 8260C**			
Acetone		5.0 µg/L	5.0 µg/L	7.20E+03 µg/L
Benzene		0.2 µg/L	0.2 µg/L	7.95E-01 µg/L
Bromodichloromethane		0.2 µg/L	0.5 µg/L	8.00E-02 µg/L
Bromoform		0.2 µg/L	0.5 µg/L	5.54E+00 µg/L
Bromomethane		1.0 µg/L	0.5 µg/L	1.12E+01 µg/L
2-Butanone		5.0 µg/L	5.0 µg/L	4.80E+03 µg/L
Carbon Disulfide		0.2 µg/L	0.5 µg/L	8.00E+02 µg/L
Carbon Tetrachloride		0.2 µg/L	0.2 µg/L	6.25E-01 µg/L
Chlorobenzene		0.2 µg/L	0.5 µg/L	1.00E+02 µg/L
Chloroethane		0.2 µg/L	0.5 µg/L	---
Chloroform		0.2 µg/L	0.2 µg/L	1.41E+00 µg/L
Chloromethane		0.5 µg/L	0.5 µg/L	---
Dibromochloromethane		0.2 µg/L	0.5 µg/L	5.21E-01 µg/L
1,1-Dichloroethane		0.2 µg/L	0.5 µg/L	7.68E+00 µg/L
1,2-Dichloroethane		0.2 µg/L	0.2 µg/L	4.81E-01 µg/L
1,1-Dichloroethene		0.2 µg/L	0.2 µg/L	7.00E+00 µg/L
cis-1,2-Dichloroethene		0.2 µg/L	0.2 µg/L	1.60E+01 µg/L
trans-1,2-Dichloroethene		0.2 µg/L	0.2 µg/L	1.00E+02 µg/L
1,2-Dichloropropane		0.2 µg/L	0.5 µg/L	1.22E+00 µg/L
cis-1,3-Dichloropropene		0.2 µg/L	0.2 µg/L	---
trans-1,3-Dichloropropene		0.2 µg/L	0.2 µg/L	---
Ethylbenzene		0.2 µg/L	0.5 µg/L	7.00E+02 µg/L
2-Hexanone		5.0 µg/L	5.0 µg/L	---
4-Methyl-2-Pentanone (MIBK)		5.0 µg/L	5.0 µg/L	6.40E+02 µg/L
Methylene Chloride		1.0 µg/L	0.5 µg/L	5.00E+00 µg/L
Styrene		0.2 µg/L	0.5 µg/L	1.00E+02 µg/L
1,1,2,2-Tetrachloroethane		0.2 µg/L	0.2 µg/L	2.19E-01 µg/L
Tetrachloroethene		0.2 µg/L	0.2 µg/L	5.00E+00 µg/L
Toluene		0.2 µg/L	0.2 µg/L	6.40E+02 µg/L
1,1,2-Trichloro-1,2,2-trifluoroethane		0.2 µg/L	0.5 µg/L	2.40E+05 µg/L
1,1,1-Trichloroethane		0.2 µg/L	0.5 µg/L	2.00E+02 µg/L
1,1,2-Trichloroethane		0.2 µg/L	0.2 µg/L	7.68E-01 µg/L
Trichloroethene		0.2 µg/L	0.2 µg/L	5.40E-01 µg/L
Trichlorofluoromethane		0.2 µg/L	0.5 µg/L	2.40E+03 µg/L
Vinyl Acetate		0.2 µg/L	0.5 µg/L	8.00E+03 µg/L
Vinyl Chloride (c)		0.2 µg/L	0.2 µg/L	2.90E-02 µg/L
m,p-Xylene		0.4 µg/L	0.5 µg/L	1.60E+03 (d) µg/L
o-Xylene		0.2 µg/L	0.5 µg/L	1.60E+03 (d) µg/L
Low-Level VOCs	**EPA 8260C-SIM**			
Tetrachloroethene		0.02 µg/L	0.020 µg/L	5.00E+00 µg/L
Trichloroethene		(e)	0.020 µg/L	5.40E-01 µg/L
Vinyl Chloride		0.02 µg/L	0.020 µg/L	2.90E-02 µg/L
TPH	**Ecology June 1997**			
Gasoline Range	NWTPH-Gx (f)	0.25 mg/L	0.25 mg/L	8.00E-01 (g,h,i) mg/L
Diesel Range	NWTPH-Dx (f)	0.10 mg/L	0.10 mg/L	5.00E-01 (g,i) mg/L
Oil Range	NWTPH-Dx (f)	0.20 mg/L	0.25 mg/L	5.00E-01 (g,i) mg/L
Dissolved Gases	**RSK-175**			
Acetylene		(e)	1 (j) µg/L	---
Methane		0.7 µg/L	3 (j) µg/L	---

Table E-1
Water Sample Laboratory Analytical Methods and Target Limits of Quantitation
Boeing Auburn Facility
Auburn, Washington

Analyte	Analytical Method (a)	Former Target Reporting Limits-ARI	Target LOQs - LLI (b)	Groundwater Screening Level
Ethane		1.2 µg/L	1 (j) µg/L	---
Ethene		1.1 µg/L	1 (j) µg/L	---
Metals (Dissolved and Total)	**EPA 6000Series/200.8**			
Arsenic	EPA 6010C	(e)	0.02 mg/L	8.00E-03 mg/L
	EPA 6020A/200.8	0.0002 mg/L	0.02 mg/L	
Cadmium	EPA 6010C	0.002 mg/L	0.005 mg/L	5.00E-03 mg/L
	EPA 6020A/200.8	(e)	0.0005 mg/L	
Nickel (soluble salts)	EPA 6010C	0.01 mg/L	0.01 mg/L	1.00E-01 mg/L
	EPA 6020A/200.8	(e)	0.002 mg/L	
Conventional Parameters	**EPA 300.0/SM205310C**			
Nitrate	EPA 300.0	0.1 mg/L	0.1 mg/L	---
Sulfate	EPA 300.0	0.1 mg/L	1.0 mg/L	---
Sulfide	SM 4500-S2-D	0.05 mg/L	0.16 mg/L	---
Total Organic Carbon	SM20 5310 C-2000	1.5 mg/L	1.0 mg/L	---

--- = Screening level not established
ARI = Analytical Resources, Inc.
EPA = U.S. Environmental Protection Agency
LLI = Eurofins Lancaster Laboratories, Inc.
LOQ = Limit of Quantitation
µg/L = microgram per liter (ppb)
mg/L = milligram per liter (ppm)
NWTPH = Northwest Total Petroleum Hydrocarbon Methods (Ecology 1997).
SIM = Selected Ion Monitoring
SM = Standard Method
SW = Solid Waste
TPH = total petroleum hydrocarbon
VOC = volatile organic compound

(a) Analytical methods are from SW-846 (EPA 1986) and updates, unless otherwise noted.
(b) Target LOQs are based on current laboratory data and may be modified during the investigation process as methodology is refined. Instances may arise where high sample concentrations, nonhomogeneity of samples or matrix interferences preclude achieving the laboratory LOQs.
(c) LLI LOQ exceeds SL; therefore,analyte will be run as low-level VOC by USEPA 8260C-SIM to achieve SL. See "Low Level VOCs" section of this table.
(d) Screening level is for total xylenes.
(e) Analyte or method not included in previous QAPP; therefore, ARI RL is not relevant.
(f) Methods NWTPH-Gx and NWTPH-Dx as described in Analytical Methods for Petroleum Hydrocarbons, Washington State Department of Ecology. Publication ECY97-602, June 1997. A silica gel cleanup will be performed for all NWTPH-Dx analyses. (Ecology 1997).
(g) MTCA Method A groundwater cleanup levels are used for diesel-range, motor oil-range, and gasoline-range petroleum hydrocarbons.
(h) If benzene is present, the cleanup level for groundwater is 0.8 mg/L. If there is no detectable benzene, cleanup level for groundwater is 1.0 mg/L.
(i) MTCA Method A groundwater cleanup levels are used for diesel-range, motor oil-range, and gasoline-range petroleum hydrocarbons.
(j) LLI will report to the method detection limit (MDL) for all dissolved gases analyzed by method RSK-175.

Table E-2
Soil Sample Laboratory Analytical Methods and Quantitation
Boeing Auburn Facility
Auburn, Washington

Analyte	Analytical Method (a)	Former Target Reporting Limits-ARI	Target LOQs-LLI (b)	Soil Screening Levels (c)
VOCs	**EPA 8260C**			
1,1,1-Trichloroethane		1.0 µg/kg	5.0 µg/kg	1.58E+03 µg/kg
1,1,2,2-Tetrachloroethane		1.0 µg/kg	5.0 µg/kg	1.23E+00 µg/kg
1,1,2-Trichloro-1,2,2-trifluoroethane		2.0 µg/kg	10.0 µg/kg	1.05E+07 µg/kg
1,1,2-Trichloroethane		1.0 µg/kg	5.0 µg/kg	4.27E+00 µg/kg
1,1-Dichloroethane		1.0 µg/kg	5.0 µg/kg	4.19E+01 µg/kg
1,1-Dichloroethene		1.0 µg/kg	5.0 µg/kg	5.01E+01 µg/kg
1,2-Dichloroethane		1.0 µg/kg	5.0 µg/kg	2.32E+00 µg/kg
1,2-Dichloropropane		1.0 µg/kg	5.0 µg/kg	6.25E+00 µg/kg
2-Butanone		5.0 µg/kg	10.0 µg/kg	1.96E+04 µg/kg
2-Hexanone		5.0 µg/kg	10.0 µg/kg	---
4-Methyl-2-Pentanone (MIBK)		5.0 µg/kg	10.0 µg/kg	4.23E+03 µg/kg
Acetone		5.0 µg/kg	20.0 µg/kg	2.89E+04 µg/kg
Benzene		1.0 µg/kg	5.0 µg/kg	4.48E+00 µg/kg
Bromodichloromethane		1.0 µg/kg	5.0 µg/kg	4.17E-01 µg/kg
Bromoform		1.0 µg/kg	5.0 µg/kg	3.63E+01 µg/kg
Bromomethane		1.0 µg/kg	5.0 µg/kg	5.18E+01 µg/kg
Carbon Disulfide		1.0 µg/kg	5.0 µg/kg	5.65E+03 µg/kg
Carbon Tetrachloride		1.0 µg/kg	5.0 µg/kg	5.75E+00 µg/kg
Chlorobenzene		1.0 µg/kg	5.0 µg/kg	8.74E+02 µg/kg
Chloroethane		1.0 µg/kg	5.0 µg/kg	---
Chloroform		1.0 µg/kg	5.0 µg/kg	7.51E+00 µg/kg
Chloromethane		1.0 µg/kg	5.0 µg/kg	--- µg/kg
cis-1,2-Dichloroethene		1.0 µg/kg	5.0 µg/kg	8.00E+01 µg/kg
cis-1,3-Dichloropropene		1.0 µg/kg	5.0 µg/kg	---
Dibromochloromethane		1.0 µg/kg	5.0 µg/kg	2.77E+00 µg/kg
Ethylbenzene		1.0 µg/kg	5.0 µg/kg	6.05E+03 µg/kg
m,p-Xylene		1.0 µg/kg	5.0 µg/kg	1.46E+04 µg/kg
Methylene Chloride		2.0 µg/kg	5.0 µg/kg	2.18E+01 µg/kg
o-Xylene		1.0 µg/kg	5.0 µg/kg	1.46E+04 µg/kg
Styrene		1.0 µg/kg	5.0 µg/kg	2.24E+03 µg/kg
Tetrachloroethene		1.0 µg/kg	5.0 µg/kg	5.30E+01 µg/kg
Toluene		1.0 µg/kg	5.0 µg/kg	4.65E+03 µg/kg
trans-1,2-Dichloroethene		1.0 µg/kg	5.0 µg/kg	5.43E+02 µg/kg
trans-1,3-Dichloropropene		1.0 µg/kg	5.0 µg/kg	---
Trichloroethene		1.0 µg/kg	5.0 µg/kg	3.57E+00 µg/kg
Trichlorofluoromethane		1.0 µg/kg	5.0 µg/kg	3.39E+04 µg/kg
Vinyl Acetate		5.0 µg/kg	10.0 µg/kg	3.31E+04 µg/kg
Vinyl Chloride		1.0 µg/kg	5.0 µg/kg	1.83E-01 µg/kg
SVOCs	**EPA 8270D**			
1,2,4-Trichlorobenzene		20 µg/kg	33 µg/kg	5.62E+01 µg/kg
1,2-Dichlorobenzene		20 µg/kg	33 µg/kg	7.03E+03 µg/kg
1,3-Dichlorobenzene		20 µg/kg	33 µg/kg	---
1,4-Dichlorobenzene		20 µg/kg	33 µg/kg	1.34E+02 µg/kg
1,4-Dioxane		(d)	333 µg/kg	---
1-Methylnaphthalene		20 µg/kg	17 µg/kg	3.45E+04 µg/kg
2,2'-oxybis(1-Chloropropane)		20 µg/kg	33 µg/kg	3.27E+00 µg/kg
2,4,5-Trichlorophenol		100 µg/kg	33 µg/kg	2.88E+04 µg/kg
2,4,6-Trichlorophenol		100 µg/kg	33 µg/kg	4.62E+01 µg/kg
2,4-Dichlorophenol		100 µg/kg	33 µg/kg	1.67E+02 µg/kg
2,4-Dimethylphenol		20 µg/kg	33 µg/kg	1.31E+03 µg/kg
2,4-Dinitrophenol		200 µg/kg	1,000 µg/kg	1.28E+02 µg/kg
2,4-Dinitrotoluene		100 µg/kg	170 µg/kg	1.67E+00 µg/kg
2,6-Dinitrotoluene		100 µg/kg	33 µg/kg	3.14E-01 µg/kg

Table E-2
Soil Sample Laboratory Analytical Methods and Quantitation
Boeing Auburn Facility
Auburn, Washington

Analyte	Analytical Method (a)	Former Target Reporting Limits-ARI	Target LOQs-LLI (b)	Soil Screening Levels (c)
2-Chloronaphthalene		20 µg/kg	33 µg/kg	2.31E+04 µg/kg
2-Chlorophenol		20 µg/kg	33 µg/kg	4.72E+02 µg/kg
2-Methylnaphthalene		20 µg/kg	17 µg/kg	3.20E+05 µg/kg
2-Methylphenol (o-Cresol)		20 µg/kg	33 µg/kg	2.33E+03 µg/kg
2-Nitroaniline		100 µg/kg	33 µg/kg	---
2-Nitrophenol		100 µg/kg	33 µg/kg	---
3,3'-Dichlorobenzidine		100 µg/kg	330 µg/kg	3.59E+00 µg/kg
3-Nitroaniline		100 µg/kg	170 µg/kg	---
4,6-Dinitro-2-methylphenol		200 µg/kg	500 µg/kg	---
4-Bromophenyl-phenylether		20 µg/kg	33 µg/kg	---
4-Chloro-3-methylphenol		100 µg/kg	33 µg/kg	---
4-Chloroaniline (p-Chloroaniline)		100 µg/kg	33 µg/kg	1.16E+00 µg/kg
4-Chlorophenyl-phenylether		200 µg/kg	33 µg/kg	---
4-Methylphenol (p-Cresol)		20 µg/kg	33 µg/kg	3.94E+03 µg/kg
4-Nitroaniline		100 µg/kg	170 µg/kg	---
4-Nitrophenol		100 µg/kg	500 µg/kg	---
Acenaphthylene		(d)	17 µg/kg	---
Acenaphthene		20 µg/kg	17 µg/kg	9.79E+04 µg/kg
Anthracene		20 µg/kg	17 µg/kg	2.27E+06 µg/kg
Benzo(b)fluoranthene		20 µg/kg	17 µg/kg	(e) µg/kg
Benzo(g,h,i)perylene		20 µg/kg	17 µg/kg	---
Benzo(k)fluoranthene		20 µg/kg	17 µg/kg	(e) µg/kg
Benzo[a]anthracene		20 µg/kg	17 µg/kg	(e) µg/kg
Benzo[a]pyrene		20 µg/kg	17 µg/kg	137 (e) µg/kg
Benzoic Acid		200 µg/kg	500 µg/kg	2.57E+05 µg/kg
Benzyl Alcohol		20 µg/kg	500 µg/kg	3.36E+03 µg/kg
bis(2-Chloroethoxy)methane		20 µg/kg	33 µg/kg	---
bis(2-Chloroethyl)ether		20 µg/kg	33 µg/kg	2.20E-01 µg/kg
bis(2-Ethylhexyl) phthalate		20 µg/kg	170 µg/kg	1.34E+04 µg/kg
Butylbenzylphthalate		20 µg/kg	170 µg/kg	1.28E+04 µg/kg
Carbazole		20 µg/kg	33 µg/kg	--- µg/kg
Chrysene		20 µg/kg	17 µg/kg	(e) µg/kg
Dibenz[a,h]anthracene		20 µg/kg	17 µg/kg	(e) µg/kg
Dibenzofuran		20 µg/kg	33 µg/kg	---
Diethyl Phthalate		20 µg/kg	170 µg/kg	7.22E+04 µg/kg
Dimethyl phthalate		20 µg/kg	170 µg/kg	---
di-n-Butyl Phthalate		20 µg/kg	170 µg/kg	5.65E+04 µg/kg
di-n-Octyl Phthalate		20 µg/kg	170 µg/kg	8.00E+05 µg/kg
Fluoranthene		20 µg/kg	17 µg/kg	6.31E+05 µg/kg
Fluorene		20 µg/kg	17 µg/kg	1.01E+05 µg/kg
Hexachlorobenzene		20 µg/kg	17 µg/kg	8.77E+01 µg/kg
Hexachlorobutadiene		20 µg/kg	33 µg/kg	---
Hexachlorocyclopentadiene		100 µg/kg	500 µg/kg	1.92E+05 µg/kg
Hexachloroethane		20 µg/kg	170 µg/kg	4.36E+01 µg/kg
Indeno[1,2,3-cd]pyrene		20 µg/kg	17 µg/kg	(e) µg/kg
Isophorone		20 µg/kg	33 µg/kg	2.27E+02 µg/kg
Naphthalene		20 µg/kg	17 µg/kg	---
Nitrobenzene		20 µg/kg	33 µg/kg	1.02E+02 µg/kg
n-Nitroso-di-n-propylamine		100 µg/kg	33 µg/kg	5.60E-02 µg/kg
n-Nitrosodiphenylamine		20 µg/kg	33 µg/kg	5.32E+02 µg/kg
Pentachlorophenol		100 µg/kg	170 µg/kg	3.47E+00 µg/kg
Phenanthrene		20 µg/kg	17 µg/kg	--- µg/kg
Phenol		20 µg/kg	33 µg/kg	1.10E+04 µg/kg
Pyrene		20 µg/kg	17 µg/kg	6.55E+05 µg/kg

Table E-2
Soil Sample Laboratory Analytical Methods and Quantitation
Boeing Auburn Facility
Auburn, Washington

Analyte	Analytical Method (a)	Former Target Reporting Limits-ARI	Target LOQs-LLI (b)	Soil Screening Levels (c)
PCBs	**EPA 8082A(Standard)**			
Aroclor 1016		33 µg/kg	17 µg/kg	5.60E+03 µg/kg
Aroclor 1221		33 µg/kg	17 µg/kg	(f) µg/kg
Aroclor 1232		33 µg/kg	17 µg/kg	(f) µg/kg
Aroclor 1242		33 µg/kg	17 µg/kg	(f) µg/kg
Aroclor 1248		33 µg/kg	17 µg/kg	(f) µg/kg
Aroclor 1254		33 µg/kg	17 µg/kg	5.00E+02 µg/kg
Aroclor 1260		33 µg/kg	17 µg/kg	5.00E+02 µg/kg
Total PCBs			--	
Total PCBs				2.71E+02 µg/kg
TPH	**Ecology June 1997**			
Gasoline Range	NWTPH-Gx (c)	5 mg/kg	5.0 mg/kg	2.00E+03 (g,h) mg/kg
Diesel Range	NWTPH-Dx (c,i)	5 mg/kg	7.0 mg/kg	1.00E+02 (g) mg/kg
Oil Range	NWTPH-Dx (c,i)	10 mg/kg	30 mg/kg	2.00E+03 (g) mg/kg
Total Metals	**EPA 6000 Series**			
Arsenic	EPA 6010C	5.0 mg/kg	4 mg/kg	7.00E+00 mg/kg
	EPA 6020A	(j)	0.8 mg/kg	
Cadmium	EPA 6010C	(j)	1 mg/kg	1.00E+00 mg/kg
	EPA 6020A	0.2 mg/kg	0.2 mg/kg	
Chromium	EPA 6010C	(j)	3 mg/kg	1.20E+05 mg/kg
	EPA 6020A	(j)	0.8 mg/kg	
Lead	EPA 6010C	(j)	3 mg/kg	2.50E+02 mg/kg
	EPA 6020A	(j)	0.4 mg/kg	
Nickel	EPA 6010C	(j)	2 mg/kg	1.30E+02 mg/kg
	EPA 6020A	(g)	0.8 mg/kg	

--- = Screening level not established
ARI = Analytical Resources, Inc.
EPA = U.S. Environmental Protection Agency
LLI = Eurofins Lancaster Laboratories, Inc.
LOQ = Limit of Quantitation
mg/kg = milligram per kilogram
µg/kg = microgram per kilogram
NWTPH-Dx = Method Northwest Total Petroleum Hydrocarbon Diesel Extended
NWTPH-Gx - Method Northwest Total Petroleum Hydrocarbon Gasoline Extended
PCB = polychlorinated biphenyl
SVOC = semi-volatile organic compound
SW = Solid Waste
TPH = total petroleum hydrocarbon
VOC = volatile organic compound

(a) Analytical methods are from SW-846 (EPA 1986) and updates, unless otherwise noted.
(b) Target LOQs are based on current laboratory data and may be modified during the investigation process as methodology is refined. Instances may arise where high sample concentrations, non-homogeneity of samples or matrix interferences preclude achieving the laboratory reporting limits.
(c) Methods NWTPH-G and NWTPH-Dx as described in Analytical Methods for Petroleum Hydrocarbons, Washington State Department of Ecology.
(d) Analyte or method not included in previous QAPP; therefore, ARI reporting limit not relevant.
(e) Evaluated using toxicity equivalency quotient (TEQ) based on benzo(a)pyrene.
(f) Evaluated using screening level for total PCBs.
(g) MTCA Method A soil cleanup levels are used for lead, diesel-range, motor oil-range, and gasoline-range petroleum hydrocarbons.
(h) The cleanup level for gasoline-range TPH is 100 mg/kg where benzene is not present and the total concentration of ethyl benzene, toluene, and xylene are less than 1 percent of the gasoline mixture. The cleanup level for all other gasoline mixtures is 30 mg/kg.
(i) A silica gel cleanup will be performed for all NWTPH-Dx analyses. Washington State Department of Ecology, Publication ECY97-602, June 1997.
(j) Analyte or method not included in previous QAPP; therefore, ARI reporting limit not relevant.

Table E-3
Soil Vapor Sample Laboratory Analytical Methods and Target Limits of Quantitation
Boeing Auburn Facility
Auburn, Washington

Analyte	Analytical Method	Target LOQs - LLI (a,b)		Target LOQs - Air Toxics (a,b)		Soil Vapor Screening Levels (c)
VOCs	EPA Method TO-15 (Low Level) (d)	µg/m³	ppbV	µg/m³	ppbV	µg/m³
cis-1,2-Dichloroethene		2.0	0.5	2.0	0.5	--- (e)
Tetrachloroethene		3.4	0.5	3.4	0.5	320
Trichloroethene		2.7	0.5	2.7	0.5	12
trans-1,2-Dichloroethene (f)		(g)	(g)	2.0	2.0	900
1,1-Dichloroethene (f)		(g)	(g)	2.0	0.5	3000
Vinyl Chloride		1.3	0.5	1.3	0.5	9.5

--- = Screening level not established
EPA = U.S. Environmental Protection Agency
LLI = Eurofins Lancaster Laboratories, Inc.
LOQ = Limit of Quantitation
µg/m³ = micrograms per cubic meter
TO = Toxic Organic
VOC = Volatile Organic Compound
ppbV = parts per billion by volume

(a) Target LOQs are based on current laboratory data and may be modified during the investigation process as methodology is refined.
(b) The Eurofins-Lancaster California Air Toxics branch is the current primary air lab. The Pennsylvania LLI branch was previously used (2012) and is now a secondary lab.
(c) Soil gas screening levels (SLs) have been developed in accordance with methods recommended by Ecology (Ecology 2012a; Jones, E. 2012). Soil gas SLs have been calculated by applying a vapor attenuation factor of 0.03 to standard Method B air cleanup levels from the CLARC database, which is applicable to shallow soil gas samples.
(d) The LLI Pennsylvania lab runs TO-15 low level from this project, which must be specified on the chain of custody.
(e) Air cleanup levels, the basis for calculating soil gas screening levels, are not calculated under MTCA for cis-1,2-DCE due to insufficient data Ecology 2010). Analysis of cis-1,2-DCE is conducted to provide information regarding the distribution of chlorinated solvent degradation products, per a recent Ecology comment letter (Ecology 2012b).
(f) Ecology has requested that Boeing screen for trans-1,2-DCE and 1,1-DCE in air if it is present in groundwater (Ecology 2013).
(g) Analyte or method not included in previous QAPP; therefore LOQs are not relevant.

Table E-4
Air Sample Laboratory Analytical Methods and Target Limits Quantitation
Boeing Auburn Facility
Auburn, Washington

Analyte	Analytical Method	Target LOQs - LLI (a,b)		Target LOQs - Air Toxics (a,b)		Air Screening Levels (c)
VOCs	EPA Method TO-15 SIM	µg/m³	ppbV	µg/m³	ppbV	µg/m³
cis-1,2-Dichloroethene		0.20	0.05	0.079	0.010	--- (d)
Tetrachloroethene		0.34	0.05	0.14	0.020	9.6
Trichloroethene		0.27	0.05	0.11	0.020	0.37
trans-1,2-Dichloroethene (e)		(f)	(f)	0.40	0.10	27
1,1-Dichloroethene (e)		(f)	(f)	0.040	0.10	91
Vinyl Chloride		0.13	0.05	0.026	0.05	0.28

--- = Screening level not established
EPA = U.S. Environmental Protection Agency
LLI = Eurofins Lancaster Laboratories, Inc.
LOQ = Limit of Quantitation
µg/m³ = micrograms per cubic meter
SIM = Selected Ion Monitoring
TO = Toxic Organic
VOC = Volatile Organic Compound
ppbV = parts per billion by volume

(a) Target LOQs are based on current laboratory data and may be modified during the investigation process as methodology is refined.
(b) The Eurofins-Lancaster California Air Toxics branch is the primary air lab. The Pennsylvania branch was previously used (2012) and is now a secondary lab.
(c) Air screening levels are standard Method B air cleanup levels from the CLARC database. Air screening levels are applied to indoor air, crawl spaces/basement, and ambient air samples.
(d) Air cleanup levels, the basis for calculating soil gas screening levels, are not calculated under MTCA for cis-1,2-DCE due to insufficient data (Ecology 2010). Analysis of cis-1,2-DCE is conducted to provide information regarding the distribution of chlorinated solvent degradation products, per a recent Ecology comment letter (Ecology, 2012b).
(e) Ecology requested that Boeing screen for trans-1,2-DCE and 1,1-DCE in air if it is present in groundwater (Ecology 2013).
(f) Analyte or method not included in previous QAPP; therefore LOQs are not relevant.

Table E-5
Sample Containers, Preservatives, and Holding Times
Boeing Auburn Facility
Auburn, Washington

Matrix /Analysis	Analytical Method	Minimum Sample Amount	Container	Preservation	Extraction Holding Time	Analysis Holding Time
WATER						
TPH-G	NWTPH-Gx	5 mL	Three-40 mL VOA glass vials with teflon septum (No Headspace)	HCl pH<2, cool to 4ºC +/- 2ºC	NA	14 days
TPH-D and TPH-O	NWTPH-Dx	1 L	Two-1 L amber glass, teflon lined cap	HCl pH<2, cool to 4ºC +/- 2ºC	7 days	40 days (a)
VOCs	EPA 8260C & 8260C SIM	25 mL	Five-40 ml VOA glass vials with teflon septum (No Headspace) (b)	HCl pH<2, cool to 4ºC +/- 2ºC	NA	14 days
Metals (Dissolved and Total) (c)	EPA 6000 Series/200.8	250 mL	One-250 mL HDPE - total metals One-250 mL HDPE- dissolved metals	HNO_3 to pH <2, cool to 4ºC +/- 2ºC	NA	6 months
TOC	SM20 5310C	40 mL	Two-40 mL VOA amber glass vials	H_3PO_4 pH <2, Cool to 4ºC +/- 2ºC	NA	28 days
Nitrate (d)	EPA 300.0	40 mL	Two-40 mL VOA glass vials	Cool to 4ºC +/- 2ºC	NA	48 hours
Sulfate (d)	EPA 300.0	40 mL	Two-40 mL VOA glass vials	Cool to 4ºC +/- 2ºC	NA	28 days
Suflide	SM 4500-S2-D	50 mL	One-125 mL Poly	NaOH and ZnAc, Cool to 4ºC +/- 2ºC	NA	7 days
Dissolved Gases (AMEE)	RSK-175	5 mL	Two-40 mL VOA glass vials with teflon septum (No Headspace)	HCl pH<2, cool to 4ºC +/- 2ºC	14 days	14 days
SOIL						
TPH-D and TPH-O	NWTPH-Dx	30 g	8-oz glass jar with teflon-lined lid	Cool to 4ºC +/- 2ºC	14 days	40 days (a)
TPH-G	NWTPH-Gx	10 g	Two-40 mL VOA vials w/methanol (from Easy-Draw Syringe) and One 2-oz glass jar with teflon-lined lid (minimize headspace)	Methanol (for VOA vial); No headspace (for 2-oz glass jar); Cool to 4ºC +/- 2ºC [5 g of sample to 5 mL of preservative]	NA	14 days
VOCs	EPA 8260C	5 g	Two-40 mL VOA vials with sodium bisulfate (from Easy-Draw Syringe); One-40 mL VOA vial with methanol (from Easy-Draw Syringe); and One 2-oz glass jar with teflon-lined lid (minimize headspace)	Sodium Bisulfate (for VOA vial); Methanol (for VOA vial); No headspace (for 2-oz glass jar); Cool to 4ºC +/- 2ºC [5 g of sample for 5 mL of preservative]	NA	14 days
Total Metals	EPA 6000 Series/200.8	5 g	4-oz glass jar with teflon-lined lid	Cool to 4ºC +/- 2ºC	NA	6 months
SVOCs	EPA 8270D	30 g	8-oz glass jar with teflon-lined lid	Cool to 4ºC +/- 2ºC	14 days	40 days (a)
PCBs	EPA 8082A (Standard)	30 g	8-oz glass jar with teflon-lined lid	Cool to 4ºC +/- 2ºC	14 days	40 days (a)

Table E-5
Sample Containers, Preservatives, and Holding Times
Boeing Auburn Facility
Auburn, Washington

Matrix /Analysis	Analytical Method	Minimum Sample Amount	Container	Preservation	Extraction Holding Time	Analysis Holding Time
SOIL VAPOR						
VOCs	EPA Method TO-15 (Low Level)	1 L	200 mL, 1 liter, 6 L Summa canister	None	NA	30 days
INDOOR AIR						
Low-Level VOCs	EPA Method TO-15 SIM	1 L	1 L or 6 L Summa canister	None	NA	30 days

AMEE = acetylene, methane, ethane, ethene
EPA = U.S. Environmental Protection Agency
g = gram
HDPE = High-density polyethylene
L = liter
mL = milliliter
NWTPH-Dx = Method Northwest diesel-range total petroleum hydrocarbon extended
NWTPH-Gx = Method Northwest gasoline-range total petroleum hydrocarbon extended
oz = ounce
PCB = Polychlorinated Biphenyls
SIM = Selected Ion Monitoring
SM = Standard Method
SVOC = Semivolatile Organic Compounds
TOC = total organic carbon
TPH-D = diesel-range total petroleum hydrocarbon
TPH-G = gasoline-range total petroleum hydrocarbon
TPH-O = oil-range total petroleum hydrocarbon
VOA = Volatile Organic Analyte
VOC = Volatile Organic Compounds

(a) Days from extraction date
(b) If analysis for VOCs and low-level VOCs are required on the same sample, collect 5-40 mL vials.
(c) Samples for dissolved metals analysis will be preserved by the laboratory after filtration, or pre-preserved containers will be used for samples filtered in the field.
(d) Sample volume for nitrate and sulfate can be combined into one sample bottle; however, nitrate analysis must be performed within the 48-hour holding time.

Table E-6
Analytes Where Laboratory Target Limits of Quantitation Exceed Screening Levels
Boeing Auburn Facility
Auburn, Washington

Analytes where LOQ exceeds SL	Analytical Method (a)	Former Target Reporting Limits - ARI	Target LOQs - LLI (b)	Screening Levels (c)
SOIL VOCs	**EPA 8260C**			
1,1,2,2-Tetrachloroethane		1.0 µg/kg	5.0 µg/kg	1.23E+00 µg/kg
1,1,2-Trichloroethane		1.0 µg/kg	5.0 µg/kg	4.27E+00 µg/kg
1,2-Dichloroethane		1.0 µg/kg	5.0 µg/kg	2.32E+00 µg/kg
Benzene		1.0 µg/kg	5.0 µg/kg	4.48E+00 µg/kg
Bromodichloromethane		1.0 µg/kg	5.0 µg/kg	4.17E-01 µg/kg
Dibromochloromethane		1.0 µg/kg	5.0 µg/kg	2.77E+00 µg/kg
Trichloroethene		1.0 µg/kg	5.0 µg/kg	3.57E+00 µg/kg
Vinyl Chloride		1.0 µg/kg	5.0 µg/kg	1.83E-01 µg/kg
SOIL SVOCs	**EPA 8270D**			
2,2'-oxybis(1-Chloropropane)		20 µg/kg	33 µg/kg	3.27E+00 µg/kg
2,4-Dinitrophenol		200 µg/kg	1,000 µg/kg	1.28E+02 µg/kg
2,4-Dinitrotoluene		100 µg/kg	170 µg/kg	1.67E+00 µg/kg
2,6-Dinitrotoluene		100 µg/kg	33 µg/kg	3.14E-01 µg/kg
3,3'-Dichlorobenzidine		100 µg/kg	330 µg/kg	3.59E+00 µg/kg
4-Chloroaniline (p-Chloroaniline)		100 µg/kg	33 µg/kg	1.16E+00 µg/kg
bis(2-Chloroethyl)ether		20 µg/kg	33 µg/kg	2.20E-01 µg/kg
Hexachloroethane		20 µg/kg	170 µg/kg	4.36E+01 µg/kg
n-Nitroso-di-n-propylamine		100 µg/kg	33 µg/kg	5.60E-02 µg/kg
Pentachlorophenol		100 µg/kg	170 µg/kg	3.47E+00 µg/kg
GROUNDWATER VOCs	**EPA 8260C**			
Bromodichloromethane		0.2 µg/L	0.5 µg/L	8.00E-02 µg/L
GROUNDWATER Metals (Dissolved and Total)	**EPA 6000 Series/200.8**			
Arsenic		(d)	0.02 mg/L	8.00E-03 mg/L

EPA = U.S. Environmental Protection Agency
LLI = Eurofins Lancaster Laboratories, Inc.
LOQ = Limit of Quantitation
SL = Screening Level
SW = Solid Waste
µg/L = microgram per liter
µg/kg = microgram per kilogram
mg/L = milligram per liter
SVOC = semi-volatile organic compound
VOC = volatile organic compound

(a) Analytical methods are from SW-846 and updates.
(b) Target LOQs are based on current laboratory data and may be modified during the investigation process as methodology is refined. Instances may arise where high sample concentrations, nonhomogeneity of samples or matrix interferences preclude achieving the LOQs.
(c) Screening levels are defined in Landau Associates 2009a,b.
(d) Analyte or method not included in previous QAPP; therefore, LOQs are not relevant

APPENDIX A

Quality Control Criteria for Data Quality Assessment

Table A-1
Quality Control Criteria for Data Quality Assessment
Volatile Organic Compounds (EPA 8260C)
Boeing Auburn Facility
Auburn, Washington

Analyte	Water			Soil		
	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %
Precision and Accuracy						
Acetone	73-135	57-163	30	18-197	31-195	30
Benzene	80-120	87-126	30	80-120	55-143	30
Bromodichloromethane	80-120	82-133	30	75-114	53-136	30
Bromoform	63-132	60-138	30	70-120	38-124	30
Bromomethane	38-146	41-145	30	32-162	42-168	30
2-Butanone (MEK)	70-130	63-146	30	38-146	37-163	30
Carbon Disulfide	80-128	84-141	30	59-129	48-146	30
Carbon Tetrachloride	74-133	81-148	30	69-122	45-153	30
Chlorobenzene	80-120	78-133	30	80-120	49-135	30
Chloroethane	67-124	70-139	30	37-154	39-152	30
Chloroform	80-120	86-136	30	80-120	61-142	30
Chloromethane	55-135	55-152	30	56-120	36-143	30
Dibromochloromethane	80-126	79-125	30	77-120	51-128	30
1,1-Dichloroethane	80-120	88-136	30	80-120	63-142	30
1,2-Dichloroethane	80-127	82-135	30	72-126	49-150	30
1,1-Dichloroethene	80-123	83-150	30	73-129	61-149	30
cis-1,2-Dichloroethene	80-120	82-129	30	74-120	49-153	30
trans-1,2-Dichloroethene	80-120	88-127	30	79-120	51-153	30
1,2-Dichloropropane	80-120	91-126	30	80-120	48-145	30
cis-1,3-Dichloropropene	74-120	74-132	30	74-120	35-151	30
trans-1,3-Dichloropropene	73-126	71-128	30	77-120	30-149	30
Ethylbenzene	80-120	80-140	30	80-120	44-141	30
2-Hexanone	80-129	59-169	30	40-129	32-160	30
4-Methyl-2-Pentanone (MIBK)	69-135	69-149	30	52-125	46-139	30
Methylene Chloride	80-120	84-122	30	76-124	49-160	30
Styrene	80-120	63-151	30	76-120	35-134	30
1,1,2,2-Tetrachloroethane	80-125	75-131	30	71-123	40-152	30
Tetrachloroethene	80-120	75-129	30	78-126	42-149	30
Toluene	80-120	83-127	30	80-120	50-146	30
Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	78-132	87-158	30	64-137	56-156	30
1,1,1-Trichloroethane	79-127	85-140	30	71-125	43-150	30
1,1,2-Trichloroethane	80-120	85-129	30	80-120	47-161	30
Trichloroethene	80-120	85-131	30	80-120	53-144	30
Trichlorofluoromethane	77-132	67-161	30	58-133	47-163	30
Vinyl Acetate	40-137	38-115	30	29-111	21-139	30
Vinyl Chloride	65-127	65-151	30	53-120	50-154	30
m,p-Xylene	80-120	81-137	30	80-120	44-137	30

Table A-1
Quality Control Criteria for Data Quality Assessment
Volatile Organic Compounds (EPA 8260C)
Boeing Auburn Facility
Auburn, Washington

Analyte	Water			Soil		
	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %
o-Xylene	80-120	81-137	30	80-120	42-137	30
Cyclohexanone	58-125	50-126	30	57-133	27-162	30
Surrogate Recoveries						
Dibromofluoromethane	77-114		--	50-141		--
1,2-Dichloroethane-d4	74-113		--	54-135		--
Toluene-d8	77-110		--	52-141		--
4-Bromofluorobenzene	78-110		--	50-131		--

Notes:

-- = not applicable

1. Quality control criteria presented are typical criteria provided by Eurofins Lancaster Laboratories, Inc. on April 24, 2013. Actual quality control criteria are subject to change due to periodic updating of laboratory control limits, but will adhere to laboratory accreditation standards.

Abbreviations/Acronyms:

EPA = U.S. Environmental Protection Agency
LCS = laboratory control spike
LCSD = laboratory control spike duplicate
MS = matrix spike
MSD = matrix spike duplicate
% = percent
RPD = relative percent difference

Table A-2
Quality Control Criteria for Data Quality Assessment Low-Level Volatile Organic Compounds (EPA 8260C-SIM)
Boeing Auburn Facility
Auburn, Washington

Analyte	Water		
	LCS/LCSD %	MS/MSD %	RPD %
Precision and Accuracy			
Tetrachloroethene	70-130	70-130	30
Trichloroethene	70-130 *	70-130 *	30
Trichloroethene	70-130	70-130	30
Vinyl Chloride	70-130	70-130	30
Surrogate Recoveries			
Toluene-d8	80-120		--
1,4-Difluorobenzene	80-120		--

Notes:

-- = not applicable

1. Quality control criteria presented are typical criteria provided by Eurofins Lancaster Laboratories, Inc. on April 24, 2013. Actual quality control criteria are subject to change due to periodic updating of laboratory control limits, but will adhere to laboratory accreditation standards.

Abbreviations/Acronyms:

EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MS = matrix spike
MSD = matrix spike duplicate
% = percentage
RPD = relative percent difference
SIM = selected ion method

Table A-3
Quality Control Criteria for Data Quality Assessment
Semivolatile Organic Compounds (EPA 8270D)
Boeing Auburn Facility
Auburn, Washington

Analyte	Soil		
	LCS/LCSD %	MS/MSD %	RPD %
Precision and Accuracy			
1,2,4-Trichlorobenzene	73-108	72-115	30
1,2-Dichlorobenzene	74-99	61-107	30
1,3-Dichlorobenzene	74-97	62-101	30
1,4-Dichlorobenzene	74-100	58-108	30
1-Methylnaphthalene	74-105	64-122	30
2,2'-oxybis(1-Chloropropane)	56-123	60-134	30
2,4,5-Trichlorophenol	76-113	69-114	30
2,4,6-Trichlorophenol	82-115	72-123	30
2,4-Dichlorophenol	69-123	69-117	30
2,4-Dimethylphenol	75-120	60-129	30
2,4-Dinitrophenol	10-117	20-143	30
2,4-Dinitrotoluene	79-114	69-115	30
2,6-Dinitrotoluene	71-122	71-118	30
2-Chloronaphthalene	55-134	50-141	30
2-Chlorophenol	69-118	65-116	30
2-Methylnaphthalene	71-119	68-119	30
2-Methylphenol	69-120	63-126	30
2-Nitroaniline	78-116	67-125	30
2-Nitrophenol	71-118	69-118	30
3,3'-Dichlorobenzidine	25-100	10-112	30
3-Nitroaniline	62-109	59-122	30
4,6-Dinitro-2-methylphenol	46-120	11-126	30
4-Bromophenyl-phenylether	73-114	68-118	30
4-Chloro-3-methylphenol	74-119	62-122	30
4-Chloroaniline	10-99	10-107	30
4-Chlorophenyl-phenylether	74-115	80-109	30
4-Methylphenol	63-125	58-128	30
4-Nitroaniline	49-98	41-109	30
4-Nitrophenol	56-118	52-123	30
Acenaphthylene	82-121	73-125	30
Acenaphthene	76-111	72-110	30
Anthracene	73-121	58-129	30
Benzo(a)anthracene	72-120	65-122	30
Benzo(a)pyrene	82-117	57-126	30
Benzo(g,h,i)perylene	69-118	59-127	30
Benzo(b)fluoranthene	81-121	59-125	30
Benzo(k)fluoranthene	78-119	70-125	30
Benzoic acid	19-135	10-114	30
Benzyl alcohol	68-111	67-115	30
bis(2-Chloroethoxy)methane	65-110	63-109	30
bis(2-Chloroethyl)ether	60-108	54-111	30
bis(2-Ethylhexyl)phthalate	75-117	74-117	30
Butylbenzylphthalate	75-115	61-127	30
Carbazole	77-113	64-120	30

Table A-3
Quality Control Criteria for Data Quality Assessment
Semivolatile Organic Compounds (EPA 8270D)
Boeing Auburn Facility
Auburn, Washington

Analyte	Soil		
	LCS/LCSD %	MS/MSD %	RPD %
Chrysene	62-120	62-128	30
Di-n-butylphthalate	79-112	75-116	30
Di-n-octylphthalate	77-128	60-146	30
Dibenz(a,h)anthracene	79-118	65-125	30
Dibenzofuran	81-107	64-117	30
Diethylphthalate	80-113	66-118	30
Dimethylphthalate	77-109	75-111	30
Fluoranthene	78-116	73-112	30
Fluorene	75-116	68-116	30
Hexachlorobenzene	63-118	65-116	30
Hexachlorobutadiene	65-110	60-111	30
Hexachlorocyclopentadiene	58-118	10-153	30
Hexachloroethane	55-107	39-110	30
Indeno(1,2,3-cd)pyrene	79-116	61-126	30
Isophorone	69-110	73-102	30
N-Nitroso-di-n-propylamine	70-113	60-116	30
N-Nitrosodiphenylamine	67-141	71-122	30
Naphthalene	73-106	66-108	30
Nitrobenzene	67-104	69-102	30
Pentachlorophenol	44-111	13-138	30
Phenanthrene	70-116	60-120	30
Phenol	62-122	46-135	30
Pyrene	79-113	60-131	30
Surrogate Recoveries			
Phenol-d6	54-116		--
2-Fluorophenol	59-117		--
2,4,6-Tribromophenol	41-137		--
Nitrobenzene-d5	61-112		--
2-Fluorobiphenyl	60-120		--
Terphenyl-d14	45-158		--

Notes:

-- = not applicable

1. Quality control criteria presented are typical criteria provided by Eurofins Lancaster Laboratories, Inc. on April 24, 2013. Actual quality control criteria are subject to change due to periodic updating of laboratory control limits, but will adhere to laboratory accreditation standards.

Abbreviations/Acronyms:

EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MS = matrix spike
MSD = matrix spike duplicate
% = percent
RPD - Relative percent difference

Table A-4
Quality Control Criteria for Data Quality Assessment
Polychlorinated Biphenyls (EPA 8082)
Boeing Auburn Facility
Auburn, Washington

Analyte	Soil		
	LCS/LCSD %	MS/MSD %	RPD %
Precision and Accuracy			
Aroclor 1016	77-121	19-146	50
Aroclor 1221	--	--	--
Aroclor 1232	--	--	--
Aroclor 1242	--	--	--
Aroclor 1248	--	--	--
Aroclor 1254	--	--	--
Aroclor 1260	72-127	29-141	50
Surrogate Recoveries			
Tetrachlorometaxylene (TCMX)	41-146		--
Decachlorobiphenyl (DCBP)	39-151		--

Notes:

-- = not applicable

1. Quality control criteria presented are typical criteria provided by Eurofins Lancaster Laboratories, Inc. on April 24, 2013. Actual quality control criteria are subject to change due to periodic updating of laboratory control limits, but will adhere to laboratory accreditation standards.

Abbreviations/Acronyms:

EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MS = matrix spike
MSD = matrix spike duplicate
% = percent
RPD = relative percent difference

Table A-5
Quality Control Criteria for Data Quality Assessment
Northwest Total Petroleum Hydrocarbons (NWTPH)
Boeing Auburn Facility
Auburn, Washington

Analyte	Water			Soil		
	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %
Precision and Accuracy						
Gasoline	75-135	75-135	30	67-119	39-118	30
Diesel	60-120	60-120	20	60-120	60-120	20
Oil	60-120	--	20	60-120	--	20
Surrogate Recoveries						
Trifluorotoluene-F (NWTPH-Gx)	63-135		--	61-122		--
Chlorobenzene (NWTPH-Dx)	50-150		--	50-150		--
o-Terphenyl (NWTPH-Dx)	50-150		--	50-150		--

Notes:

-- = not applicable

1. Quality control criteria presented are typical criteria provided by Eurofins Lancaster Laboratories, Inc. on April 24, 2013. Actual quality control criteria are subject to change due to periodic updating of laboratory control limits, but will adhere to laboratory accreditation standards.

Abbreviations/Acronyms:

LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MS = matrix spike
MSD = matrix spike duplicate
NWTPH - Northwest Total Petroleum Hydrocarbon Methods (Ecology 1997).
NWTPH-Dx = Method northwest diesel-range total petroleum hydrocarbon extended
NWTPH-Gx = Method northwest gasoline-range total petroleum hydrocarbon extended
% = percent
RPD = relative percent difference

Table A-6
Quality Control Criteria for Data Quality Assessment
Dissolved Gases (RSK-175)
Boeing Auburn Facility
Auburn, Washington

Analyte	Water		
	LCS/LCSD %	MS/MSD %	RPD %
Precision and Accuracy			
Ethane	80-120	32-129	20
Ethene	75-130	35-162	20
Methane	80-120	35-157	20
Surrogate Recoveries			
Propene	42-131		--

Notes:

-- = not applicable

1. Quality control criteria presented are typical criteria provided by Eurofins Lancaster Laboratories, Inc. on April 24, 2013. Actual quality control criteria are subject to change due to periodic updating of laboratory control limits, but will adhere to laboratory accreditation standards.

Abbreviations/Acronyms:

LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MS = matrix spike
MSD = matrix spike duplicate
% = percent
RPD = relative percent difference

Table A-7
Quality Control Criteria for Data Quality Assessment
Total and Dissolved Metals (EPA 6000 Series and 200.8)
Boeing Auburn Facility
Auburn, Washington

Analyte	Water								
	EPA Method 6020A			EPA Method 200.8			EPA Method 6010C		
	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %
Arsenic	80-120	75-125	20	80-115	70-130	20	80-120	81-123	20
Cadmium	90-114	79-118	20	85-115	79-118	20	90-112	83-116	20
Nickel	90-113	85-117	20	85-115	85-117	20	90-111	86-115	20

Analyte	Soil / Sediment								
	EPA Method 6020A			EPA Method 200.8			EPA Method 6010C		
	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	--	--	--	90-112	75-125	20
Chromium	80-120	75-125	20	--	--	--	90-110	75-125	20
Lead	80-120	75-125	20	--	--	--	88-110	75-125	20
Nickel	80-120	75-125	20	--	--	--	90-111	75-125	20

Notes:

-- = not applicable

1. Quality control criteria presented are typical criteria provided by Eurofins Lancaster Laboratories, Inc. on April 24, 2013. Actual quality control criteria are subject to change due to periodic updating of laboratory control limits, but will adhere to laboratory accreditation standards.

Abbreviations/Acronyms:

EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MS = matrix spike
MSD = matrix spike duplicate
% = percent
RPD = relative percent difference

Table A-8
Quality Control Criteria for Data Quality Assessment
Conventional Parameters
Boeing Auburn Facility
Auburn, Washington

Analyte	Method	Water		
		LCS/LCSD %	MS/MSD %	RPD %
Precision and Accuracy				
Nitrate	EPA 300.0	90-110	90-110	20
Sulfate	EPA 300.0	90-110	90-110	20
Total Organic Carbon	SM20 5310C	91-113	63-142	3

Notes:

-- = not applicable

1. Quality control criteria presented are typical criteria provided by Eurofins Lancaster Laboratories, Inc. on April 24, 2013. Actual quality control criteria are subject to change due to periodic updating of laboratory control limits, but will adhere to laboratory accreditation standards.

Abbreviations/Acronyms:

EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MS = matrix spike
MSD = matrix spike duplicate
% = percent
RPD = relative percent difference
SM = standard method

Table A-9
Quality Control Criteria for Data Quality Assessment
Volatile Organic Compounds in Soil Vapor/Air (EPA TO-15)
Boeing Auburn Facility
Auburn, Washington

Analyte	EPA Method TO-15 Low Level			EPA Method TO-15 SIM		
	LCS/LCSD %	MS/MSD %	RPD %	LCS/LCSD %	MS/MSD %	RPD %
Precision and Accuracy						
1,1-Dichloroethane	70-130	--	25	70-130	--	25
1,1-Dichloroethene	70-130	--	25	70-130	--	25
cis-1,2-Dichloroethene	70-130	--	25	70-130	--	25
Tetrachloroethene	70-130	--	25	70-130	--	25
1,1,1-Trichloroethane	70-130	--	25	70-130	--	25
Trichloroethene	70-130	--	25	70-130	--	25
Vinyl Chloride	70-130	--	25	70-130	--	25
Surrogate Recoveries						
1,2-Dichloroethane-d4	70-130		--	70-130		--
Toluene-d8	70-130		--	70-130		--
4-Bromofluorobenzene	70-130		--	70-130		--

Notes:

-- = not applicable

1. Quality control criteria presented are from the primary air lab, Eurofins-Lancaster California Air Toxics branch.
2. Quality control criteria presented are typical criteria provided by Eurofins-Lancaster California Air Toxics on May 8, 2013. Actual quality control criteria are subject to change due to periodic updating of laboratory control limits, but will adhere to laboratory accreditation standards.

Abbreviations/Acronyms:

EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MS = matrix spike
MSD = matrix spike duplicate
% = percent
RPD = relative percent difference
SIM = selected ion method