APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

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1.0 INTRODUCTION

This quality assurance project plan (QAPP) establishes the quality assurance (QA) objectives for the remedial investigation (RI) at the Astoria Area-Wide site in Astoria, Oregon. This plan also presents the QA organization and quality control (QC) procedures developed to meet project QA objectives. These QA/QC procedures are intended to facilitate meeting project data quality objectives [DQOs, developed in accordance with the Oregon Department of Environmental Quality (DEQ) QA - policy) and U.S. Environmental Protection Agency (EPA) guidance documents] and generating data that are representative of actual conditions at the Astoria Area-Wide subject area. The goal of the project QA program is to provide a reasonable degree of confidence in project data and results by establishing a system of quality and performance checks on data collection, analysis, and reporting activities. The QA program establishes a protocol for appropriate and timely corrective action to achieve compliance with established performance and quality criteria.

The QAPP is divided into the following sections:

- Section 2.0 - Project QA organization and responsibilities
- Section 3.0 - Data quality objectives
- Section 4.0 - Sampling, documentation, and custody procedures
- Section 5.0 - Preventive maintenance/calibration procedures
- Section 6.0 - Analytical procedures
- Section 7.0 - Field screening methods
- Section 8.0 - Data reduction, validation, and reporting
- Section 9.0 - Internal quality control
- Section 10.0 - Specific routine procedures used to assess data
- Section 11.0 - Performance and system audits
- Section 12.0 - Corrective actions
- Section 13.0 - Reporting
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2.0 PROJECT QA ORGANIZATION AND RESPONSIBILITIES

The project QA organization for evaluation of quality assurance during RI activities is shown on Figure 1. The responsible parties' project managers will be responsible for QA oversight during RI activities including sampling events, analytical laboratory coordination, and direct implementation of this QAPP. The responsible parties' QA officer will be responsible for directing/conducting data validation and for confirming that the QA objectives of the project are met. The project manager is responsible for overall implementation of this QAPP. Specific project QA responsibilities are listed in Table 1. Laboratory analyses may be performed by the following laboratories:

- North Creek Analytical Laboratories, Inc., Beaverton, Oregon
- Columbia Analytical Laboratories, Inc., Kelso, Washington
- STL- Seattle, Tacoma, Washington

These laboratories have the facilities, equipment, staff, and QA/QC program and procedures to perform sample analyses in support of this QAPP and in accordance with the DEQ QA policy.

3.0 DATA QUALITY OBJECTIVES

The overall objective of the QA/QC program is to establish confidence that project data are of known and appropriate quality and sufficient to support their intended use. To accomplish this goal, project data should be technically sound, statistically valid, and properly documented, having been evaluated against established criteria for precision, accuracy, representativeness, completeness, and comparability (PARCC), as defined in EPA guidance.

The QA procedures presented in this QAPP are based on DQOs that were developed in accordance with DEQ and EPA guidance documents and reflect the intended use of project data. The project DQOs (summarized in Table B-2) prescribe the sampling program design (e.g., type of analysis, sampling protocols) and the level of quality, precision, accuracy, representativeness, completeness, and comparability of data to be collected and analyzed for RI activities.

Based on previous site data, petroleum constituents have been identified as potential constituents of interest at the site. The data objectives for the RI are to further characterize documented or suspected areas of contamination and to determine the nature and extent of contamination in soil, sediment, surface water and ground water in these areas resulting from previous activities at the Astoria Area-Wide site. These data objectives will be accomplished by conducting chemical analyses on soil, sediment, surface-water and ground-water samples using standard analytical laboratory methods.

The analytical level data quality objective for data generated at the Astoria Area-Wide subject area will be Level III (as defined by DEQ) or non-Contract Laboratory Program (CLP)-RAS. Level III non-CLP-RAS refers to the use of Northwest Total Petroleum Hydrocarbon (TPH) methods and standard EPA approved methods. The level of data quality will be comparable to that obtained from the use of CLP methods, with the exception of the level of documentation required with submittal of the analytical results from the laboratories. The documentation and validation procedures established in this QAPP are sufficient to

achieve non-CLP-RAS data quality and, therefore, sufficient to support the appropriate conclusions about the data and support the objectives of the RI.

The analytical level data quality objective of data generated by field screening methods will be Level I. Level I refers to use of portable instruments (i.e., OVA, or HNu, etc.) for obtaining qualitative results (results that are not compound-specific or quantitative) that will be used to make decisions regarding health and safety and assisting in locating sample collection points for laboratory analysis (Level III). Data precision will be evaluated through the use of check standards and calibration blanks, as appropriate. The procedures established in this QAPP are considered sufficient to achieve the appropriate data quality for the intended use of the data, and therefore, sufficient to support the objectives of the RI.

The target control limits (the range within which project data of acceptable quality should fall) for the PARCC parameters are presented in Tables B-3 and B-4. The target control limits will be used to evaluate data acceptability as noted in Section 10.0. The control limits listed in these tables are considered to be QC goals for data acceptance. Field and laboratory precision will be determined through the collection and analysis of duplicate samples. Laboratory accuracy will be determined through the use of laboratory-spiked samples. In field duplicates, both field variability and laboratory variability are potential sources of error; therefore, both will be considered in any investigation of relative percent difference (RPD) values outside the target control limits. Data acceptability will be determined on the basis of the results of this qualitative review of error sources and, therefore, will be case specific.

The QA objective for representativeness, completeness, and comparability will be achieved by:

- Collecting samples from areas known or suspected to be contaminated, thereby adequately characterizing analytical concentrations (biased locations);
- Collecting samples that have been located to provide representative distribution of the data (random locations);
- Implementing standardized, uniform field procedures (Appendix A);

- Collecting field equipment blanks for nondedicated equipment and analyzing laboratory method blanks to verify that the analytical results are representative of the sampled item and not influenced by cross contamination; and
- Reporting data in conventional and standard units.

PARCC parameters are defined and discussed further in Section 10.0.

Quantitation limits will generally equal those listed in the Northwest TPH and standard EPA methods or those currently achievable for laboratory data depending on effects by matrix interferences. The analytes and quantitation limits for soil, sediment, and water for each analytical procedure are presented in Table B-5. Project quantitation limits have been lowered by analytical method modifications, where practical, to accommodate use of the data in human and environmental risk assessments; however, for some constituents the risk associated with the laboratory quantitation limit will still exceed $1x10^{6}$.

4.0 SAMPLING, DOCUMENTATION, AND CUSTODY PROCEDURES

Sampling procedures and protocols for each sampling activity were developed to meet the project data quality objectives and are based on proven and acceptable sampling methods as established by EPA guidance documents, Oregon State regulations, and professional judgment.

Sampling, documentation, and custody procedures, as described in detail in the Astoria Area-Wide Field Sampling Plan (FSP), include the following elements:

- Sampling methods, including identification of sampling equipment, purging procedures, and decontamination procedures to be used.
- Criteria for determining the type of sampling, sample containers, preservation, and holding times.
- Measures to be taken to prevent contamination of the sampling equipment and cross contamination between sampling points.
- Sample preservation methods.
- Chain-of-custody procedures.

A description of sampling, documentation, custody procedures, and sampling locations for RI activities are presented in the Astoria Area-Wide FSP.

5.0 PREVENTIVE MAINTENANCE/CALIBRATION PROCEDURES

Laboratory and field instruments will be properly operated, calibrated, and maintained by qualified personnel according to the manufacturer's guidelines and recommendations, as well as criteria in the analytical method. Documentation of routine and special preventive maintenance and calibration information will be maintained in a field or laboratory notebook or reference file and will be available upon request. Each maintenance and calibration notebook entry will include the date and initials of the individual performing the activity. The subsections below summarize preventive maintenance and calibration procedures for field and laboratory instruments.

5.1 FIELD INSTRUMENTS

Periodic schedules for preventive maintenance of field instruments, including equipment testing, parts replacement, and general cleaning will be followed according to the manufacturer's instructions. Field equipment performance will be calibrated and tested following the manufacturer's instructions prior to use of the equipment. Meter calibration will be checked at least twice during a sample day (middle and end of day) or when meter drift is suspected, and data will be recorded in a calibration log. Field instruments used during RI activities requiring calibration will include, pH, temperature, specific conductance, dissolved oxygen, and oxidation-reduction potential meters for ground-water sampling events, and a photoionization detector (PID) that will be used for health and safety air monitoring purposes during soil, sediment, surface water and ground-water sampling events.

5.2 LABORATORY INSTRUMENTS

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 and will be available for review by DEQ upon request.

6.0 ANALYTICAL PROCEDURES

Laboratory analyses performed on soil, sediment, surface-water and ground-water samples collected during RI activities will include: semivolatiles, volatiles, TPH, metals, and polychlorinated biphenyls (PCBs).

Laboratory chemical analyses for all constituents will be conducted by Astoria Area-Wide consultant approved laboratories, as listed in Section 2.0 above. These laboratories are qualified to perform the analyses using standard, documented laboratory analytical procedures. The laboratory QAPP and standard operating procedures (SOPs) provide data quality procedures according to the protocols for the analytical method and cleanup steps. The data quality procedures are at a level sufficient to meet the sampling program DQOs; the laboratory QAPP and SOPs can be provided upon request. Analytical methods and associated extraction procedures are listed in Table B-6.

The quantitation limits listed are only goals because instances may arise where high sample concentrations, heterogeneity of samples, or matrix interferences preclude achieving the desired quantitation limits and associated QC criteria. If this occurs, the laboratory will report the reason(s) for deviations from these quantitation limits or noncompliance with QC criteria.

7.0 FIELD SCREENING METHODS

Field screening will be conducted on soil, sediment, surface-water and ground-water samples during RI activities using DEQ and EPA accepted methods for organic vapors. An experienced technician who has used the proposed instrumentation under field conditions will conduct field-screening methods. The data quality procedures will be performed in accordance with the protocols of the methods and at a level to meet the sampling program DQOs.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

Analytical reports from the laboratory for this project will be accompanied by QC results and any other necessary analytical information to enable reviewers to determine the quality of the data. The responsible parties' QA officers will be responsible to the project manager for conducting checks for adherence to the QC elements specified in this QAPP. The responsible parties' QA officers will prepare a laboratory data validation report, as described below. If significant nonconformities are found, additional laboratory data will be evaluated by the responsible parties' QA officers. The responsible parties' QA officers will submit the laboratory data validation reports to the *EnviroLogic Resources* project manager.

Analytical data for the specific tasks will be reported in the units specified by the quantitation limits (Table B-5). These units have been selected to provide for comparability of the data with previously generated relevant facility data.

The analytical laboratories will provide reports that will include the following elements:

- Case narrative, including adherence to prescribed protocols, nonconformity events, corrective measures, and/or data deficiencies
- Sample analytical results
- Surrogate recoveries
- Laboratory method blank results
- Matrix spike/matrix spike duplicate results
- Laboratory duplicate results and Blank results
- Sample custody (including signed, original chain-of-custody records, and documentation of condition of custody seals)
- Analytical responsibility

The analytical laboratory will routinely archive raw laboratory data, including initial and continuing calibration data, chromatograms, quantitation reports, blank sheets, and sampling

logs, in addition to those deliverables listed above, if requested by the responsible parties' QA officers.

Data validation will be performed based on data in analytical laboratory report packages obtained as part of the RI. Validation will be performed according to portions of the Northwest TPH and EPA guidelines on data validation and will include evaluations of the following QA components:

- Chain-of-custody records
  - Holding times
  - Field blanks
  - Laboratory method blanks
  - Surrogate recoveries
- Laboratory matrix spikes and matrix spike duplicates
  - Laboratory duplicates
  - Field duplicates
- Corrective action records
- Completeness
  - Overall assessment of data quality.

Section 10.0 presents statistical tests used to determine data precision, accuracy, and completeness during data evaluation and validation. If a portion of the data is outside the limits specified in Tables B-3 or B-4, or in Northwest TPH or EPA guidelines, or if sample collection and/or documentation practices are deficient, corrective action(s) will be initiated. Corrective action, as described in Section 12.0, will be determined by the responsible parties'QA officer in consultation with the project manager and may include any of the following responses:

- Rejection of the data and re-sampling
- Qualification of the data
- Modification of 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.

9.0 INTERNAL QUALITY CONTROL

Internal quality control will be accomplished through specific QC samples collected and/or measurements taken in the field and laboratory. The QC samples are used to evaluate precision, accuracy, representativeness, completeness, and comparability of the analytical results for this project. Analytical methods (Table B-6) specify routine procedures required to evaluate if data are within proper QC limits. Additional internal QC includes collection and analysis of a number of field and laboratory QC samples, which are described in the following subsections.

Field and laboratory QC samples will be used to evaluate data validity and representativeness. Field and laboratory QC samples will include blind field duplicates, field equipment blanks, field trip blanks, laboratory matrix or method spikes, laboratory matrix spike duplicates, laboratory duplicates, and laboratory method blanks.

A sampling event, as defined for the purpose of QC sample frequency, consists of a set of ground-water samples of similar matrix, collected within a regularly scheduled quarterly event or a set of soil and/or sediment samples collected within a 14 (calendar) day period. The following sections describe the types of field and laboratory QA samples.

9.1 BLIND FIELD DUPLICATE

Blind field duplicates for soil, sediment, surface water and ground water will consist of a split sample collected at a single sample location. The blind field duplicates will be given a separate sample number that cannot be associated by the laboratory to the specific sample location, as described in the FSP (Appendix A). Soil and sediment samples to be analyzed for volatiles will be collected from co-located areas within the same depth interval and placed directly into separate sample containers immediately following collection. Soil and sediment samples for all other analyses, including samples for field screening, will be collected from the same depth interval, homogenized by mixing in a stainless steel bowl, and split into

duplicate sample containers. Duplicate water samples 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 duplicates. Blind field duplicates will be collected at a frequency of one per 20 samples, not including QC samples, but not less than one duplicate per sampling event per matrix (soil, sediment, surface water and ground water).

9.2 FIELD EQUIPMENT BLANKS

Field equipment blanks will be collected to evaluate the effectiveness of sampling equipment decontamination procedures and the potential for equipment or field cross contamination where undedicated sampling equipment is used. Field equipment blanks for soil and sediment samples will consist of wipe equipment blanks and will be collected for analyses performed on soil samples (except for volatiles). The wipe equipment blank samples will be prepared by a licensed laboratory and will consist of a contaminant-free fabric (such as gauze or cheesecloth) saturated with pesticide-grade hexane placed in separate, marked, pre-cleaned containers. Wipe blanks will not be collected for TPH samples because of the difficulty of preparing TPH-free wipe materials. The solvent-saturated wipe will be used to wipe the surfaces of the sampling equipment and will be returned to the original sample container. Wipe equipment blank samples will remain sealed in the container until sample collection is performed. Field equipment blanks will be collected at a frequency of at least one per 20 soil samples, not including QC samples, but not less than one soil and/or sediment equipment blank per sampling event.

Field equipment rinsate blanks will be collected for analyses performed on ground-water samples and for soil and sediment samples analyzed for volatiles. The rinsate blanks will be collected by pouring deionized water (supplied by the analytical laboratory) over or through decontaminated sampling equipment and collected in the appropriate sample containers. Equipment surfaces exposed during actual sampling will be rinsed. No rinsate blanks will be collected from dedicated or disposable field equipment. Field equipment rinsate blanks will be collected at a rate of one blank per 20 samples per sample type (i.e., soil, sediment,

surface water and ground water), not including QC samples, but not less than one blank per sampling event.

9.3 FIELD TRIP BLANK

Field trip banks will consist of deionized water sealed in a sample container by the analytical laboratory. The trip blank will be transported to and from the field, then returned to the laboratory unopened for analysis. One trip blank per cooler containing samples for volatile organic analysis will be evaluated to determine possible sample contamination during transport.

9.4 LABORATORY MATRIX SPIKE

For each sample matrix (soil, sediment, surface water and ground water), a minimum of one laboratory matrix spike per 20 samples, not including QC samples, or one matrix spike sample per sampling event, if fewer than 20 samples are obtained, will be analyzed for all constituents. Spiking compounds and associated control limits are listed in Table B-3. 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 Northwest TPH and EPA guidance for matrix spikes. Matrices used to prepare the laboratory matrix spike will be collected from the Astoria Area-Wide site.

9.5 LABORATORY MATRIX SPIKE DUPLICATE OR LABORATORY DUPLICATE

For each sample matrix (soil, sediment, surface water and ground water), a minimum of one laboratory matrix spike duplicate (for organic analysis) or one laboratory duplicate (for inorganic analysis) per 20 samples, not including QC samples, or one matrix spike sample

per sampling event, if fewer than 20 samples are obtained, will be analyzed for all constituents. These analyses will be performed to provide information on the precision of chemical analyses. The laboratory spikes will follow Northwest TPH and EPA guidance for matrix spike duplicates.

9.6 LABORATORY OR FIELD METHOD BLANKS

A minimum of one laboratory or field method blank per 20 samples, or one every 12 hours, or one per batch of samples analyzed (if fewer than 20 samples are analyzed) will be analyzed for all parameters conducted for standard analytical methods and field screening methods to assess possible cross contamination introduced during the analysis. Dilution water will be used whenever possible and appropriate. Laboratory and field method blanks will contain the same reagents used for the associated sample analysis. The generation and analysis of additional method, reagent, and glassware blanks may be necessary to verify that sample extraction and analysis procedures do not contaminate samples.

10.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA

Analytical laboratory data will be reviewed to confirm that the QA/QC objectives for the PARCC parameters are met. The PARCC parameters and the associated statistical tests used in their evaluation are included in the following sections.

10.1 PRECISION

Precision is a measure of "the reproducibility of analyses under a given set of conditions". Precision is best expressed in terms of the standard deviation or relative percent difference (RPD). QA/QC sample types that test precision include field and laboratory duplicates and matrix spike duplicates. The estimate of precision of duplicate measurements will be expressed as an RPD, which is calculated:

$$RPD = \left| \frac{D_1 - D_2}{\frac{D_1 + D_2}{2}} \right| x100$$

where: D_1 = first sample value

D_2 = second sample value (duplicate)

The RPDs for laboratory duplicates and matrix spike duplicates will be routinely calculated and compared with DQO control limits as listed in Table B-3. For field duplicates, RPD control limits will be 20 percent for ground water and 35 percent for soil and sediment. If duplicate sample values are within five (5) times the quantitation limit, then the control limit interval will be plus or minus the quantitation limit for water, and plus or minus 2 times the quantitation limit for soil and sediment.

10.2 ACCURACY

Accuracy is a measure of "the bias in a measurement system." Numerically, accuracy can be described as an average of measurements of the same property (X), with an accepted reference or true value (T), usually expressed as the difference between the two values (X-T), the difference as a percentage of the reference or true value (100 * (X-T)/T), or as a ratio (X/T). Accuracy is expressed as the percent recovery of spiked (matrix or surrogate spike) samples:

Percent Recovery: [Analyte Found]/[Analyte Added] * 100

where: [Analyte Found] = amount of analyte as measured by instrument
[Analyte Added] = amount of analyte added prior analysis

The percent recovery will be routinely calculated and checked against DQO control limits as listed in Tables B-3 and B-4.

The accuracy of the major ion data for ground water will be checked by calculating the charge-balance error:

$$error = \frac{\sum cations - \sum anions}{\sum cations + \sum anions} x100$$

where the concentration of cations and anions are expressed in milliequivalents (m-eq) per liter. If the error is greater than +5 percent, the data will not be used quantitatively in the RI evaluation.

10.3 REPRESENTATIVENESS

Representativeness expresses "the degree to which data accurately and precisely represent selected characteristics." Representativeness can be evaluated using replicate samples, additional sampling locations, and blanks. Representativeness for the project will be monitored as outlined in Section 3.0.

10.4 COMPLETENESS

Completeness is a measure of "the amount of valid data obtained from a measurement system compared to the amount that could be expected to be obtained under 'normal' conditions". Completeness is calculated as the number of valid (i.e., non-rejected) data points divided by the total number of data points requested. Completeness will be routinely determined and compared to the DQO acceptable percentage of 90 percent, as listed in Table B-2.

10.5 COMPARABILITY

Comparability is the "degree of confidence with which one data set can be compared to another". QA procedures in this plan will provide for measurements that are consistent and representative of the media and conditions measured. All sampling procedures and analytical methods used for RI activities will be consistent to provide comparability of results for samples and split samples. Data collected under this QAPP also will be calculated, qualified, and reported in units consistent with Northwest TPH and EPA guidelines. Quantitation limits are listed in Table B-5, and QC samples are described in Section 9.0.

11.0 PERFORMANCE AND SYSTEM AUDITS

Internal performance and/or system audits will not be conducted as part of the RI activities.

12.0 CORRECTIVE ACTIONS

Corrective actions will be required if there are deviations from the methods or QA requirements established in this QAPP or if there are equipment or analytical malfunctions. Corrective action procedures will be implemented based on the type of unacceptable data and will be developed on a case-by-case basis. The following corrective actions may be included:

- 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)
- Re-sampling
- Evaluating sampling and analytical procedures to determine possible causes of the discrepancies
- Accepting the data with no 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 action. A description of any corrective action taken will be entered in the daily field notebook. If field conditions do not allow for conformance with this QAPP, the responsible parties' project manager will be consulted immediately. For any corrective action or field condition resulting in a revision of this QAPP, the responsible parties' project manager will coordinate with the *EnviroLogic Resources* QA officer or project manager, 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 goals outlined in this QAPP, corrective action generally will follow the guidelines in the EPA analytical methods noted in this QAPP and the EPA guidelines for data validation. If analytical conditions are such that nonconformance with this QAPP is indicated, the

responsible parties' QA officer will be notified as soon as possible so that any additional corrective actions can be taken.

Corrective action reports will be used to document responses to reported nonconformances. These reports may be generated from internal or external audits or from informal reviews of project activities. Corrective action reports will be reviewed initially for appropriateness of recommendations and actions by the responsible parties' QA officer or project manager. The reponsible parties' QA officers or project manager will define responsibilities for scheduling, performing, documenting, and assessing the effectiveness of the required action. As appropriate, the corrective action reports also may be submitted to the *EnviroLogic Resources'* project manager and DEQ for review and approval. The responsible parties' QA officers ultimately are responsible for implementation of appropriate corrective action and maintenance of a complete record of QC issues and corrective actions.

The responsible parties' QA officers or project managers will keep the *EnviroLogic Resources* project manager informed of significant deviations from the QAPP due to equipment or analytical malfunctions and any corrective action reports written for this project.

13.0 REPORTING

QA reports will include analytical reports from the laboratory and corrective action reports from the responsible parties' QA officer. QA reports required under this QAPP will be submitted to the *EnviroLogic Resources* project manager for review.

13.1 LABORATORY REPORTS

The laboratory project manager from each laboratory will transmit written reports that summarize the test procedures and provide test results and QC data required for validation, as well as the elements listed in Section 8.0. Laboratory reports and analysis results will be signed by the laboratory project manager and submitted in data packages to the responsible parties' project manager with paper and electronic copies of the report to the *EnviroLogic Resources* project manager . Additional copies of reports will be distributed among the PRPs as requested.

The analytical laboratory will submit electronic copies of the analytical reports in addition to paper copies. The format of the electronic deliverable will be defined to allow importing into the project data management system.

13.2 QUALITY ASSURANCE REPORTS

Reports of significant QA deficiencies will be provided immediately to the responsible parties' QA officer upon discovery. Verbal notice will be followed with written documentation through a memorandum and a corrective action report. The responsible parties' QA officer will be responsible for reporting QA problems to the project manager. The *EnviroLogic Resources* project manager will be informed of significant problems.

All reported data will include results of the QA data validation review and conclusions containing information regarding data accuracy, precision, completeness, and any corrective action and sampling procedure alteration documentation. Data validation results will be issued in technical memoranda that report the results of data collection events.

14.0 REFERENCES

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TABLE B-1

QUALITY ASSURANCE RESPONSIBILITIES

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

NAME	RESPONSIBILITY
Astoria Area-Wide PRP Group	Provides project direction and coordinates project-agency communication or liaison.
Thomas Calabrese Project Manager *EnviroLogic Resources, Inc.*	Directs and supervises project technical team activities to successfully accomplish technical and QA project objectives; review project QA requirements and activities; and approves appropriate QA corrective actions.
Lynn D. Green QA Officer *EnviroLogic Resources, Inc.*	Assists project manager in the establishment and review of project QA requirements and activities; recommends and review corrective action responses and deviations from the QAPP; coordinates with other consultants or performs data validation; compiles and prepares data validation reports; and review QA reports.
PRP Consultant QA Officer	Assists project manager in the establishment and review of project QA requirements and activities; recommends and review corrective action responses and deviations from the QAPP; coordinates or performs data validation; prepares data validation reports; and review QA reports.
Melanie Hance QA Task Leader *EnviroLogic Resources, Inc.*	Provides technical QA assistance; direct implementation of QAPP; prepares QA reports; and provides correction action response.
Laboratory QA Officer [TBA]	Directs and supervises laboratory implementation of QA/QC protocols so the QA objectives are met and property documented and laboratory QA/QC information is reported
Laboratory Project Manager [TBA]	Directs and supervises laboratory analytical activities, verifies adherence to project specifications, and QA objectives; confirms that technical, financial, and scheduling objectives are achieved.

TABLE B-2

DATA QUALITY OBJECTIVES FOR RI SAMPLING PROGRAMS

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

DQO Parameter	RI Sampling Programs
Data users	Astoria Area Wide PRPs, DEQ
Data use/decision	Monitoring/characterization/necessity of remedial action
Data type	Concentrations of constituents of Interest[a]
Data quality objectives[b]	
Analytical level	Level III (non-CLP-RAS)[c]
	Level I (field screening methods only)
QA Goals	
Precision[d][e]	Matrix spike and laboratory duplicates
	Field duplicates
Accuracy[d][e]	Matrix and surrogate spikes
Representativeness[d]	Field and laboratory blanks[f]
	Sampling protocols[g]
Completeness[d]	90 percent
Quantitation limits[h]	As presented in Table B-5

(a) Potential constituents of interest are identified in Section 2.4.1 of the work plan.

(b) Developed in accordance with DEQ and EPA guidance documents.

(c) The Level III and Level I analytical levels are discussed in Section 3.0 of this QA.PP.

(d) Criteria for the evaluation of precision, accuracy, representativeness, and completeness are discussed in Section 10.0 of this QAPP.

(e) Control limits for evaluation of precision and accuracy for project analytes are listed in Tables B-3 and B-4.

(f) Blank concentrations will be monitored and corrective action determined on a case-by-case basis.

(g) Sampling protocols will be monitored for adherence to the sampling procedures discussed in Appendix A; corrective action will be determined on a case-by-case basis.

(h) Quantitation limits may be affected by matrix interferences. Values are based on current laboratory data.

TABLE B-3

MATRIX SPIKE RECOVERY CONTROL LIMITS

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

Analysis (Method)	Matrix Spike Compound	Recovery Control Limits (%)[a]			RPD (%)[b][c]		
		Water	Soil	Sediment	Water	Soil	Sediment
Volatiles (8021)							
	Benzene	65-151	46-160	46-160	30	30	30
	Toluene	77-143	49-160	49-160	30	30	30
Volatiles (8260)							
	1,1-Dichloroethene	65-151	46-160	46-160	30	30	30
	Trichloroethene	77-143	49-160	49-160	30	30	30
	Chlorobenzene	87-141	87-143	87-143	30	30	30
	Toluene	87-138	66-160	66-160	30	30	30
	Benzene	79-141	83-158	83-158	30	30	30
Semivolatiles (8270)							
	1,2,4-Trichlorobenzene	47-105	34-110	34-110	30	30	30
	Acenaphthene	39-128	41-119	41-119	30	30	30
	2,4-Dinitrotoluene	24-134	40-152	40-152	30	30	30
	Pyrene	26-150	10-162	10-162	30	30	30
	N-Nitroso-di-n-propylamine	39-121	38-122	38-122	30	30	30
	1,4-Dichlorobenzene	41-106	33-103	33-103	30	30	30
	Pentachlorophenol	10-138	10-125	10-125	30	30	30
	Phenol	10-126	18-150	18-150	30	30	30
	2-Chlorophenol	10-141	21-124	21-124	30	30	30
	4-Chloro-3-Methylphenol	10-165	37-141	37-141	30	30	30
	4-Nitrophenol	24-134	12-206	12-206	30	30	30
Polychlorinated biphenyls (8081)							
	Aroclor 1242	30-160	30-133	30-133	30	30	30
Metals (6010/7000) and major ions[d]		75-125	75-125	75-125	20	20	

(a) Control limits are based on the EPA method. Control limits may be modified during the RI/FS process as the limits are refined. Instances may arise where high sample concentrations, heterogeneity of samples, or matrix interferences preclude achieving the desired control limits and associated QC criteria

(b) RPD = relative percent difference.

(c) If duplicate sample values are within five (5) times the quantitation limit (QL), then the control limit interval will be plus or minus the QL for water, and plus or minus 2 times the QL for soil and sediment.

(d) Refers to laboratory duplicate results.

TABLE B-4

SURROGATE RECOVERY CONTROL LIMITS

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

Analysis (Method)	Surrogate Compound	Recover Control Limits (%)[a]		
		Water	Soil	Sediment
Volatiles (8021)				
	Trifluorotoluene	70-130	70-130	70-130
	Bromofluorobenzene	70-130	70-130	70-130
Volatiles (8260)				
	Dibromofluoromethane	87-114	85-114	85-114
	Fluorobenzene	91-110	82-131	82-131
	D8-Toluene	92-107	84-116	84-116
	Ethylbenzene-d10	86-108		
	Bromofluorobenzene	87-110	85-115	85-115
Semivolatiles (8270)				
	D5-Nitrobenzene	50-145	27-109	27-109
	2-Fluorobiphenyl	55-130	47-108	47-108
	d14-p-Terphenyl	54-139	43-122	43-122
	d5-Phenol	10-90	31-102	31-102
	2-Fluorophenol	10-117	47-108	47-108
	2,4,6-Tribromophenol	46-158	28-117	28-117
Polychlorinated biphenyls (8081)				
	TCMX	30-103	33-134	33-134
	DCBP	30-128	43-155	43-155
Northwest TPH (NWTPH-HCID, Gx, Dx)				
	1-Chlorooctane	50-150	50-150	50-150
	Bromofluorobenzene	50-150	50-150	50-150
	Pentacosane	50-150	50-150	50-150
	1,4-Difluorobenzene	50-150	50-150	50-150
	2-Fluorobiphenyl	50-150	50-150	50-150
	o-terphenyl or p-terphenyl	50-150	50-150	50-150

(a) Control Limits are based on the EPA method. Control limits may be modified during the RI process as the limits are refined. Instances may arise where high sample concentrations, heterogeneity of samples, or matrix interferences preclude achieving the desired control limits and associated QC criteria.

TABLE B-5

QUANTITATION LIMITS

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

Analysis (Method)	Analyte	Quantitation Limits[a] Water (ug/L)	Soil (mg/kg)	Sediment (mg/kg)
Volatiles (8260 or 8021)				
	1,1,1,2-Tetrachloroethane	0.5	0.0005	0.005
	1,1,1-Trichloroethane	0.5	0.0005	0.005
	1,1,2,2-Tetrachloroethane	0.5	0.0005	0.005
	1,1,2-Trichloroethane	0.5	0.0005	0.005
	1,1-Dichloroethane	0.5	0.0005	0.005
	1,1-Dichloroethene	0.5	0.0005	0.005
	1,1-Dichloropropene	0.5	0.0005	0.005
	1,2,3-Trichloropropane	0.5	0.0005	0.005
	1,2,4-Trichlorobenzene	0.5	0.0005	0.005
	1,2,4-Trimethylbenzene	0.5	0.0005	0.005
	1,2-Dibromo-3-chloropropane	0.5	0.0005	0.01
	1,2-Dibromoethane	0.4	0.0005	0.005
	1,2-Dichlorobenzene	0.5	0.0005	0.005
	1,2-Dichloroethane	0.4	0.0005	0.005
	1,2-Dichloropropane	0.5	0.0005	0.005
	1,3,5-Trimethylbenzene	0.5	0.0005	0.005
	1,3-Dichlorobenzene	0.5	0.0005	0.005
	1,3-Dichloropropane	0.5	0.0005	0.005
	1,4-Dichlorobenzene	0.5	0.0005	0.005
	2,2-Dichloropropane	0.5	0.0005	0.005
	2-Butanone	2.5	0.1	0.1
	2-Chloroethyl vinyl ether	10	0.05	0.05
	2-Chlorotoluene	0.5	0.0005	0.005
	2-Hexanone	2.5	0.1	0.1
	4-Chlorotoluene	0.5	0.0005	0.005
	4-Isopropyltoluene	0.5	0.0005	0.005
	4-Methyl-2-pentanone	2.5	0.0005	0.005
	Acetone	2.5	0.1	0.1
	Acrylonitrile	50	0.25	0.25
	Benzene	0.4	0.0005	0.005
	Bromobenzene	0.5	0.0005	0.005
	Bromochloromethane	0.5	0.0005	0.005
	Bromodichloromethane	0.5	0.0005	0.005
	Bromoform	0.5	0.0005	0.005
	Bromomethane	0.5	0.0005	0.01
	Carbon disulfide	0.5	0.0005	0.005
	Carbon tetrachloride	0.5	0.0005	0.005
	Chlorobenzene	0.5	0.0005	0.005
	Chloroethane	0.5	0.0005	0.01
	Chloroform	0.5	0.0005	0.005
	Chloromethane	0.5	0.0005	0.01
		0.5	0.0005	

Analysis (Method)	Analyte	Quantitation Limits[a] Water (ug/L)	Soil (mg/kg)	Sediment (mg/kg)
	cis-1,3-Dichloropropene	0.5	0.0005	0.005
	Dibromochloromethane	0.5	0.0005	0.005
	Dibromomethane	0.5	0.0005	0.005
	Dichlorodifluoromethane	0.5	0.0005	0.01
	Ethylbenzene	0.4	0.0005	0.005
	Hexachlorobutadiene	0.5	0.0005	0.005
	Iodomethane	0.5	0.0005	0.005
	Isopropylbenzene	0.5	0.0005	0.005
	m,p-Xylene	0.8	0.001	0.01
	Methyl tert-butyl ether	0.4	0.01	0.01
	Methylene chloride	0.5	0.0005	0.1
	n-Butylbenzene	0.5	0.0005	0.005
	n-Propylbenzene	0.5	0.0005	0.005
	Naphthalene	0.5	0.0005	0.025
	o-Xylene	0.4	0.0005	0.005
	sec-Butylbenzene	0.5	0.0005	0.005
	Styrene	0.5	0.0005	0.005
	tert-Butylbenzene	0.5	0.0005	0.005
	Tetrachloroethene	0.5	0.0005	0.005
	Toluene	0.4	0.0005	0.005
	trans-1,2-Dichloroethene	0.5	0.0005	0.005
	trans-1,3-Dichloropropene	0.5	0.0005	0.005
	Trichloroethene	0.5	0.0005	0.005
	Trichlorofluoromethane	0.5	0.0005	0.01
	Vinyl acetate	0.5	0.0005	0.005
	Vinyl chloride	0.5	0.0005	0.01
Carbonyl Compounds (8315)				
	Formaldehyde	20	1	1
Semivolatiles (8270)				
	Acenaphthene	1.0	0.33	0.33
	Anthracene	1.0	0.33	0.33
	Benz[a]anthracene	1.0	0.33	0.33
	Benzo[b]fluoranthene	1.0	0.33	0.33
	Benzo[k]fluoranthene	1.0	0.33	0.33
	Benzo[a]pyrene	1.0	0.33	0.33
	Chrysene	1.0	0.33	0.33
	Dibenz[a,h]anthracene	1.0	0.33	0.33
	Fluoranthene	1.0	0.33	0.33
	Fluorene	1.0	0.33	0.33
	Indeno[1,2,3-cd]pyrene	1.0	0.33	0.33
	Naphthalene	1.0	0.33	0.33
	Pyrene	1.0	0.33	0.33
Priority pollutant Metals		0.2-10	0.02-1.0	0.02-1.0
Polychlorinated biphenyls (8081)		1-2	0.033-0.067	0.033-0.067
Northwest TPH (NWTPH-HCID, Gx, Dx)		100-250	10-50	10-50
Total organic carbon		--	1	1

(a) Quantitation limits are based on current laboratory data and may be modified during the RI process as methodology is refined. Quantitation limits listed for soil are based on wet weight. The quantitation limits calculated by the laboratory for soil, calculated on dry weight basis, will be higher. Laboratory quantitation limits will be based on the lowest standard on the calibration curve. Instances may arise where high sample

concentrations, heterogeneity of samples, or matrix interferences preclude achieving the desired quantitation limits and associated QC criteria.

(b) Laboratory target detection limit, which is generally achievable but may be influenced by instrument sensitivity, recovery, and matrix interferences.

TABLE B-6

RI ANALYTICAL METHODS[a]

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

Sample Type	Extraction/Cleanup	Analytical Method
Standard Laboratory Methods		
Soil		
Volatile organics[b]	None	8021, 8260
Semivolatile organics	3550	8270 (modified)
Total Petroleum Hydrocarbons	3550	NWTPH-HCID and/or NWTPH Dx and/or NWTPH Gx[c]
Polychlorinated biphenyls	3550	8081
Priority pollutant metals[d]	3050	6010/7000
Total organic carbon	Drying, purging[e]	Combustion/infrared[e]
Grain size	None	ASTM D 422
Vertical conductivity	None	ASTM D 5084
Percent moisture/solids	None	ASTM D 2216
Ground Water		
Volatile organics[b]	None	8021, 8260
Semivolatile organics	3510 (separatory funnel)	8270 (modified)
Total Petroleum Hydrocarbons	3510	NWTPH-HCID and/or NWTPH Dx and/or NWTPH Gx
Polychlorinated biphenyls	3510	8081
Priority pollutant metals[d]	3020	6010/7000
Major ions[f]	None	Cations by ICP (6010), Anions by standard EPA methods
Sediment		
Volatile organics[b]	None	8021, 8260
Semivolatile organics	3550	8270 (modified)
Total Petroleum Hydrocarbons	3550	NWTPH-HCID and/or NWTPH Dx and/or NWTPH Gx
Polychlorinated biphenyls	3510	8081
Priority pollutant metals[d]	3020	6010/7000
Major ions[f]	None	Cations by ICP (6010), Anions by standard EPA methods

(a) Methods are from SW-846 (EPA 1986, updated version available on the Internet: http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm) unless otherwise referenced.

(b) Laboratory will be required to report fist ten (10) tentatively identified compounds (TICs) to aid in the identification of carrier and additive chemicals.

(c) Source: DEQ, updated laboratory methods available on the Internet: http://www.deq.state.or.us/lab/Methods/tphmain.html

(d) Includes antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.

(e) Source: American Society of Agronomy

(f) Includes calcium, magnesium, sodium, potassium, sulfate, nitrate, chloride, carbonate, and bicarbonate.

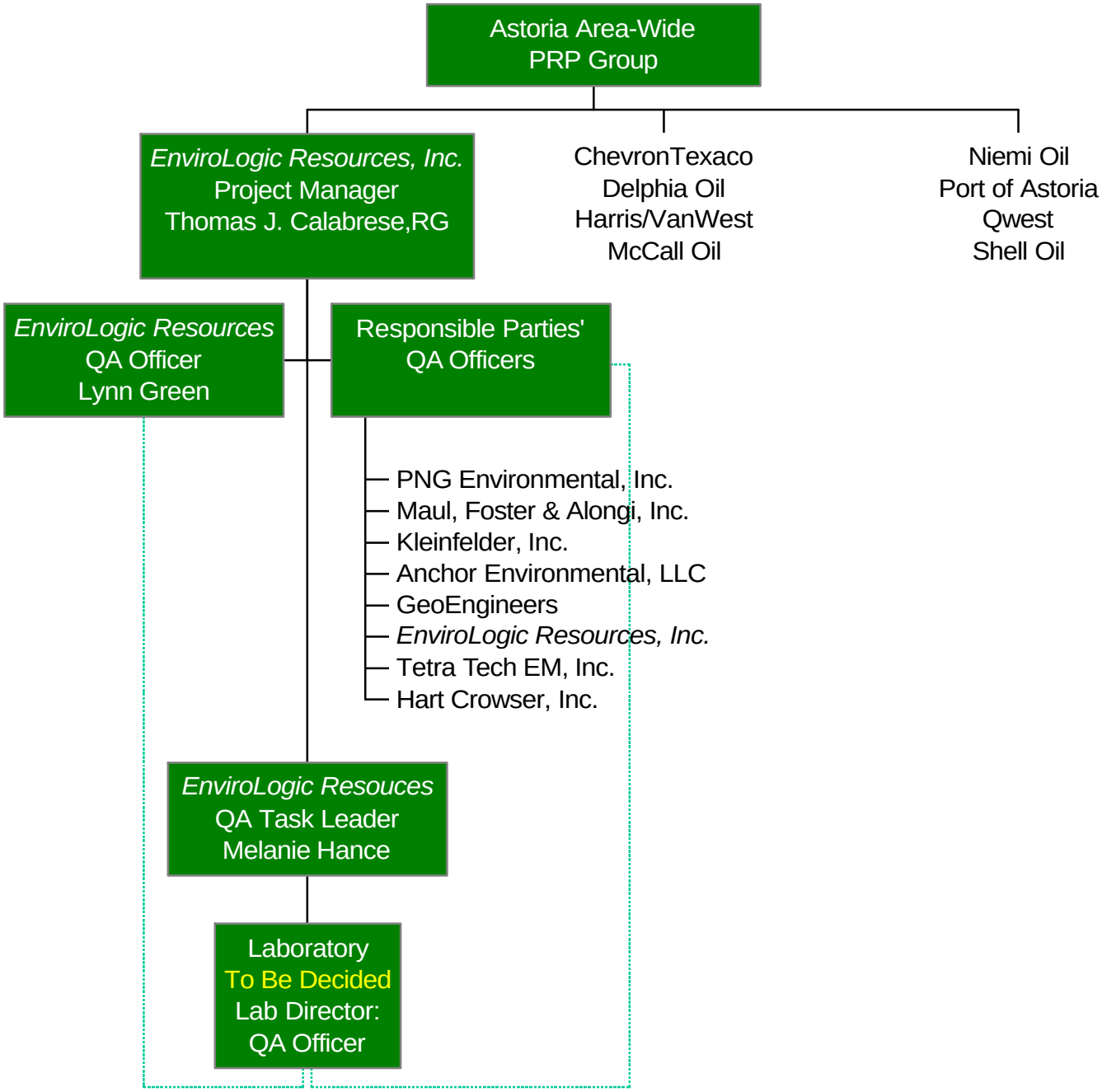

FIGURE B-1

PROJECT QUALITY ASSURANCE ORGANIZATION

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon