APPENDIX C
PERFORMANCE MONITORING AND CONTINGENCY RESPONSE PLAN

Eldridge Municipal Landfill Interim Action
Bellingham, WA

Prepared for
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ACRONYMS AND ABBREVIATIONS

ARI	Analytical Resources Inc.
bgs	below ground surface
BNSF	Burlington Northern Santa Fe Railway
BTC	Bellingham Technical College
CAP	Cleanup Action Plan
City	City of Bellingham, Public Works Department
Creek	Little Squalicum Creek
DGPS	differential global positioning system
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EIM	environmental information management
EPA	U.S. Environmental Protection Agency
FCR	field change request
FS	feasibility study
ICP/MS	inductively coupled plasma/mass spectrometry
LCS	laboratory control sample
MTCA	Model Toxics Control Act
mg/kg	milligrams per kilogram
MQO	measurement quality objective
Oeser	Oeser Company
PAH	polycyclic aromatic hydrocarbon
Park	Little Squalicum Park
PLP	potential liable party
POTW	publicly-owned treatment works
PPE	personal protection equipment
PQL	practical quantitation limit
QA	quality assurance
QC	quality control
RI/FS	remedial investigation and feasibility study
RLs	remediation levels
RPD	relative percent difference
RSD	relative standard deviation
SOP	standard operating procedure
TCP	Toxics Cleanup Program
WAC	Washington Administrative Code

CERTIFICATION

I, Mark J. Herrenkohl, a professional engineering geologist in the State of Washington, certify that I have reviewed the geosciences portions of this document.

Signature and Name of Geologist: Mark J. Herrenkohl Date: July 6, 2011

1 INTRODUCTION

This plan describes the performance monitoring proposed by the City of Bellingham (City) for the interim action to remove municipal refuse and contaminated soils at the Eldridge Municipal Landfill Site (Site) located in Bellingham, Washington. The plan was developed based on information presented in the draft Remedial Investigation/Feasibility Study (RI/FS) Report for the Site (Herrenkohl 2011a) and satisfies the requirements of the Model Toxics Control Cleanup Act (MTCA), Chapter 70.105D RCW, administered by the Washington State Department of Ecology (Ecology) under the MTCA Cleanup Regulation, Chapter 173-340WAC.

Herrenkohl Consulting LLC has written this performance monitoring plan with assistance from Wilson Engineering, LLC and Integral Consulting Inc. under contract with the City Public Works Department, and with direction from Ecology's Toxics Cleanup Program (TCP). The City has negotiated an amended Agreed Order (No. DE 8073) with Ecology to complete the interim action for the Site.

1.1 SITE DESCRIPTION

While performing an RI under separate order (Agreed Order No. DE 2016)[1] for the Little Squalicum Park (Park) site, a separate and distinct area of contamination from an old municipal landfill was discovered in the Park. In the mid- to late-1930s, the City had used a portion of the Park as a "sanitary landfill" for burning and burying local municipal waste hauled by a garbage collection contractor. The landfill was operated for only a few years before operations ceased. The landfill area is located on property owned by Whatcom County (Parcel Number: 38022347 32190000), which is currently leased by the City for management of the Park. The remains of the landfill are located west of the Bellingham Technical College (BTC) campus parking lot and north of Building-U (Figure 1).

The initial boundaries of the landfill were delineated in January 2006 as part of the draft Park RI, through the excavation of reconnaissance test pits in which evidence of municipal garbage was found within various fill materials. The types of municipal garbage observed consisted of glass bottles, metal scraps, ash, ceramics, construction debris, and various indiscernible rusted materials.

Upon completion of the draft Park RI in December 2008, the area of the historical landfill was estimated to be approximately 7,100 ft^2. The draft Park RI documented the presence of low levels of polycyclic aromatic hydrocarbons (PAHs), benzoic acid, phthalates, and pentachlorophenol in surface soil samples collected in the landfill area, as well as elevated

[1] The Agreed Order for the Little Squalicum Park site is no longer in effect. The City and Ecology agreed to terminate the original Little Squalicum Park Agreed Order in October 2010. Oversight of most of the non-landfill Little Squalicum Park site was transferred to the United States Environmental Protection Agency (EPA) to become the Little Squalicum Creek Removal Action site.

concentrations of some heavy metals (e.g., lead). Higher levels of metals were detected in subsurface soils.

In November 2009, Ecology listed the landfill area as a separate site and named both the City and County as potentially liable persons (PLPs). Soon after, the City and Ecology began negotiating an Agreed Order for completing an RI/FS report and draft Cleanup Action Plan (DCAP) for the Site.

In September 2010, EPA uncovered additional landfill material during excavations in support of the cleanup at the Oeser/Little Squalicum Creek site. In order to allow the EPA work to continue, the City undertook an independent action to investigate, analyze, relocate and secure most of the contaminated soil excavated during construction of the BTC/Birchwood storm channel. Some contaminated soil that was left in-place, along with the relocated material, will be addressed as part of the landfill cleanup. The estimated area of the historical landfill was revised to be approximately 19,000 ft^2 (Figure 1).

The Agreed Order (No. DE 8073) requiring the City to complete an RI/FS report and DCAP for the Site was signed by the City and Ecology on November 19, 2010. A draft RI/FS report was completed for the Site in February 2011 (Herrenkohl Consulting 2011a). After review by Ecology and further discussion between parties, the City agreed to conduct an interim action for the Site in summer 2011.

1.2 PURPOSE AND OBJECTIVES

Performance monitoring and contingency responses (as needed) will be implemented for the Site in accordance with WAC 173-340-410. The objective of the monitoring is to assess whether remediation levels (RLs) have been achieved for the Site. This monitoring plan contains information on the quantity and location of sample stations, the trigger for contingency response actions, and the justification for discontinuing monitoring. The plan is subject to Ecology review as part of the Engineering Design Report (EDR) for the cleanup project. The following type of monitoring will be conducted in support of the interim action[2]:

> **Performance Monitoring of Soil Remediation Levels –** Soil samples will be collected from the bottom and sidewalls of the excavation to assess whether metals (arsenic, cadmium, copper, lead, mercury, zinc) and pentachlorophenol levels are below the Site RLs:
>
> - Arsenic: 10 mg/kg
> - Cadmium: 45 mg/kg
> - Copper: 50 mg/kg
> - Lead: 50 mg/kg

[2] Protection and confirmation monitoring will also be conducted in support of the interim action but are not presented in this performance monitoring plan.

- Mercury: 0.1 mg/kg
- Zinc: 86 mg/kg
- Pentachlorophenol: 2.5 mg/kg

Although there are no remediation levels for PAHs, selected soil samples will be analyzed for these contaminants. An additional representative sample from each sampling location will also be archived (frozen) for possible future analysis[3].

In the event that soil performance monitoring does not meet the RLs evaluation requirements presented in Section 5.1, additional soil will be removed where concentrations exceed corresponding RLs. Upon removal, additional soil samples will be collected from excavated areas and evaluated as described in Section 5.1.

This contingency will be coordinated with City and Ecology project representatives. Coordination and review will be conducted in a timely manner, concurrent with construction activities.

[3] For frozen (-18^{o}C) archived soil samples, the holding time for metals analysis (except mercury) is 2 years from collection. For organics (except volatiles), the holding time is 1 year from collection (refer to Section 4).

2 ORGANIZATION AND RESPONSIBILITIES

Performance monitoring of contaminated soils during construction will be the responsibility of the City and its contractors and consultants. The roles of the team members are discussed below.

Washington State Department of Ecology. The City and Ecology have entered into an amended Agreed Order for completing an interim action for the Site. Mary O'Herron is the designated project manager for Ecology and responsible for oversight of the monitoring. Ecology will provide technical review of this plan and the results of performance monitoring during and after construction.

City of Bellingham, Public Works Department. The Public Works Department will be responsible for overall project management and reporting tasks. Sam Shipp, professional engineer, is the designated project manager and will coordinate all activities under the amended Agreed Order with the Ecology project manager. Mr. Shipp or designee will be responsible for contracting with and directly supervising the environmental consultant that will conduct the analysis and reporting tasks for the performance monitoring. He will direct the consultant on a day-to-day basis and provide primary review of all reports and other work products.

Coordination with Site Owners and Stakeholders. BTC, Whatcom County Parks, City Parks, and the general public will be kept informed of the progress made by the City on construction and performance monitoring activities.

Herrenkohl Consulting LLC. Mark Herrenkohl of Herrenkohl Consulting was selected by the City to lead the performance monitoring for the Eldridge Municipal Landfill Site. Mr. Herrenkohl, a licensed engineering geologist in Washington State will be responsible for implementing and executing the technical, quality assurance (QA), and administrative aspects of the monitoring. Mr. Herrenkohl is also accountable for ensuring that the field and testing investigation is conducted in accordance with applicable plans and guidelines, including this monitoring plan. In addition, Mark Herrenkohl will communicate all technical, QA and administrative matters to the project team and the City project manager. He will ensure that any deviations from the monitoring plan are documented, communicated to the City and Ecology, and approved before implementation. Mr. Herrenkohl is responsible for overseeing the preparation of project deliverables to be submitted to the City and Ecology.

Analytical Laboratory. Analytical Resources, Inc. (ARI) of Tukwila, Washington will perform the chemical analysis on soil samples collected for this project. The project manager at ARI will be Ms. Kelly Bottem. Data validation will be completed by Herrenkohl Consulting or subcontractor (to-be-determined).

3 SAMPLING ACTIVITIES

Construction on the Eldridge Municipal Landfill project will begin in summer 2011. Confirmation soil sampling will be conducted following excavation of all visible municipal solid waste and visible contaminated soils.. Soil samples will be collected from the bottom and sidewalls of two excavation areas (designated Excavation Areas 1 and 2 on Figure 2 and in the EDR) as described below.

3.1 SAMPLE LOCATIONS

A total of 50 soil samples will be collected from the bottom and the sidewalls of the excavation in a 30-ft to 40-ft grid pattern that meets the following criteria (Figure 2):

1. Each cell area is no greater than 600 ft^2;
2. At least one bottom sample is collected from each cell;
3. At least one sidewall sample is collected from each perimeter cell; and
4. The cell areas must be as uniform as possible.

The number and location of samples collected is subject-to-change in the field. For example, the extent of the excavation may be less than anticipated, reducing the number of performance monitoring samples collected from the Site. All soil samples will be analyzed for total metals and pentachlorophenol using methods described in Section 4. Selected samples will also be analyzed for PAHs (5 sample locations distributed to represent each excavation area for a total of 10 samples analyzed) and an additional representative sample from each bottom and sidewall location will be archived (frozen) for possible future analysis.

3.2 SAMPLE COLLECTION METHODS

The following sections describe the soil sampling methods for the performance monitoring.

3.2.1 Soil Sampling

Soil samples will be collected using a stainless-steel spoon or hand auger[4] at locations specified in Section 3.1. Bottom samples will be collected from 0 to 0.5 ft below ground surface (bgs). Sidewall samples will be collected from approximately the vertical center of the sidewall to a lateral depth of 0.5 ft[5]. The location of each station will be staked in the field and then documented by project surveyors (Total Station techniques). Compositing of up to 3 subsamples/replicate samples may be required at each station to provide enough soil for

[4] A hand auger may be required to collect compacted clay or coarse-grained soil from 0.5 ft depth.
[5] Sidewalls are expected to be either vertical or up to a 2H:1V. On a sloped sidewall, the toe of the slope will be considered the "bottom" of the sidewall.

analytical testing and archive sample requirements. SOP-1 presents the procedures planned for soil sampling for performance monitoring (Attachment A).

3.2.2 Field Documentation

The primary types of documentation that will be used for performance monitoring include site logbook, photo logs, sample log forms, and sample tracking forms. Copies of field forms planned for use in the monitoring are presented in Attachment B. The site logbooks are vital for documenting all onsite activities. Photo documentation will be used to provide an accurate account of the material sampled, sample locations, and environmental conditions. Sample log forms are used to summarize sampling data collected for various sample locations. Sample tracking forms include the chain-of-custody form, sample labels, and custody seals. The chain-of-custody form is used to track sample custody, which is an important aspect of field investigation activities that documents the proper handling and integrity of the samples. Sample labels are used to provide essential information and identification for all samples collected during field activities. Custody seals are used on all sample shipment containers to detect any tampering that may have occurred during transport or shipment.

3.2.3 Decontamination Procedures

Equipment decontamination will be performed using procedures outlined below and in SOP-3 (Attachment A). Site personnel will perform decontamination of all equipment prior to removal from the Site and between sample locations.

All non-disposable components of the soil sampling equipment (e.g., stainless steel spoons) will be decontaminated as follows:

- Potable water rinse
- Alconox/Liquinox detergent wash
- Potable water rinse
- Deionized water rinse
- Air dry.

3.3 MANAGEMENT OF INVESTIGATION-DERIVED WASTES

The primary waste streams generated during the performance monitoring are excess soil during sampling and decontamination fluids. The management of each is described in the following subsections.

3.3.1 Excess/Rejected Soil Samples

Soil samples that are rejected and/or determined to be in excess of what is required to conduct analytical sampling will be returned to the project area where they were collected.

3.3.2 Decontamination Waters

Liquid wastes (i.e., decontamination waters) will be potentially contaminated with metals and organics (e.g., pentachlorophenol). The presence of any of these chemicals in the wastewaters is expected to be diluted; therefore, the wastewaters are not expected to be classified as dangerous or hazardous waste. Consequently, the wastewaters are not likely to contain hazardous waste pursuant to the contained-in policy (i.e., environmental media that contain a listed hazardous waste are to be managed as a hazardous waste). Decontamination waters will be collected in a 55-gallon drum for disposal at the publicly-owned treatment works (POTW).

3.3.3 Personal Protective Equipment/Miscellaneous Debris

Personal Protective Equipment (PPE) and miscellaneous debris will be generated during sampling activities. Interim storage of these materials in plastic bags is acceptable. The bags are to be disposed of at an appropriate solid waste facility dumpster after the completion of each sampling event.

3.4 FIELD QUALITY ASSURANCE

Field duplicates will be collected at a frequency of 1 per 20 field samples or 1 per sampling event, whichever is more frequent. Duplicate samples will be analyzed for total metals and pentachlorophenol. One duplicate sample will also be analyzed for PAHs. No field blank samples (e.g., equipment rinsate) will be required for the performance monitoring program.

4 ANALYTICAL METHODS

Performance monitoring samples will be analyzed for total metals, pentachlorophenol, and PAHs as described in the following sections. The laboratory will provide rapid (within 5 days)[6] turnaround of sample results to facilitate performance evaluation and reduce delays to project construction. Detailed analyte lists and recommended reporting limits are provided in Table 1. Laboratory quality assurance/quality control requirements (QA/QC) are summarized in Tables 2 and 3.

4.1 TOTAL METALS

Soil samples will be analyzed for arsenic, cadmium, copper, lead, and zinc by inductively coupled plasma/mass spectrometry (ICP/MS) using EPA Method 200.8. Soil samples will also be analyzed for mercury by cold vapor atomic absorption (CVAA) using EPA Method SW 7471A (Table 1). Strong acid digestion with nitric acid and hydrogen peroxide will be used to prepare soil samples for analysis (EPA Method SW 3050B).

4.2 PENTACHLOROPHENOL AND PAHS

Soil samples will be analyzed for pentachlorophenol and PAHs[7] by gas chromatography – mass spectrometry (GC/MS) by EPA Method SW 8270D low level reporting limits (Table 1). Sonication by EPA Method SW 3550C will be used to prepare soil samples for analysis.

4.3 CORRECTIVE ACTIONS

Corrective actions may be initiated in response to deviations from this monitoring plan or laboratory protocols. If deviations from this monitoring plan or unexpected conditions are encountered in the field, the field manager will immediately institute the necessary corrective actions (with City and Ecology notification and approval), complete a field change request (FCR) form (refer to Attachment B), and conduct an evaluation to ensure that the correct procedures continue to be followed. In circumstances where sampling conditions are unexpected, the appropriate sampling actions consistent with project objectives will be conducted. The procedural change will be noted in the field log and a corrective action report will be completed for the project files.

At the laboratory, any deviations from the monitoring plan or laboratory protocols will be addressed by the laboratory's project manager and QA officer. The laboratory's project manager

[6] A 48-72 hour turnaround time on results will be requested from the laboratory but matrix effects or reruns may require more analysis time.
[7] PAHs include naphthalene, 2-methylnaphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthene(s) (total), benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene.

is responsible for maintaining records of QC issues related to laboratory work and for notifying the project QA manager of the QC issues. The project QA manager will be responsible for evaluating all reported non-conformances, conferring with the project manager, and verifying that the corrective action is implemented as developed and scheduled by the laboratory's project manager or QA officer. Corrective action records generated at the laboratory will be included with the data package and discussed in the case narrative.

All deviations from this monitoring plan require Ecology notification and approval.

Table 1. Recommended Sampling Preparation Methods, Cleanup Methods, Analytical Methods, and Detection Limits for Soil Samples

Chemical	Recommended Sample Preparation Methods	Recommended Analytical Methods	Site Remediation Level	Recommended Reporting Limit
Arsenic	SW 3050B	EPA 200.8	10 mg/kg	0.2 mg/kg
Cadmium	SW 3050B	EPA 200.8	45 mg/kg	0.2 mg/kg
Copper	SW 3050B	EPA 200.8	50 mg/kg	0.5 mg/kg
Lead	SW 3050B	EPA 200.8	50 mg/kg	1.0 mg/kg
Zinc	SW 3050B	EPA 200.8	86 mg/kg	4.0 mg/kg
Mercury	SW 3050B	SW 7471A	0.1 mg/kg	0.025 mg/kg
Pentachlorophenol	SW 3550C	SW 8270D	2.5 mg/kg	0.100 mg/kg
PAHs	SW 3550C	SW 8270D	--	0.020 mg/kg

4.4 QUALITY ASSURANCE AND QUALITY CONTROL

Extensive and detailed requirements for laboratory QC procedures are provided in the method protocols that will be used for this study (refer to Tables 1-3). Every method protocol includes descriptions of QC procedures, and many incorporate additional QC requirements by reference to separate QC sections. QC requirements include control limits and, in many cases, requirements for corrective action. QC procedures will be completed by the laboratories, as required in each method protocol and as indicated in this plan.

The frequency of analysis for laboratory control samples, matrix spike samples, matrix spike duplicates or laboratory duplicates, and method blanks will be one for every 20 samples or one per extraction batch, whichever is more frequent. Surrogate spikes and internal standards will be added to every field sample and QC sample, as required by the method. Calibration procedures will be completed at the frequency specified in each method description. As required for EPA SW-846 methods (USEPA 2008a), performance-based control limits have been established by each laboratory. These and all other control limits specified in the method descriptions will be used by the laboratories to establish the acceptability of the data or the need for reanalysis of the samples (refer to Tables 1-3).

4.5 DATA QUALITY REVIEW PROCEDURES

Field and laboratory data for this project will undergo a formal verification and validation process. All entries into the database will be verified. All errors found during the verification of field data, laboratory data, and the database will be corrected prior to release of the final data.

Data verification and validation for metals, pentachlorophenol, and PAHs will be completed according to methods described in the guidelines for inorganic and organic data review (USEPA 2004, 2008b). Data will be qualified as estimated if results for laboratory control samples, matrix spike samples, and matrix spike or laboratory duplicates do not meet measurement quality objectives (refer to Tables 2-3). Data will also be qualified as estimated as applicable if control limits for other QC samples or procedures do not meet performance-based control limits established periodically by the laboratory.

Results for field duplicates will be evaluated using the measurement quality objectives (MQOs) provided in Tables 2 and 3. Data will not be qualified as estimated if the MQOs are exceeded, but relative percent difference (RPD) results will be tabulated, and any exceedances will be discussed in the data report.

Data will be rejected if control limits for acceptance of data are not met (Ecology 2008, USEPA 2004, 2008b).

Table 2. Quality Control Procedures for Metal Analyses (from Ecology 2008)

Quality Control Procedure	Frequency	Control Limit	Corrective Action
Instrument Quality Assurance/Quality Control			
Initial Calibration	Daily	Correlation coefficient ≥0.995	Laboratory to optimize and recalibrate the instrument and reanalyze any affected samples
Initial Calibration Verification	Immediately after initial calibration	90–110 percent recovery for ICP-MS or performance based intralaboratory control limits, whichever is lower	Laboratory to resolve discre-pancy prior to sample ana-lysis
Continuing Calibration Verification	After every 10 samples or every 2 hours, whichever is more frequent, and after the last sample	85-115% for ICP-MS	Laboratory to recalibrate and reanalyze affected samples
Initial and Continuing Calibration Blanks	Immediately after initial calibration, then 10 percent of samples or every 2 hours, whichever is more frequent, and after the last sample	Analyte concentration <PQL	Laboratory to recalibrate and reanalyze affected samples
ICP Interelement	At the beginning and end	80–120 percent of the true	Laboratory to correct probl-

Table 2. Quality Control Procedures for Metal Analyses (from Ecology 2008)

Quality Control Procedure	**Frequency**	**Control Limit**	**Corrective Action**
Interference Check Samples	of each analytical sequence or twice per 8 hour shift, whichever is more frequent	value	em, recalibrate, and reanalyze affected samples
Method Quality Assurance/Quality Control			
Holding Times	Not applicable	Soils: 6 months/28 days for mercury (4°C) or 2 years (frozen)	Qualify data or collect fresh samples
Detection Limits	Not applicable	See Table 1	Laboratory must initiate corrective actions and contact the QA/QC coordinator and/or the project manager immediately
Method Blanks	With every sample batch or every 20 samples, whichever is more frequent	Analyte concentration ≤PQL	Laboratory to redigest and reanalyze samples with analyte concentrations <10 times the highest method blank
Laboratory Replicates and Matrix Spike Duplicates	With every sample batch or every 20 samples, whichever is more frequent; Use analytical replicates when samples are expected to contain target analytes. Use matrix spike replicates when samples are not expected to contain target analytes	RPD ≤20% applied when the analyte concentration is >PQL	Laboratory to correct problem and redigest and reanalyze affected samples if analytical problems suspected, or to qualify the data if sample homogeneity problems suspected and the project manager consulted
Matrix Quality Assurance/Quality Control			
Matrix Spikes	With every sample batch or every 20 samples, whichever is more frequent	75–125 percent recovery applied when the sample concentration is <4 times the spiked concentration for a particular analyte	Laboratory may be able to correct or minimize problem; or qualify and accept data
Laboratory Control Samples	Overall frequency of 5 percent of field samples	80–120 percent recovery, or performance based intralaboratory control limits, whichever is lower	Project Manager decision: discuss results with laboratory; qualify sample results
Field Quality Assurance/Quality Control			
Field Replicates	At project manager's	Not applicable	Not Applicable

Table 2. Quality Control Procedures for Metal Analyses (from Ecology 2008)

Quality Control Procedure	Frequency	Control Limit	Corrective Action
	discretion		
Field Blanks	At project manager's discretion	Analyte concentration ≤PQL	Compare to method blank results to rule out laboratory contamination; modify sample collection and equipment decontamination procedures

Table 3. Quality Control Procedures for Organic Analyses (from Ecology 2008)

Quality Control Procedure	Frequency	Control Limit	Corrective Action
Instrument Quality Assurance/Quality Control			
Initial Calibration	As recommended by PSEP (1989a) and specified in analytical protocol	≤30 %RSD for SVOCs Relative response factors ≥0.05 for SVOCs	Laboratory to recalibrate and reanalyze affected samples
Continuing Calibration	After every 10–12 samples or every 12 hours, whichever is more frequent, and after the last sample of each work shift	≤25 %D for SVOCs Relative response factors ≥0.05 for SVOCs	Laboratory to recalibrate and reanalyze affected samples
Method Quality Assurance/Quality Control			
Holding Times	Not applicable	1 year (samples stored frozen [-18°C]) or 14 days (samples stored at 4°C) for SVOCs; analyze extract within 40 days	Qualify data or collect fresh samples
Method Blank	With every extraction batch	Analyte concentration >PQL (the LOD constitutes the warning limit)	Laboratory to eliminate or greatly reduce contamination; reanalyze affected samples
Surrogate Compounds	Added to every sample as specified in analytical protocol	EPA CLP control limits	Laboratory to follow EPA CLP protocols (reanalyses or reextraction may be required)
Matrix Spike Sample and Matrix Spike Duplicate	With every sample batch or every 20 samples, whichever is more frequent	Recovery of 50–150 percent; precision of ≤50 RPD	Follow EPA CLP protocols
Laboratory Control Sample	With every sample batch or every 20 samples, whichever is more frequent	Recovery of 50–150 percent	Laboratory to correct problem and reanalyze affected samples

Table 3. Quality Control Procedures for Organic Analyses (from Ecology 2008)

Quality Control Procedure	Frequency	Control Limit	Corrective Action
Internal Standards	Added to every sample as specified in analytical protocol	Area response of 50–200 percent of calibration standard; retention time within 30 seconds of calibration standard	Laboratory to correct problem and reanalyze affected samples
Detection Limits	Not applicable	(see Table 1)	Laboratory must initiate corrective actions (which may include additional cleanup steps as well as other measures, see Table 1) and contact the QA/QC coordinator and/or project manager immediately.
Field Quality Assurance/Quality Control			
Field Duplicates	At project manager's discretion	Not applicable	Not applicable

5 DATA ANALYSIS AND REPORTING

This section provides information on the approach for data analysis and evaluation of performance for the cleanup project. Reporting requirements are also provided.

5.1 PERFORMANCE EVALUATION

Soil sample results for each station will be compared to the RLs. Sample concentrations below RLs meet performance evaluation requirements and the excavation area or cell represented by that station (Figure 2) can be backfilled by the contractor. Additional excavation will be required for sample concentrations exceeding one or more RLs (refer to Section 6).

This evaluation will be followed for soil performance samples collected from the bottom and sidewalls of the excavation.

5.2 LABORATORY REPORTS

Final laboratory reports will be required for chemical analyses. Key elements of these reports are described below. It is expected that these reports, or summaries of these reports (as appropriate), will be appended to the compliance monitoring reports or letters, as appropriate.

Data will be delivered in both hard-copy and electronic format to the consultant project manager, who will be responsible for oversight of data verification and validation and for archiving the final data and data quality reports in the project file. Electronic data deliverables will be compatible with the project team Microsoft Access-based database and Ecology's Environmental Information Management (EIM) database.

Final written laboratory reports and data deliverables will contain the following:

- A cover letter discussing analytical procedures and any difficulties that were encountered
- A case narrative referencing or describing the procedures used and discussing any analytical problems and deviations from SOPs and quality assurance requirements
- Chain-of-custody and cooler receipt forms
- A summary of analyte concentrations (to two significant figures, unless otherwise justified), method reporting limits, and method detection limits
- Laboratory data qualifier codes appended to analyte concentrations, as appropriate, and a summary of code definitions
- Sample preparation, extraction, dilution, and cleanup logs

- Instrument tuning data
- Initial and continuing calibration data, including instrument printouts and quantification reports, for all analytes
- Results for method and calibration blanks
- Results for all QA/QC checks, including surrogate spikes, internal standards, laboratory control samples (LCSs), matrix spike samples, matrix spike duplicate samples, laboratory duplicate or triplicate samples, and any additional QC procedures
- Original data quantification reports for all analyses and samples
- All laboratory worksheets and standards preparation logs
- Supporting documentation on any corrective actions.

Initial calibration information must include concentrations of each standard analyzed, response factors for each analyte at each standard concentration, relative standard deviation (RSD) (or correlation coefficient for metals analytes) over all standards for individual analytes. The RSD control limit range must also be indicated in the initial calibration summary data. Control limits for each analyte must also be indicated on each continuing calibration summary data sheet.

Method blank and field sample data pages must indicate the method reporting limit and the dilution factor. Surrogate reporting forms must list control limits for surrogate recovery. Spike reporting forms (blank and matrix spikes) must indicate spike percent recovery and relative percent difference control limits (if spikes are analyzed in duplicate).

Documentation of detection limits (detection limit studies) and results of performance evaluation samples (supplied by regulatory agencies or purchased from certified vendors) are not required for the data deliverable. However, these records must be supplied upon request. Total measurement error determination for field duplicate samples will be calculated by the project team.

5.3 QUALITY ASSURANCE REPORT

Data validation reports will be prepared by the project team or a contracted validation firm for chemical data and provided to the consultant project manager. Results of the validation reports will be summarized in a quality assurance report. This report will also identify any field and laboratory activities that deviated from the approved sampling plan and the referenced protocols and will make a statement regarding the overall validity of the data collected. Any limitations to the usability of the data will be discussed in this report. The quality assurance report will be incorporated into the final report either as a section or appendix.

5.4 PERFORMANCE MONITORING REPORT

A draft and final performance monitoring report will be prepared after the initial sampling event and submitted to the City and Ecology. The report will include the following components:

- Introduction/Purpose;
- Summary of field activities and sample collection;
- Results of soil chemistry tests;
- Quality Assurance/Quality Control (QA/QC);
- Discussion and interpretation of results with respect to performance; and
- Conclusions and recommendations.

Figure(s) showing the final sample locations using the project basemap created for this work will be included in the report. Chemical laboratory data will be entered into Ecology EIM templates and be submitted with the final report.

6 CONTINGENCY

In the event that soil performance monitoring does not meet the RLs evaluation requirements presented in Section 5.1, the following contingency will be conducted for the interim action.

Soil Excavation – Additional soil will be removed from the bottom and/or sidewalls of the excavation where concentrations exceed corresponding RLs.

- For bottom stations, additional soil will be excavated midway (delineated by tape measure) between the failing sample location and adjacent clean sample locations (refer to Figure 2 for proposed station areas). The excavation depth will be determined by the field engineer using best professional judgment based on such information as the degree of RL exceedance.
- For sidewall stations, additional soil will be excavated midway (delineated by tape measure) between the failing sidewall location and adjacent clean sidewall locations (refer to Figure 2 for proposed station areas). The lateral extent of the excavation into the sidewall will be determined by the field engineer using best professional judgment based on such information as the degree of RL exceedance.
- After soil removal, the excavated area will be resampled and evaluated as described in Sections 3.1 and 5.1.

This contingency will be coordinated with City and Ecology project representatives. Coordination and review will be conducted in a timely manner, concurrent with construction activities.

7 REFERENCES

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ATTACHMENT A

STANDARD OPERATING PROCEDURES

ATTACHMENT B

FIELD FORMS