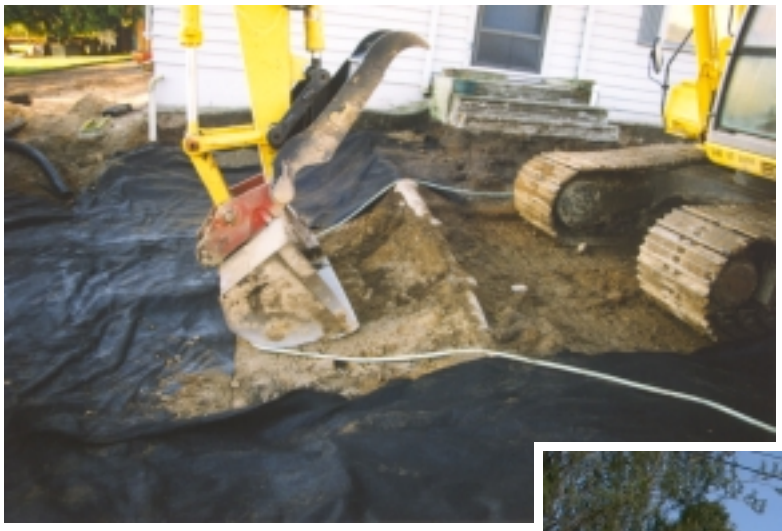
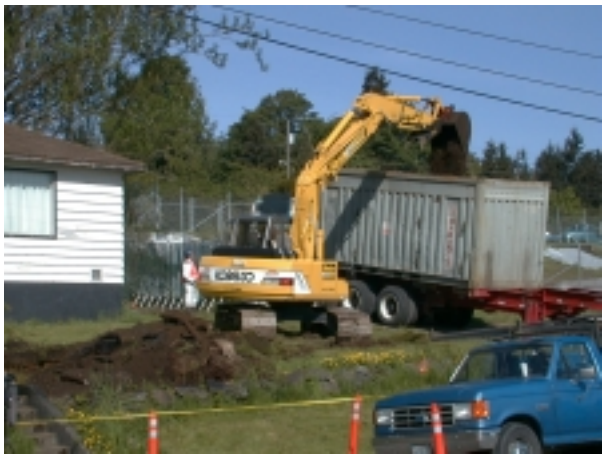
Property Cleanup Manual for the Peripheral Area of the Everett Smelter Site





by
Toxics Cleanup Program

Washington State Department of Ecology

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Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

Asarco	ASARCO Incorporated
Ecology	Washington State Department of Ecology
FCAP/FEIS	Everett Smelter Site Integrated Final Cleanup Action Plan and Final Environmental Impact Statement for the Upland Area
mg/Kg	milligrams per kilogram
MTCA	Model Toxics Control Act
RCW	Revised Code of Washington
WAC	Washington Administrative Code

Introduction

Overview

The Everett Smelter Site is in the northeast portion of Everett, Washington (See Figures 1 and 2). It is an area where hazardous substances have come to be located as a result of operation of the Everett Smelter between 1894 and 1912, and its subsequent demolition. The principal contaminants are arsenic and lead.

The Washington State Department of Ecology (Ecology) is cleaning up the site with its authority under the Model Toxics Control Act [MTCA, Ch.70.105D RCW] and the Model Toxics Control Act Cleanup Regulation [Ch. 173-340 WAC]. Environmental conditions and necessary cleanup actions for a portion of the site are discussed in the Everett Smelter Site, Everett, Washington, Integrated Final Cleanup Action Plan and Final Environmental Impact Statement for the Upland Area (FCAP/FEIS, Ecology, 1999). The FCAP/FEIS is the cleanup action plan prepared under WAC 173-340-360 which selected the necessary cleanup actions for the Upland Area of the Everett Smelter Site and specifies the cleanup standards and other requirements for cleanup actions to be taken at the site.

The site is divided into two major areas for the purposes of remediation: the Upland Area and the Lowland Area (See Figure 1). The Upland Area is further divided into the Former Arsenic Trioxide Processing Area and the Peripheral Area. The Former Arsenic Trioxide Processing Area was in the southern portion of the historic plant site as shown on Figure 2. It is the area in which arsenic trioxide was produced during smelter operations and has concentrations of arsenic in the soil of up to 727,000 mg/Kg. Homes in this area have been purchased and demolished by ASARCO Incorporated (Asarco), the last operator of the smelter. The area is currently fenced. The Peripheral Area consists of residential, commercial, and recreational land outside of the Former Arsenic Trioxide Processing Area but within the Community Protection Measures boundary, an area defined by soil sampling as having or potentially having arsenic, lead, and related metals above regulatory levels. It does not include the Lowland Area.

The Peripheral Area has been divided into Zones A, B, and C. Zone A includes the historic smelter plant boundary outside of the Former Arsenic Trioxide Processing Area. Concentrations of arsenic in soil are highest in Zone A and generally decrease outward towards the Community Protection Measures Boundary, with numerous local variations. Sampling of individual properties to determine necessary cleanup actions is most intense in Zone A and decreases in intensity as distance from the historic plant boundary increases, being least intense in Zone D. The FCAP/FEIS discusses sampling to determine cleanup needs for properties within the Everett Smelter Site (Ecology, 1999, Chapter 7).

Purpose, Scope, and Format

This ***Property Cleanup Manual*** provides the framework for cleaning up individual properties in the Peripheral Area of the Everett Smelter Site. It provides for implementation of those portions of the FCAP/FEIS relating to such cleanup. In case of any conflict between this document and the FCAP/FEIS, the FCAP/FEIS shall govern.

The *Property Cleanup Manual* combines the engineering design report, construction plans and specifications, performance monitoring plan, and operations and maintenance plan required by the MTCA Cleanup Regulation [See WAC 173-340-400 and 410]. The *Property Cleanup Manual* contains a summary of information about the Everett Smelter Site and describes the process for cleaning up properties in sufficient detail that anyone responsible for managing the site may read it and know what must be done before, during, and after cleanup.

Chapter 2 provides a brief background summary of the site history and environmental conditions relevant to the cleanup actions governed by this *Property Cleanup Manual* and provides references where more detailed information may be obtained.

Chapter 3 describes the activities necessary to plan, conduct, and document property cleanup. This includes identifying properties to be sampled, preparing for and conducting necessary sampling, developing property-specific plans and specifications for cleanup, field oversight of cleanup activities, and performance monitoring.

Chapter 4 generally deals with construction documentation including the format and contents of the notebook that will be prepared for each property. The property notebooks will contain the initial sampling data, site maps, specifications for how cleanup will be conducted on the property, and documentation of the actual cleanup. This information can/will be provided to the owner for use in real estate disclosure and in damaged property claims made to the tax assessor. The notebook will also address any maintenance requirements for the cleanup actions and will reference interaction with the *Institutional Controls Manual*.

Appendices to this *Property Cleanup Manual* consist of planning and technical documents necessary to conduct and document the cleanup actions. These include: Appendix A, Quality Assurance Project Plan; Appendix B, Letter Sent to Property Owners Declining Cleanup; Appendix C, Procedures for Home Heating Oil Tanks; Appendix D, Field Oversight Checklist; and Appendix E, List of Attachments.

A series of attachments will be included with the *Property Cleanup Manual* over time. These attachments will include: (1) project control documents in chronological order (work plans, field sampling plans, public participation plans, bid specifications, contractor work assignments and contracts, and other documents relating to implementation and control of the remediation work); (2) a list of which properties have or have not been cleaned, including a cross reference of addresses & tax parcel numbers;

and (3) individual property notebooks which document cleanup activities undertaken at each property.

The *Property Cleanup Manual* and its appendices and attachments will be updated as appropriate during the course of the cleanup. These documents will be retained in the Everett Smelter Site file in Central Records at Ecology's Northwest Regional Office. Some or all of the documents will be placed in information repositories, as appropriate.

Other Project Documents

This *Property Cleanup Manual* is one of several documents that will be used to describe work to be performed to implement the FCAP/FEIS in the Peripheral Area of the Everett Smelter Site. In addition to the Property Cleanup Manual, the following documents discuss related activities:

Institutional Controls Manual

The *Institutional Controls Manual* will discuss implementation of institutional controls required by the FCAP/FEIS. The *Institutional Controls Manua*l has not been developed as of the date of issuance of this *Property Cleanup Manual.* It is anticipated that many elements the *Institutional Controls Manual* will be developed during the year 2000.

To find out the current status of the *Institutional Controls Manual*, please contact the Site Manager for the Everett Smelter Site.

Documents Relating to Cleanup of the Former Arsenic Trioxide Processing Area

Cleanup actions to be taken within the Former Arsenic Trioxide Processing Area are described in the FCAP/FEIS. Development of an Engineering Design Report and other cleanup documents will be done at a future date yet to be determined. For questions regarding the current status of the Former Arsenic Trioxide Processing Area, please contact the Site Manager for the Everett Smelter Site.

Documents Relating to Cleanup of the Lowland Area

Cleanup actions to be taken within the Lowland Area have not yet been identified. A draft Remedial Investigation Report describing environmental conditions within the Lowland Area has been received by Ecology. This report will be reviewed at a future date. The next steps will then be to prepare a Feasibility Study report describing potential alternative cleanup actions; to prepare a Cleanup Action Plan which selects a cleanup action to be implemented; and an Engineering Design Report and related documents to implement the selected cleanup actions. To find out the current status of the Lowland Area, please contact the Site Manager for the Everett Smelter Site.

Site Background

Site History

The Everett Smelter Site is a former lead, gold, and silver smelter located in northeast Everett. The smelter operated from 1894 to 1912, with an arsenic extraction plant being added in 1898. The smelter was built by the Puget Sound Reduction Company and subsequently acquired by Asarco. Asarco operated the smelter until 1912, and demolished it between 1912 and 1915. The property was sold in various parcels, with the last parcel owned by Asarco being sold in 1936.

The Everett Smelter Site includes both the former smelter plant property, which contains residual smelter debris, and the surrounding area which was affected by air emissions from the smelter stacks and fugitive emissions (spilled products and waste and air emissions which escaped through means other than stack emissions). Arsenic is the primary determinant of site risks. Risks from exposures to lead, cadmium, antimony, mercury, and thallium also exist at the Site, but cleanup of arsenic will address those risks as well.

Environmental Conditions

The highest concentrations of contaminants in soil exist on and immediately adjacent to the original smelter property. Contaminant concentrations generally decrease with increased distance from the original smelter property, although there are numerous localized exceptions. Within the Former Arsenic Trioxide Processing Area, antimony, mercury, and thallium were found in elevated concentrations and are associated with samples containing very high arsenic levels due to the presence of flue dust and/or arsenic trioxide product.

The contaminant concentrations within the Former Arsenic Trioxide Processing Area occur at depths up to 15 feet below the current ground and are quite variable. Within the Area are abandoned underground flues which led from the arsenic processing equipment to the old stacks. These flues contain residual dust. There is spilled or leftover arsenic trioxide product within the Area as well. The highest arsenic concentration measured on-site to date – 727,000 mg/Kg (72% total arsenic) at a depth of one foot in the backyard of the residence at 520 East Marine View Drive – was within the Former Arsenic Trioxide Processing Area and was probably spilled arsenic trioxide product.

Contamination in the Peripheral Area occurs at lower concentrations than in the Former Arsenic Trioxide Processing Area, and within the upper few feet of soil. Samples collected in the portion of the Peripheral Area within and immediately adjacent to the former smelter plant boundary had the highest arsenic concentrations outside of the Former Arsenic Trioxide Processing Area, with concentrations generally decreasing with increasing distance from the Former Arsenic Trioxide Processing Area. The Peripheral Area outside the former smelter plant boundary was contaminated primarily through

airborne deposition of smelter smokestack emissions, although areas adjacent to the former smelter plant boundary may also have been impacted by fugitive emissions from smelter operations. The smelter ceased operations in 1912, and the stacks were demolished in the period 1912-1915. Since then, much of the area has been developed into residential, commercial, and public land uses. Re-grading during development has moved and mixed soils contaminated with airborne emissions with other soils, making the pattern of contamination distribution irregular both with depth and lateral location. In some cases, deeper soil horizons have higher levels of contamination than surface soil horizons.

The distance at which contamination in the Peripheral Area decreases below regulatory standards, and hence the final site boundary, was not defined by either the Remedial Investigation study (Hydrometrics, 1995a) or by subsequent studies. The Community Protection Measures boundary currently defines the site. It is the best estimate available of the area contaminated or potentially contaminated with arsenic, lead and related metals above regulatory levels, based on current data. The final site boundary will be defined by property-specific sampling as described in the FCAP/FEIS (Ecology, 1999, p. 150).

Peripheral Area Cleanup Actions at Individual Properties

This section provides a brief overview of cleanup actions to be taken at individual properties within the Peripheral Area. Detailed implementation plans for the cleanup actions are discussed in subsequent chapters.

The basic objective of cleanup actions at individual properties is to remove or contain accessible contaminated soil. All contaminated soil not covered by permanent structures and asphalt or concrete paving is considered accessible soil (Ecology, 1999, p. 119).

Soil in maintenance areas not normally occupied, such as crawl spaces beneath homes, will be addressed by sampling the soil and, if necessary, advising people of the hazards of entry and appropriate protective measures to take upon entry or by containing the soil in some manner. Placement of a durable plastic barrier and/or application of materials to the soil surface that will prevent dust generation during work activities are examples of acceptable containment actions. Maintenance areas not normally occupied will be thoroughly cleaned of dust unless site-specific studies demonstrate that dust does not pose a hazard to exposed individuals during activities that will occur in the maintenance areas not normally occupied.

Finally, vouchers will be issued to property owners for air duct cleaning and carpet shampooing whenever such actions are determined to be appropriate. This determination will be based on the results of a past and future studies of arsenic and lead in house dust, carpets and air ducts. Prior to conducting any cleanup actions on site, the property owner and tenants, if any, will be contacted. Ecology will discuss planned work, as well as develop a site-specific cleanup plan in consultation with, the property owner.

Two separate access agreements must be signed by Ecology and the property owner: (1) an agreement allowing Ecology and its contractors access to the property to obtain samples; and (2) an agreement describing the cleanup actions to be taken and allowing Ecology and its contractors access to the property to conduct the agreed-upon cleanup actions. At each property, performance monitoring will be done to evaluate which soils must be removed and replaced and which may be contained. The manner in which performance monitoring will be conducted is described in the FCAP/FEIS (Ecology, 1999, Chapter 7) and in Appendix A, Quality Assurance Project Plan. A Field Sampling Plan will be developed for each portion of the Site when sampling is to be conducted on that portion of the Site.

As the performance monitoring data are collected, a detailed site map will be developed. Once performance monitoring data have identified the areas that must be excavated and to what depths, a final cleanup plan will be developed in consultation with the property owner. This plan will then be followed in excavating contaminated soil exceeding the relevant performance standard for each depth interval, as indicated in Table 1. Soils within the 0-6 and 6-12 inch depth interval will be excavated if performance monitoring indicates the average arsenic concentration exceeds 20 mg/Kg or the maximum arsenic concentration exceeds 40 mg/Kg. Below 12 inches, soil will be excavated if either the average or maximum remediation levels shown in Table 1 are exceeded. A geofabric[1] will be placed above any soil that remains on site and either has an average arsenic concentration exceeding the cleanup level of 20 mg/Kg or has a maximum arsenic concentration exceeding the other performance standard of 40 mg/Kg.

Table 1: Soil Performance Standards.

Performance Standards				
Depth (inches)	Cleanup Level, Average Arsenic Concentration, mg/kg	Other Performance Standard, Maximum Arsenic Concentration, mg/kg	Remediation Level, Average Arsenic Concentration, mg/kg	Remediation Level, Maximum Arsenic Concentration, mg/kg
0-6	20	40	Not Applicable	Not Applicable
6-12	20	40	Not Applicable	Not Applicable
12-18	20	40	60	150
28-24	20	40	60	150
24-30	20	40	150	500
30-36	20	40	150	500
36-42	20	40	150	500
42-48	20	40	150	500
Below 48	20	40	150	500

(After Ecology, 1999, Figure 6-7).

[1] A **geofabric** is a a fabric made of synthetic material designed to be used in earthwork construction for engineering purposes.

Maintenance areas not normally occupied will be sampled to evaluate cleanup needs as discussed above and in the section on Removal Operations.

At the conclusion of soil excavation, removal, and containment, each decision unit will be backfilled with clean soil and re-landscaped. Property owners will be furnished with:

- Instructions for caring for their new lawn and any other items which require maintenance;
- Vouchers for air duct cleaning and carpet shampooing, which the property owner may schedule at their convenience;
- A Property Notebook containing details of the cleanup actions conducted at that property; and
- Information on cleanup costs which may be used to file a "damaged property" claim with the Snohomish County tax assessor's office which may result in a property tax refund.

In addition, an Institutional Control Program will be developed as provided for in the FCAP/FEIS (Ecology, 1999, Section 6.7). Property owners will be furnished information on institutional controls that particularly affect them as individual property owners.

For More Information

The FCAP/FEIS (Ecology, 1999) gives detailed information on site conditions and required cleanup actions. It should be referred to for more detailed information regarding the Site. The FCAP/FEIS lists pertinent site documents and provides a brief description of each (See Ecology, 1999, Section 1.2).

Cleanup Implementation

Work Plans

Ecology will develop work plans for cleanup actions to be taken at properties within the Peripheral Area. Work plans will be developed over time as portions of the Peripheral Area are addressed. Each work plan will identify the properties to be sampled and evaluated for cleanup for each construction season, including a map of the area, and the properties slated for cleanup. Considerations include levels of contamination, nature of the land use (residential, commercial etc.), presence of sensitive or vulnerable individuals (children), proximity of the properties, topography, construction staging considerations, access restrictions or limitations and other relevant factors. Property-specific maps containing basic information (approximate property boundaries, approximate outline of structures, locations of sidewalks, streets, etc.) will be prepared for each property.

The plan for work to be performed at individual properties in the Peripheral Area may include work that covers additional aspects of the Site as described in the FCAP/FEIS.

Property-Specific Cleanup Plans

Owners of the properties to be cleaned up in a particular construction season will be contacted in accordance with the Public Participation Plan. Generally, the property owner will be sent an invitation, via certified mail, to attend an orientation meeting. The meeting with the owners will provide a brief history of the Site, the goals of the cleanup plan, a description of how their property will be sampled, how the property-specific cleanup plan will be developed and how removal and restoration activities will be conducted. Property owners will be provided with a copy of the standard agreement between the agency and the property owner for access to collect samples.

Once the owner has granted access, Ecology personnel will visit the Site to establish the size and location of decision units and identify sampling locations within each decision unit. Property owners will be asked to identify specific issues (trees to save, septic tank location, sprinkler systems, underground utilities, home heating oil tank location, etc.) of ongoing concern. The property map will be updated with this information and will become a part of the access agreement for sampling that specific property. The contractor will have a utility locate performed prior to any sampling activities. The location of all utilities will be marked on the ground (just prior to work) and on the property map. The contractor will be responsible for calling the Utilities Underground Location Center, 425-424-5555 at least two business days before excavation is to be performed. The location service will mark utility locations on the ground with water-soluble paint on public rights-of-way to the property line. In most cases, it is anticipated that the location of utilities on rights-of-way and inspection of utility appurtenances on a specific property will be sufficient to identify the location of underground utilities on the property. If marking the utilities on public rights-of- way and inspection of the property does not yield sufficient information to locate underground utilities on the property, then

the utilities on the property itself should be located using a commercial service. This service is widely available from plumbing companies or in the yellow pages under *Utilities Underground – Locating*.

Care will be taken during sampling to avoid known utilities and to watch for unmarked utilities.

Sampling will be conducted as specified in Appendix A, Quality Assurance Project Plan. Each property will be divided into a number of decision units. The number and maximum depth of samples to be taken in each decision unit will be based on the size of the decision unit and on the proximity of the property to the former smelter site. The resulting analytical data will be used to make decisions on the depth of soil to be excavated within each decision unit in residential yards. Samples will also be collected of the soil and dust in crawlspaces under homes or other maintenance areas not normally occupied.

If a home heating oil tank has been identified at a property, the property owner will be advised to register it with the Pollution Liability Insurance Agency if not registered already and will provide the appropriate form to the property owner. Appendix C describes procedures Ecology will follow in addressing home heating oil tanks during the course of the remediation.

Refusal of Access for Sampling or Cleanup Activities

If a property owner refuses access for sampling or cleanup activities, Ecology will document that the property owner was contacted and declined cleanup. Ecology will send a copy of the letter in Appendix B via certified mail, return receipt requested, which states the date the property owner was contacted and Ecology's understanding that the property owner has refused Ecology access for sampling or cleanup and hence declines cleanup of their property. A copy of this letter will be placed in the file for the property.

Bid Specifications and Advertising

Once the general site plans have been developed, bid specifications will be developed and advertised. During the bid period, a site walk will be scheduled for interested contractors. Once the contract has been awarded, pre-construction meetings will be held with the contractor to develop schedule and detailed specifications for each property.

Pre-Mobilization

Prior to mobilizing to the field, stakeholders will be advised of the general plans for cleanup, the location, proposed schedule and start dates. Stakeholders include:

- Affected property owners
- Tenants in rental properties
- Everett Police Dept.

- Everett Fire Dept, Special Operations
- United States Postal Service
- Puget Sound Energy
- Everett Public Utilities
- Snohomish Public Utilities District
- Snohomish Health District
- Snohomish County
- Everett Housing Authority
- Washington Department of Labor & Industries
- City of Everett
- Northeast Everett Community Organization
- Northwest Everett Neighborhood Association

The Ecology Public Involvement Specialist will contact or visit individuals and organizations in the community to provide them with information about the planned activities, listen to their concerns and help the Project team address those concerns.

The Ecology Project team or contractor will identify a location for the job trailer and arrange for delivery, power, security, telephone, portable toilet, including service contract and other essential services.

The contractor will have backfill and topsoil sampled and analyzed in accordance with the Quality Assurance Project Plan (Appendix A) to ensure the proposed sources comply with the imported materials criteria. The results will be provided to Ecology for review prior to placement of these materials.

The property owner will be notified several days in advance of the beginning of the work on their property to schedule an appointment for a site walk with the contractor. During the site walk, the owner or owner's representative, Ecology, and the contractor will discuss all details of the cleanup agreement, including depths of excavation, and coordination of other work planned by the owner.

Immediately prior to beginning work, utility locations will be marked and hand excavated to verify location and depth at several places in the yard. Fences will be removed where necessary. Soil or other protective cover will be placed over sidewalks or other features that must be crossed by equipment. Shrubs or plants to be saved for replanting will be removed prior to work commencing in that portion of the yard.

Removal Operations

Cleanup activities generally will address lawn areas, landscaped areas, garden areas, unpaved areas, parking areas, and roadway shoulders. Removal activities, in general, will not address soil within residential areas that are covered by existing structures or hard surfaces, e.g. concrete pads, patios, sidewalks, driveways. Some sidewalks will be removed and replaced where it will allow for a more efficient removal of contaminated

soil. Provisions will be made to address large trees and shrubs where excavation cannot be accomplished without damaging the roots. Trees with a trunk circumference smaller than 19 inches (diameter < 6 inches), measured 36 inches above the ground, will be removed with the property owner's permission.

Selected ornamental or fruit trees with a trunk circumference larger than 19 inches, measured 36 inches above the ground, property owner may, on a property specific basis, be removed with the property owner's permission to allow soil removal. Such trees will be replaced after backfilling. If stumps from larger trees are encountered, Ecology's remediation contractor will remove them to allow complete soil removal.

If appropriate on a property-specific basis, provisions may include containment without excavation or by other methods acceptable to the property owner and Ecology. This is an acceptable solution so long as the final arsenic concentration at depth meets the requirements of the FCAP/FEIS (Ecology, 1999, Figure 6-7). Provisions will be made to remove and replant, replace, and otherwise address plants of special concern to the property owner.

If a home heating oil tank is uncovered during the remediation of a property, it will be addressed as provided in Appendix C.

Utilities encountered at depths within the scope of excavation will be hand excavated. Where interruptions to any services occur as a result of removal activities, utility companies will be contacted as soon as possible to aid in rapid re-establishment of services. Contractors will be required to have contingency plans to restore service interruptions rapidly.

Excavation around shrubs and tree roots will be done by a combination of equipment and handwork to remove as much soil as practical without undue damage to the root system. This will generally result in a tapering excavation from the trunk of the tree or shrub outward following the root mass growth. The smaller shrubs can be removed if required for excavation but removal will be avoided as much as possible to maintain plant vigor and ensure continued growth after work is complete. Once excavation around plants is completed, backfill will be initiated as soon as possible with replacement soil and moistened to reduce plant stress.

Sprinkler systems encountered will be either excavated by hand or removed and disposed with other inorganic debris. Generally the sprinkler heads will be removed and saved along with major components such as manifolds, valves and controllers. The pipe will be removed and disposed. Upon backfill the pipe will be replaced and the components re-installed.

Fences will generally be removed, salvaged, and replaced upon completion of backfill. Where feasible to leave in place during excavation, handwork around posts, etc. will be done to maintain fence stability and to prevent damage.

Existing decks shall remain in place and excavation will be done beneath and around the decks unless the existing deck impedes soil removal. If existing decks impede soil removal, the deck may remain in place, but must be enclosed to prevent access by animals beneath the deck. Closure shall be sufficient to prevent entry by rats, in a manner consistent with standard rat-proofing techniques for buildings (See Table 2) or as otherwise approved by Ecology and the Snohomish Health District. If a property owner desires soil beneath a deck to be remediated, the property owner must remove the deck to allow access.

Table 2: Standard Rat-Proofing Techniques.

Standard rat-proofing techniques are described in *Rats – Let's Get Rid of Them*, published by the Snohomish Health Department. For this cleanup, the approach is to build them out. Techniques for doing this are to close openings with ¼-inch wire mesh (hardware cloth), concrete, or sheet metal. Cover all edges subject to gnawing with sheet metal or hardware cloth. Cover unnecessary openings with concrete or sheet metal. Fit pieces of sheet metal around pipes to make a collar through which rodents cannot gnaw.

Debris piles and other similar impediments to soil remediation will be moved and soil exceeding remediation levels will be removed, replaced and contained, as appropriate.

Garden and flower bed soils will be excavated to a depth of 18 inches and topsoil will be placed loose and left uncompacted.

Trees and shrubs that are removed during soil excavation will be replaced in kind with new, immature plants according to the site plan. Property owners wishing different species of vegetation may express that during development of the property-specific cleanup plan for their property.

Exposed tree roots will be covered with backfill as soon as possible. Tree roots that must be left exposed overnight will be covered with wet burlap to reduce desiccation. Walkways, sidewalks, and driveways may be removed to promote construction efficiency. Fences or other decorative or aesthetic structures removed for excavation will be replaced in accordance with the site plan.

Areas under large trees often will not support lawn grasses and may be left bare with a cover agreed upon between the property owner and Ecology. This may be bark, gravel, sand, or other material.

Maintenance areas not normally occupied where arsenic in soil, dust or other materials or solid waste which humans or animals may contact exceeds an average concentration of 20 mg/Kg or a maximum concentration of 40 mg/Kg must be addressed by having

institutional controls, such as a placard, which advise people of the hazards of entry and provide information on appropriate protective measures to take upon entry. In addition, the maintenance area must be sealed to prevent entry of animals including rats. All maintenance areas not normally occupied containing soil or dust exceeding 200 mg/Kg arsenic will have the soil contained or removed in some manner, such as by placement of a durable plastic barrier and/or application of materials to the soil surface which will prevent dust generation during work activities. Maintenance areas not normally occupied will be thoroughly cleaned of dust unless site-specific studies demonstrate that dust does not pose a hazard to exposed individuals during activities that will occur in the maintenance areas not normally occupied.

Soil removal and replacement activities will be conducted to minimize, to the extent possible, damage to site property. Any other features such as streets, roads, sidewalks, or utilities will be repaired or replaced upon determination that the damage was caused by remediation efforts.

If sampling indicates the underlying soil has an average arsenic concentration above the cleanup level of 20 mg/Kg or a maximum arsenic concentration exceeding 40 mg/Kg, a permanent marker material (durable, permeable geofabric or gravel) will be placed at the bottom of the excavation.

Best management practices are to be used to prevent erosion during soil removal and subsequent backfilling.

Back-filling and Restoration

Once an excavation has been completed, it will be back-filled with clean soil to approximately the grade that existed prior to construction. Landscaping will be installed to prevent erosion, subject to the approval of the Project Manager. Backfill and topsoil materials must be suitable for use and must meet the requirements for Imported Soil discussed under Performance Monitoring. The backfill and topsoil must not have concentrations of any hazardous substance exceeding the greater of MTCA Method A concentrations, MTCA Method B concentrations, or concentrations set for the Upland Area of the Everett Smelter Site; have engineering, drainage, and agricultural characteristics suitable for its intended use; and come from a source approved by Ecology.

Replacement backfill must be a sandy, freely draining material. Soil used for topsoil must meet Washington State Department of Transportation specifications for Type “A” topsoil (1991 Standard Specifications). Suitability criteria for replacement soil are shown in Table 3 and Figure 3. The range of parameters shown generally include the soil loam classification with desirable ranges of pH, water holding capacity, and other parameters that provide the best medium for plant growth. Well-developed topsoils are typically in the parameter ranges shown. These parameters are not intended to be site-specific, but instead are a general guide for a suitable replacement source that has the textural qualities associated with good productive topsoil (parameters taken from Hydrometrics, 1994).

These parameters may be adjusted as appropriate as the cleanup proceeds.

Table 3: Replacement Soil Parameters.

Parameter	Specification	
	Topsoil	Backfill
Texture	See textural triangle, Figure ***	100% passing ½-inch diameter
Rock fragments	Particles > 2mm constitutes < 20% of sample	Not applicable
Available water holding capacity	> 1 inch/foot	Not applicable
Saturation percentage	25%-85%	Not applicable
PH	5.5 < pH , 7.5	5.5 < pH , 7.5
Electrical conductivity	< 2 μmhos/cm	Not applicable
Sodium adsorption ration	10	Not applicable

Areas previously planted with grass will be restored with sod in accordance with the site plan. Other areas such as vacant lots and road slopes may be re-seeded with a vegetative cover suitable for the site conditions and land use. The vegetative cover type will be specified in the site plans.

Conclusion of Property Cleanup

Once a property has been cleaned up, the owner or occupants will be provided with information on property-specific measures necessary to maintain the cleanup. These items may include suggestions for care and maintenance of their newly installed lawns and a list of applicable institutional controls.

At the conclusion of remediation of a property, the resident will be provided an opportunity to have their carpets shampooed and air ducts cleaned whenever such actions are determined to be appropriate. Carpet cleaning and duct vacuuming services will be contracted for this work and the resident provided vouchers valid for some time period. It will then be the residents' responsibility to arrange for the cleaning, if they so choose, within that time period and to coordinate with the cleaning contractor.

Institutional controls will provide for maintenance of the containment barrier of clean soil and any remedial actions for trees and prize plants and will provide that redevelopment of the site or other construction work will, when completed, leave accessible soils with the required contaminant concentration profile. Institutional controls will use zoning overlays, notices in local zoning or building department records or state lands records, other public notices, permitting overlays, and educational mailings.

For each property where cleanup has occurred, Ecology or its contractor will prepare a Property Notebook. The property notebooks will contain the initial sampling data, site maps, specifications for how cleanup was be conducted and documentation of the actual cleanup which the owner can use in real estate disclosures and damaged-property claims to the tax assessor. The notebook will also address any maintenance requirements for the cleanup actions and will reference the *Institutional Controls Manual*. Other information will be included as appropriate.

Field Oversight

An Ecology field representative will be on site throughout the project. The field representative will oversee contractor activities and coordinate with owners of properties being cleaned up. Appendix D provides a field oversight checklist of tasks that Ecology staff may be called upon to perform.

Management and Disposal of Waste Materials

All waste materials will be disposed of at a properly permitted facility. The contractor will submit an Excavation Plan to Ecology for approval. The plan must include methods, equipment, procedures, and sequences of excavation operations and methods for loading the waste material for shipment to the planned disposal site. The sampling done to characterize the soils on each property and determine what, if any, soil need to be removed will be used to characterize the soils for disposal. Based on previous sampling and analysis of the data, the concentrations of arsenic, lead and other metals are not expected to designate as Dangerous Waste as defined by Chapter 173-303 WAC. The materials will generally be classified as “problem waste” suitable for disposal in a solid waste landfill whose permit conditions permit acceptance of such waste.

No soil is to be stockpiled on City of Everett rights-of-way.

Control of Hazardous Materials Spills and Accidental Discharges

Soil removal in residential yards and public areas will result in unavoidable short-term impacts to the community. Expected impacts include fugitive dust at removal sites, soil spills during transport, and erosion of exposed soils. All work will be conducted in a manner to minimize potential impacts.

The primary method of spill control is the proper loading and covering of the excavated material. Equipment will be cleaned prior to leaving the work area. Visible dirt

accumulations will be removed from vehicles and tires prior to traveling on the street, even within the work area.

All haul trucks containing excavated soils will be covered by a tarp while being transported. Trucks will be inspected for loose soil and any loose soil will be removed from the truck prior to leaving the loading area. Any soil swept up during this process will be placed on the truck or in an area that is next to be loaded. No soil may be tracked onto City of Everett rights-of-way or other streets or alleys. If necessary, the remediation contractor will set up a wheel wash.

The construction foreman will be notified of any substantial spills and a report made to include actions necessary to prevent further occurrences. In addition, work activities will not be conducted during periods of excessive precipitation in order to reduce potential transport of mud off-site by haul truck and other working vehicles.

No visible dust will be allowed. Dust suppression mist sprays will be used to minimize the potential for fugitive dust emissions. Application rates will be regulated to control dust during excavation, yet not result in development of mud. The objective is to minimize production of mud that could be transported off-site by haul trucks and other equipment. Outdoor faucets and hydrants from private residents and public areas will be used as water supply sources. Ecology will coordinate with residents regarding water use.

Site drainage and erosion control measures will be taken at each site to prevent the inadvertent discharge of soils to surface water during excavation activities. Best management practices will be used to prevent offsite erosion. The remediation area has an established surface water drainage system consisting of curbs, gutters, storm drainage inlets, and street drainage features. This drainage system will be maintained during work. Visual inspection of the existing storm system and natural drainage flows will be performed as a routine part of the work throughout the work area. During severe weather, preventive actions, such as covering bare soil with plastic, may be required. Such items as filter fabric or quarry spall check dams, cleaning of catch basins, or other actions will be undertaken when necessary to prevent damage to the existing system. Soil and stormwater runoff will be kept in the individual work sites during excavation through maintenance of a berm at the work site. The berm will be constructed of native soil or imported subsoil and will be placed across the natural drainage channels at the site to contain the water on-site. The drainage pattern at each site prior to remediation will be maintained or improved during back-filling and landscaping. Where practical and cost-effective, drainage may be altered to improve protection of property and reduce potential erosion and off-site water damage to other properties.

Health and Safety

All operations will be conducted following all appropriate OSHA rules and the requirements of Chapter 296-62 WAC, General Occupational Health Standards. Each

contractor and subcontractor working at the Site is required to have a Health and Safety Plan that covers their employees.

The contractor shall provide measures as necessary and in accordance with the Manual of Uniform Traffic Control Devices (23 CFT Part 655, Subpart F; See also http://mutcd.fhwa.dot.gov/kno-overview.htm) requirements to provide adequate control for site work which may affect vehicle or pedestrian traffic.

Compliance Monitoring

Protection Monitoring

Site specific air quality monitoring will be conducted during construction activities. In general, peripheral ambient air sampling will be conducted periodically to verify the adequacy of dust control measures. Personal air samplers will also be worn by representative individuals of the removal team to monitor air quality conditions inside excavation equipment cabs and to provide data on the breathing zone or remedial team workers. If site specific monitoring suggests ambient air arsenic concentrations at the boundary of the work area are higher than the action level of 0.2 ug/m^3, or, for workers, are higher than Permissible Exposure Limit (PEL) for arsenic (10 ug/m3), dust suppression methods in use at excavation sites will be enhanced to reduce ambient air arsenic concentrations below the above concentrations.

Performance Monitoring

Requirements for performance monitoring are described in the FCAP/FEIS (Ecology, 1999, Chapter 7). For soil in the Peripheral Area, performance monitoring schemes are described for residential properties, public areas, and rights-of-way. There is a description of boundary sampling to establish a final site boundary.

Further details regarding performance monitoring for cleanup of soils at properties in the Peripheral Area are contained in Appendix A, Quality Assurance Project Plan. Field sampling plans will be developed for each portion of the Everett Smelter Site as that portion of the site is addressed.

Confirmational Monitoring

Detailed confirmational monitoring plans will be developed to confirm the long-term effectiveness of the cleanup action. With respect to property cleanup in the Peripheral Area, confirmational monitoring will evaluate soil quality over time by re-sampling selected properties during 5-year periodic reviews of the cleanup action as described in the FCAP/FEIS (Ecology, 1999, Section 6.7.10).

Public Participation

Each year a Public Participation Plan will be developed that describes public outreach activities that will be undertaken for cleanup operations that year. The Public Participation Plan for the year 2000 may be used as a guide for future plans.

Construction Documentation

Property Notebooks

For each property where cleanup has occurred, Ecology or its contractor will prepare a Property Notebook. The property notebooks will contain a summary of the information collected on the property such as initial sampling data, provide a brief explanation in lay-terms of what needed to be done, site maps, and documentation of the actual cleanup which the owner can use in real estate disclosures and damaged-property claims to the tax assessor. The notebook will also address any maintenance requirements for the cleanup actions and will reference the *Institutional Controls Manual.*

At the beginning of cleanup a Property notebook will be provided to the property owner and added to throughout the cleanup. One copy will be placed in Central Records at Ecology's Northwest Regional Office and one copy will be given to the Snohomish Health District. Additional copies will be placed in appropriate repositories.

The elements of the notebook are given in Appendix E.

Other Construction Documentation

Other construction documentation will be developed as appropriate to the cleanup actions being conducted. This documentation will be placed in the file with other project control documents in chronological order.

Operations and Maintenance Plan

Instructions to Property Owners

Operations and maintenance requirements for cleaned-up properties will be described in a brochure prepared each year. The brochure will be provided to each property owner at the conclusion of cleanup. The brochure will include instructions to property owners for lawn car after re-landscaping and other necessary instructions as identified on a property-specific basis.

Follow-up Work

In general, no long-term operations and maintenance is anticipated to be required for cleaned up soil areas. Ecology staff will follow up at cleaned properties where conditions are identified requiring maintenance.

References

Ecology, 1999, Everett Smelter Site, Everett, Washington, Integrated Final Cleanup Action Plan and Final Environmental Impact Statement for the Upland Area: Washington State Department of Ecology, Bellevue, Washington.

Hydrometrics, 1994, Revised Work Plan for Excavation and Removal of Soils, Ruston and North Tacoma, Washington: Hydrometrics, Inc., Tacoma, Washington.

Appendix A – Quality Assurance Project Plan

Quality Assurance Project Plan

for
Peripheral Area Sampling Program
Everett Smelter Site
Everett, Washington

June 26, 2000

Prepared for:
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Table of Contents

QUALITY ASSURANCE PROJECT PLAN
Peripheral Area Property Sampling Program
Everett Smelter Site Peripheral Area
Everett, Washington
Washington Department of Ecology
Work Assignment No. SAI012, Contract No. C9800045

June 12, 2000

1.0 PURPOSE

This Quality Assurance Project Plan (QAPP) has been developed for the sampling and analysis that will be carried out in the Peripheral Area of the Everett Smelter Site in Everett, Washington. This QAPP is to be used in conjunction with two other project plans developed for this project: a field sampling plan (Attachment A) and a health and safety plan (Attachment B).

The Everett Smelter Site is contaminated by arsenic, lead and other metals. The sampling and analysis project governed by this QAPP will provide chemical data needed to support soil removal and other cleanup activities at properties within the Peripheral Area of the site.

1.1 Project Objectives

The Peripheral Area Sampling Program includes four general categories of sampling activities with differing objectives. The objectives for each category are discussed in the following subsections.

Decision Unit Sampling

At each property, the outdoor areas with accessible soils will be divided into two or more decision unit (DU) areas for sampling and remediation purposes. Accessible soils are those not covered by buildings, pavement, or landscaping that the property-owner does not want disturbed. Surface and subsurface soil samples will be collected from DUs at each property. The DU samples will be analyzed for arsenic to provide data needed to implement remedial actions at the properties in accordance with the FCAP/FEIS (Ecology 1999). This sampling is part of the performance monitoring requirements described in the FCAP/FEIS. The data will serve two main objectives: (1) determination of which soils are to remain in place and which soils are to be removed from the site, and (2) characterization of those soils that are to be left in place that may still have concentrations above the site cleanup levels established for the site.

Landscape Unit Sampling

At each property, outdoor areas covered by landscaping that the property-owner does not want disturbed will be divided into one or more landscape areas (LAs) for sampling and remediation purposes. Surface and near-surface soil samples will be collected from each LA to a depth of two (2) feet.

The LA samples will be analyzed for arsenic to provide data to characterize soils that the property-owner prefers to leave in place in landscaped areas.

Sitework Sampling

Site-work sampling will include three types of samples that will be analyzed to provide data in support of the earth-moving, or site-work, activity that will occur at properties where soil removal will be needed. These samples are manifest samples, backfill samples, and topsoil samples.

The manifest samples will provide data needed to characterize soil being removed from the property for manifesting purposes and allowing acceptance by the landfill where the soil will be disposed. The manifest samples will consist of one composite sample per property that represents the soils in all layers of all DUs and LAs subject to soil removal. The manifest samples will be analyzed for pH and Toxicity Characteristic Leachate Procedure (TCLP) metals.

The backfill and topsoil samples will provide data to verify that material imported to the properties (to replace the soils that will be removed) is free of contamination. The backfill samples will be analyzed for priority pollutant metals and the topsoil samples will be analyzed for priority pollutant metals, organics, and cyanide, with results compared to MTCA cleanup levels. This sampling will include analysis of several samples of topsoil and backfill materials prior to commencement of site work to identify acceptable sources of materials, and analysis of about one sample of each type per month subsequently as a QC spot-check on the material being supplied.

Maintenance Areas Not Normally Occupied (MANNO)

Surface soil sampling will be conducted in maintenance areas not normally occupied (MANNO). Four surface soil samples will be collected from each MANNO at each property. A composited sample will be prepared for each MANNO and analyzed for arsenic to provide data needed to implement remedial actions at the property in accordance with the FCAP/FEIS (Ecology 1999). This sampling is part of the performance monitoring requirements described in the FCAP/FEIS. The data will serve two objectives: (1) determination of which MANNO will need to be subject to institutional controls discussed in the FCAP/FEIS, and (2) characterization of the soils that will be left in place that may still have concentrations above the site cleanup levels.

1.2 Sampling Design and Expected Schedule

As discussed above, the Peripheral Area Sampling Program includes four general categories of sampling activities. The overall sampling design and schedule planned for each category are discussed in the following subsections.

Decision Unit Sampling

DU soil samples will be collected from 6-inch vertical increments at multiple boring locations per property. The samples will be collected up to a depth of 4 feet in Zone A, 3 feet in Zone B, 2 feet in Zone C or to refusal by the drilling equipment if dense till is encountered at shallower depth. The sampling locations will be in accordance with the performance monitoring strategy

described in Section 7 of the FCAP/FEIS (Ecology 1999). In general, the strategy calls for the surface area at each property to be divided into two or more DUs, and each DU to have from 5 to 12 boring locations. A separate soil removal decision, based on criteria listed in the FCAP/FEIS, will be made for each 6-inch soil layer within each decision unit. The discrete samples from each decision unit layer will be composited for quick-turnaround arsenic analysis. The decision of whether to remove a particular layer will be made based on the results for the composite sample, if these results clearly show the soil removal criteria to be either satisfied or not satisfied. If the results of the composite do not clearly show whether the soil layer should be removed, the corresponding discrete samples will be analyzed. For soil layers that will remain at the site, the discrete samples will also be analyzed if the corresponding composite does not clearly show whether the layer meets the cleanup levels established for the site.

All of the composite samples from the deepest sample horizons (i.e., below the 12-inch depth) will be delivered to the laboratory for arsenic analysis. If these results show that a deep layer will need to be excavated and removed, then there will be no need to analyze the samples for the uppermost layers, because these layers will also need to be excavated and removed to provide access to the deeper layers. If the composite results for the deeper layers do not clearly show that one of the deeper layers must be excavated, then the composites for the upper 2 sample layers will be submitted to the laboratory for arsenic analysis. The results for the composite soil samples will be used to determine whether the corresponding discrete soil samples need to be analyzed. The actual number of discrete soil analyses cannot be determined in advance, since it will depend on field geologic conditions and the laboratory results for the composite samples. The discrete samples will be analyzed for arsenic as soon as possible after receiving the preliminary analytical results for the corresponding composite samples. Field duplicate (soil) samples will be submitted for arsenic analysis at a rate of approximately 5% of the environmental samples analyzed. Equipment rinse (water) samples will also be collected during the program, and will be analyzed for arsenic.

Landscape Area Sampling

LA soil samples will be collected from 6-inch vertical increments at multiple boring locations per property. The samples will be collected up to a depth of 2 feet or to refusal by the sampling device if dense till is encountered at shallower depth. The number of LAs will be determined by Ecology on a case-by-case basis, but an average of approximately 3 LAs is expected per property, with an average of approximately 3 borings per LA. Each discrete sample from each LA will be analyzed for arsenic (LA samples will not be composited).

The actual number of samples collected will depend on field geologic conditions that are not fully known. All collected LA discretes will be submitted for arsenic analysis. Field duplicate (soil) samples will be submitted for arsenic analysis at a rate of approximately 5% of the environmental samples analyzed. Equipment rinse (water) samples will also be collected during the program, and will be analyzed for arsenic.

Site-work Sampling

The manifest composite samples will be prepared by the laboratory from written instructions provided by the contractor once all results from the DU samples are available for a particular

property. Each manifest composite will consist of equal aliquots of the composite samples that were collected previously for arsenic analysis and held in archived storage at the laboratory—for those soil layers and DUs that will be excavated and removed from the property. The instructions for compositing and request for analysis of the manifest composite samples will be sent to the laboratory as soon as feasible after receiving all analytical results for the DU samples for the property. Hence, the manifest composites are expected to occur periodically as the property DU sampling is completed. Approximately one manifest composite will need to be prepared for analysis per property. Each manifest sample will be analyzed for pH and TCLP metals as defined in Section 5.

Approximately three backfill samples will be collected prior to commencing sitework, with one sample per month subsequently during sitework activities. The initial samples are expected to be collected as soon as practicable before starting sitework to ensure the backfill to be used is suitable, with subsequent monthly samples through the completion of site work. The backfill samples will be analyzed for priority pollutant metals as defined in Section 5.

Approximately three topsoil samples will be collected prior to commencing sitework, with one sample per month subsequently during sitework activities (7 total samples expected). The initial samples are expected to be collected as soon as practicable before starting sitework to ensure the topsoil to be used is suitable, with subsequent monthly samples through the completion of site work. The topsoil samples will be analyzed for priority pollutant metals, organics, and cyanides as defined in Section 5.

Maintenance Areas Not Normally Occupied (MANNO)

Surface soil samples (upper 2 inches of soil at ground surface) will be collected from the MANNO of each property. Four discrete samples will be collected at each MANNO at each property, composited, and the composites submitted to the laboratory for arsenic analysis.

Field duplicate (soil) samples will be submitted for arsenic analysis at a rate of approximately 5% of the environmental samples analyzed. Equipment rinse (water) samples will also be collected during the program, and will be analyzed for arsenic.

2.0 DATA QUALITY OBJECTIVES

Chemical results for environmental samples are only estimates of the true values of the parameters measured. These estimates are affected by variability in the medium sampled and by random and systematic errors introduced by the sampling and measurement processes.

Data quality objectives (DQOs) are qualitative or quantitative statements of the precision, accuracy (or bias), representativeness, completeness, and comparability necessary for the data to serve the objectives of the project. The DQOs for these parameters selected for this project are defined in the following subsections. The quantitative aspects of the DQOs are summarized in Table 3-1 along with the reporting limit objectives for the project. Specific laboratory control limit requirements for this project are listed in Appendix A. These objectives define data quality that will be adequate to serve the performance monitoring purposes for which the data will be used in remediation of the properties under MTCA. The DQOs discussed herein have been

developed as objectives for the environmental samples to be collected at the properties; they will not be used as objectives for the sitework sampling described in Section 1.2.

2.1 Precision

Precision is a measure of the reproducibility of an analytical result (i.e., the ability to obtain the same or similar results on replicate measurements of the same sample or of duplicate samples). Matrix variations, sample preparation procedures, and the analytical method affect reproducibility. Precision is measured by the variability in results between replicate analyses (e.g., the relative percent difference between duplicates).

Field precision will be assessed through the analysis of duplicate field samples collected from a particular sampling point. A minimum of one duplicate per twenty samples will be collected. The DQO for the field duplicates will be a relative percent difference (RPD) no greater than ± 50% for each target element in the samples.

Laboratory precision will be evaluated by analysis of laboratory duplicates. Analysis and comparison of laboratory duplicates will evaluate laboratory precision within an analytical data group (batch). Laboratory duplicates will be analyzed for one sample in twenty (i.e., 5%) or one per batch of samples analyzed, whichever is more frequent. Target laboratory precision objectives for laboratory duplicates, expressed as RPD, are 20% for each sample and element.

These objectives are consistent with levels of precision normally achievable by the standard EPA methods selected for this project. Duplicates with RPD values in excess of these control limits may be indicate a lack of precision resulting from sampling or analysis techniques, and the results should be evaluated accordingly. In these cases, the usability of the data for decision-making will include consideration of the difference between the concentrations in the samples and the corresponding decision criteria.

2.2 Accuracy

Accuracy is defined as how close a measured parameter is to its true value. The accuracy of a measurement is affected by a combination of random error (precision, as discussed above) and systematic error (bias). Potential sources of bias include imperfect sample collection methods (such as equipment cleaning), chemical instability of the samples, and interferences (matrix effects).

The potential for introducing bias will be minimized by adherence to established procedures for collection, preservation, transportation, and storage of samples (Section 4). Analysis of equipment rinsate samples will be used as a check on potential bias from sample handling during collection and handling (compositing) prior to receipt by the laboratory. Equipment rinsate samples, consisting of deionized water rinsates of sampling and compositing equipment, will be analyzed to indicate potential sample contamination from contaminated sample handling equipment. Positive contamination from sampling equipment would indicate a potential high bias to associated data. The types and frequencies of equipment rinsates are discussed in Section 3.

Bias due to sample matrix effects will be assessed by spiking a sample with target elements of known concentration and calculating the percent recovery. In addition, analytical bias will be assessed by analyzing a standard reference material (SRM) and calculating the percent difference between the measured value and the known value of the standard. SRMs are purchased samples with certified, known concentrations. If a suitable SRM is not available at the start of this project, a performance evaluation (PE) sample will be substituted for the SRM. In this event, references to SRM and control requirements throughout this QAPP will be interpreted as PE sample analysis and control requirements, and the use of PE samples will be as follows:

> The PE sample will be analyzed with each analytical batch of samples, and the results of the analysis must be within the performance acceptance limits, as published by the supplier of the PE sample, that correspond to the digestion procedure used by the laboratory. The acceptance limits for the PE sample will not be known in advance by the laboratory. The laboratory will call the contractor's project manager or designated project QA officer with the PE results for the first batch, to determine whether the acceptance limits were met. If PE sample results are outside the acceptance limits, the first course of corrective action will be reanalysis of the PE sample and associated samples and QC (no redigestion). If, upon reanalysis, the PE sample results are still not within the acceptance limits, the entire analytical batch, including a new aliquot of the PE sample, all associated samples, and all QC samples, will be redigested and reanalyzed. For subsequent batches, in cases where an analytical batch of samples must be redigested and reanalyzed, the laboratory must notify the SAIC or designated project QA officer within 24 hours.

Matrix spike samples and SRMs will be analyzed for no less than one sample in twenty (i.e., 5%) of samples or one per batch analyzed, whichever is more frequent. Target laboratory accuracy objectives for matrix spike recoveries, expressed as percent recovery of the known spike amount, are 75% to 125% for each sample and element. Target laboratory accuracy objectives for SRM results, expressed as percent difference between the measured and known amounts, are ± 35% for each sample and element.

Laboratory accuracy (as bias) will also be assessed by analysis of procedure (method) blank samples. A method blank sample is an aliquot of a known clean soil, sand, or deionized water sample that is prepared, digested, and analyzed along with an analytical batch of samples. The method blanks are analyzed to indicate potential sample contamination from contaminated laboratory equipment. Positive contamination from laboratory equipment would indicate a potential high bias to associated data. At least one method blank sample will be prepared and analyzed along with each analytical data group (batch).

2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, element variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. The representativeness criterion is best satisfied by making certain that sampling locations are selected properly and a sufficient number of samples are collected. The samples for this project will be collected in accordance with the sampling strategy specified in the FCAP/FEIS for the site. The strategy has been developed to provide adequate locations and numbers of samples to meet the performance monitoring requirements of MTCA

and provide data that are representative of the conditions within the remediation area. The details and rationale of the strategy are given in the FCAP/FEIS (Ecology 1999).

2.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions. Comparability will be maintained by employing an Ecology-accredited laboratory, use of EPA-approved analytical methods, consistent reporting limits, and consistent units. Comparability is affected by the other DQO parameters because only when precision and accuracy are known can data sets be compared with confidence.

2.5 Completeness

Completeness is a measure of the amount of valid data obtained from a sampling and analysis program, expressed as a percentage of the number of valid measurements that should have been obtained. In general, completeness can be impacted by the number of field samples collected as opposed to the number planned, as well as by the number of valid analytical measurements obtained as compared to the number requested. For this project, it is planned to collect a soil sample from each 6-inch vertical layer of soil at each boring location to a specified depth below ground surface, unless dense till is encountered and refusal (by the drilling equipment or sampling device) occurs at a shallower depth. Since the potential for shallow till is significant, the number of planned samples cannot be determined in advance, and therefore specifying a sampling completeness goal in this QAPP is not appropriate.

For analytical measurements, the target overall completeness objective for this project is 90%. This DQO is intended for those discrete samples that need to be submitted for analysis after evaluating the results of their corresponding composite sample result. For the composite samples, the completeness objective is 100%. Each composite sample is considered a critical sample, because it will be used to represent an entire soil horizon (i.e., layer) within a particular soil decision unit, and a valid result will be needed to decide whether each soil layer should remain or be removed from the site, and/or be subject to institutional controls. If the data validation process determines a result for a composite sample is not usable for its intended purpose, the Department of Ecology will be notified so that a decision can be made regarding whether to reanalyze the archived sample or the associated discrete samples.

3.0 SAMPLING PROCEDURES

The procedures that will be followed for collection, preservation, transportation, and storage of the soil samples and associated field QC samples are described in the project field sampling plan. This includes procedures for sample custody and chain of custody documentation, and for recording field and sample handling data in field notebooks and on field data forms. The sample identification scheme is described in Appendix B. Sampling container and preservation information is summarized in Table 3-1.

The field QC sampling will include field duplicates (splits) of the soil samples at a rate of approximately one per twenty environmental samples collected. This rate applies to both the

discrete and composite samples. In addition, two types of equipment rinsates will be collected: (1) rinses of unused PVC geoprobe sampling tubes at a rate of approximately five percent of the tubes as delivered to the field and (2) rinses of the soil sample compositing equipment after decontamination at a rate of one rinsate every two days.

4.0 ANALYTICAL PROCEDURES

4.1 Procedures for Environmental Samples from Properties

The following subsections discuss analytical procedures for the environmental samples that will be collected from the properties. This includes the DU samples, the LU samples and the MANNO samples described in Section 1.2.

Analytical Scheme

As discussed in Section 1.3, the sampling and analysis program includes arsenic analysis of various composite soil samples that represent conditions for particular soil horizons (layers of soil) within specific DUs at each property. Most of the composite sample analyses will be analyzed prior to analyzing any of the corresponding discrete samples, in order to serve as a screening step to determine whether the discrete samples associated with the composite sample actually need to be analyzed. Many of the discrete samples, should they need to be analyzed, will require less rigorous detection limits for arsenic than the composite samples, and hence different analytical methods are appropriate.

The composite samples may need to be analyzed with a quick turnaround time (e.g., 72-hr) in order to meet Ecology's schedule requirements, while most of the discrete samples can be analyzed with a more relaxed turnaround time (e.g., 14-day) without an adverse effect on the schedule. Initially, all composite samples will be submitted for quick turnaround analysis and all discrete samples will be submitted for 14-day turnaround time analysis. After DU sampling has been completed for several properties, the project manager for Ecology's contractor will evaluate and adjust the turnaround times and analysis requests as needed to meet the schedule and sampling objectives while saving analytical cost to the extent feasible.

The following subsection describes analytical methods that can achieve the data quality objectives and that will be considered for the property environmental samples for this project. The actual methods used for analysis will be selected based on the most cost-effective approach from assessment of competitive bids from three or more Ecology-certified laboratories.

Analytical Methods

The required analytical methods and detection limits are listed in Table 5-1. The soil samples will be prepared using either a hot plate digestion technique (EPA SW 846 Method 3050B) or a microwave digestion technique (EPA SW 846 Method 3051A). Arsenic in the soil samples will be analyzed by inductively coupled plasma (ICP) atomic emission spectroscopy, ICP-Trace, (a method similar to ICP that can achieve lower detection limits), ICP mass spectrometry (ICP-MS), or graphite furnace atomic absorption spectroscopy (GFAA), as described in the 6000 and 7000 series methods of EPA SW-846. It is anticipated that ICP may be satisfactory for analysis

of arsenic in many of the discrete samples, while one of the other methods will be necessary for meeting the reporting limits for analyzing arsenic in most or all of the composite samples. As stated above, the actual method(s) used will be based on cost-effectiveness from competitive laboratory bids.

There are several quality control (QC) elements and acceptance limits which will supersede the standard method requirements; these are listed in Appendix A (Required Quality Control Elements and Acceptance Limits). These include analysis of a standard reference material (SRM), which will be prepared and analyzed with each analytical batch of samples. The SRM will provide a measure of accuracy, as well as batch to batch precision and comparability.

The target reporting limits will be greater than the laboratory MDL and will be reported on a dry weight basis. The percent moisture determination will be performed and reported for all soil samples using the EPA CLP ILMO4.0 method or equivalent. A duplicate moisture analysis must be performed at a frequency of at least one per batch or twenty samples, whichever is more frequent. The relative percent difference (RPD) shall not exceed 20%, or the percent moisture determination of the samples in that batch will need to be redone.

The water samples from the field QC equipment rinses will be analyzed for the same analyte as the soil samples (i.e., arsenic). The waters will be digested using either Method 3010A, 3015A, or 3020A of EPA SW 846, as appropriate, and analyzed using one of the methods mentioned previously (ICP is anticipated to be satisfactory, so the selected method for water analysis will depend on the prices received from the most cost-effective laboratory bid.)

Calibration Procedures

Each laboratory instrument used must be calibrated, prior to the analysis of samples, to establish the instrumental response to known standard concentrations. Stock standard solutions, from which working solutions are generated, must be traceable to national reference standards, and this traceability must be documented. Initial calibration curves must be analyzed at the initiation of each analytical sequence, every 24 hours, or as necessitated by corrective action processes. All subsequent sample measurements must be within the calibrated range of the instrument. The laboratory calibration procedures are specified in the appropriate analytical methods and the laboratory analytical standard operating procedures.

Continuing calibration verification (CCV) standards must be analyzed every ten analyses. Samples must be bracketed by acceptable CCVs. If a CCV result is not within the acceptance limits, the appropriate corrective action must be taken. If, following corrective action, continuing calibration criteria are still not met, a full multi-point initial calibration must be performed, and the associated samples reanalyzed with a new in-control continuing calibration. It is not acceptable to simply flag samples associated with an out-of-control calibration check standard without reanalysis.

General calibration procedures are described below.

- ***Calibration for Metals by ICP, ICP-Trace, and ICP/MS.*** An initial 2-point calibration curve will be established with each target analyte. An initial calibration verification (ICV) standard, from a source separate from that of the calibration standards, must be analyzed after initial calibration with a percent recovery between 90% and 110%. Continuing calibration solutions must be analyzed after every 10 samples and must have a percent recovery between 90% and 110%.

- ***Calibration for Metals by GFAA.*** An initial 4-point calibration curve will be established with each target analyte analyzed by GFAA. An ICV standard must be analyzed after initial calibration with a percent recovery between 90% and 110%. Continuing calibration solutions must be analyzed after every 10 samples and must have a percent recovery between 90% and 110%.

4.2 Procedures for Sitework Samples

This section discusses analytical procedures for the sitework samples that will be collected in support of the earth-moving remediation activities at the properties. This includes the manifest samples, the backfill samples, and the topsoil samples described in Section 1.2.

Manifest Samples

Approximately 20 manifest composite soil samples will need to be prepared by the laboratory for TCLP analysis during the program. The laboratory will analyze each such composite for TCLP metals and pH. The TCLP metals are arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

Analysis of each composite sample will be by the following standard EPA Methods:

- TCLP Extraction: SW846 Method 1311.
- Digestion: SW846 Method 3010A.
- Mercury analysis: SW 846 Method 7470A.
- Seven other metals analysis: SW 846 Method 6010B.
- pH analysis: SW 846 Method 9045C

The detection/reporting limits and DQOs for these methods are those listed for each method in SW 846 and in the laboratory's current quality assurance manual or SOP.

Backfill Samples

Backfill samples will be analyzed for total metals for the following analytes: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. Analysis will be by the following standard EPA Methods:

- Mercury analysis and digestion: SW 846 Method 7471A.
- Twelve other metals digestion/analysis: SW 846 Methods 3050B/6020A (ICP-MS). These metals are: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, and zinc.

For the analysis of arsenic, the detection/reporting limits and data quality objectives (DQOs) are the same as specified above for arsenic analysis of property environmental soil samples. For the remaining analytes, the detection/reporting limits and DQOs are those listed for each method in SW 846 and in the laboratory's current quality assurance manual or SOP.

Topsoil Samples

Approximately 7 topsoil will be analyzed for "priority pollutants," defined by the standard EPA Methods listed below:

- Mercury analysis and digestion: SW 846 Method 7471A (CVAA).
- Twelve other metals digestion/analysis: SW 846 Methods 3050B/6020A (ICP-MS). These metals are: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, and zinc.
- Volatile organic compounds (VOCs) digestion/analysis: SW 846 Methods 5030/8260.
- Semi-volatile organic compounds (SVOCs) digestion/analysis: SW 846 Methods 3550/8270.
- Chlorinated pesticides digestion/analysis: SW 846 Methods 3545/8081A.
- Polychlorinated biphenyls (PCBs) digestion/analysis: SW 846 Methods 3545/8082.
- Cyanide digestion/analysis: SW 846 Method 9010B.

For the analysis of arsenic, the detection/reporting limits and data quality objectives (DQOs) are the same as specified above for arsenic analysis of property environmental soil samples. For the remaining analytes, the detection/reporting limits and DQOs are those listed for each method in SW 846 and in the laboratory's current quality assurance manual or SOP. The target analytes for VOCs, SVOCs, chlorinated pesticides, and PCBs are those listed in SW 846 for the methods specified above.

5.0 DATA REDUCTION, REVIEW, AND REPORTING

The process of data reduction, review, and reporting is applicable to all aspects of the project (field activities, laboratory analyses, analytical data validation) and is required for both project information and technical data. Project information (e.g., field logbooks, storage records, project tracking records) will be maintained to verify adherence to both field and laboratory protocols.

Technical data from field and laboratory analyses will be combined to characterize the contamination at the properties. Documented verification of these data is crucial. Consistent, documented data reduction techniques, for both hand calculations and computer analyses, and standardized technical data validation are equally important in the verification of the technical data.

The following sections describe the process of handling field and laboratory data in terms of data reduction, review, and reporting. The technical data validation process is described in Section 9.

5.1 Laboratory Data Review and Reporting

Data generated by the laboratory will be reviewed prior to their release. In-laboratory data reduction and review will be conducted by the laboratory in accordance with the review processes documented in its Quality Assurance Manual. At a minimum, the laboratory will perform the following levels of data review:

- Analytical level (bench level chemist).
- Data section level (laboratory section supervisor).
- Final quality review (laboratory project manager or laboratory QA officer).

Analytical data deliverables from the laboratory will include items listed in Appendix C (Laboratory Data Package Deliverables). Full data packages will be required for all analyses of environmental samples from the properties; abbreviated data packages will be used for the sitework samples. All data packages must be complete, legible and of sufficient quality to undergo evaluation by an independent, third party validator. Incomplete, illegible or unusable data packages will not be accepted, and will be returned to the laboratory for correction. Minor clarification and corrections to the data package, which are requested by the data validator, will be provided by the laboratory within three (3) calendar days of the request.

Completed data packages from the laboratory will include a narrative outlining any problems, corrections, anomalies, and conclusions, as well as chain-of-custody documentation. For the property environmental samples, the laboratory will also provide a copy of the data deliverables in electronic format (Section 6.3). All data package pages will be sequentially numbered.

5.2 Data Reduction And Review

Data reported by the laboratory and data collected in the field will be reduced by manual and computerized calculations. Procedures for ensuring the correctness of the data reduction process will include the following:

- Data will be reduced either manually on calculation sheets and field logbooks or by computer in spreadsheets or databases.
- Technical personnel will document and review their own work and are responsible for the correctness of the work.
- Calculations will be checked for methodology and accuracy, prior to use in reports, by an engineer or scientist of a professional level equal to or higher than that of the person who performed the calculation.
- The project QA officer will be responsible for ensuring that data reduction is performed in accordance with this QAPP.

5.3 Data Management

This section describes the procedures to be used to document and track chemical data. The objective of these procedures is to assure that all data collected during the project are processed and archived in a manner that assures data quality, security, and retrievability, thereby assuring information integrity. A microcomputer-based data management system will be used to store and track data from collection through reporting.

Maintaining data integrity involves all aspects of the project beginning with the collection of the first sample and continuing through data reporting of validated results. Three primary tasks will be carried out to ensure data integrity throughout the duration of the project: sample management, management of hardcopy forms of data, and electronic data management.

5.3.1 Sample Management

Sample management will involve monitoring and tracking of field samples through the chain-of-custody process and serving as a liaison between the sample collectors, the sample processors, and the analytical laboratory. The data manager will assure the following sample management tasks are conducted:

- Accurately tracking the transport of field sample materials to the analytical laboratory and the disposition of resulting analytical data.
- Keeping the laboratory informed of pending sample shipments to achieve the required turnaround times and avoid missing sample holding times.
- Confirming that all requested analysis have been performed and coordinating with the laboratory for any additional analyses.

5.3.2 Management of Hardcopy Data

Field data will be recorded in field log books and on standard forms. Field data that is pertinent for characterizing the contaminants at the properties will be reported to Ecology in a summary data report. Copies or originals of the field data will be sent to Ecology for appropriate long-term storage. Some of the laboratory data deliverables will be reported only in hardcopy format (i.e., an electronic format is not feasible for some deliverables). These laboratory deliverables will be stored and maintained in organized files until the data validation process and data reporting are completed, at which time all hardcopy materials will be sent to Ecology for appropriate storage pertinent to the Administrative Record for the Everett Smelter Site.

5.3.3 Electronic Data Management System

A microcomputer-based data management system will be used for this project to store the results of the laboratory chemical analyses and associated field information. These data will be stored in a database specifically created for this project using a relational database software program. The information compiled for the chemical analysis results will include:

- Station identification and sample identification.
- QA/QC sample identification and duplicate sample cross reference identification.
- Sample matrix.
- Analytical laboratory/analytical method.
- Dates of analysis and extraction.
- Constituents, results, units, QA qualifiers, and detection limits.
- Laboratory QC data: method blank, blank spike, blank spike duplicate, laboratory matrix spike, laboratory replicate and SRM results.

The associated field information will include:

- Sample location identification, including any survey coordinates.
- Date of sample collection.

An electronic version of the laboratory chemistry data will be supplied by the laboratory in a format agreed upon prior to project commencement.

5.3.4 Database Entry And Validation

Information from each sampling event will be loaded into the data validation database promptly following the receipt of the data from the field or laboratory. Some data entry will be accomplished manually, but the majority will be downloaded into the database from the laboratory electronic data deliverables and any field data recording devices (e.g., survey coordinates). Data entered manually from documents and field forms will be checked to assure that correct data transcription has occurred. Electronically loaded data will be compared to hardcopy forms of the data to confirm correct transfer.

Any necessary data validation qualifiers or database corrections will be entered into the database as sample delivery groups are validated. After the entries are complete, a person other than the data entry person will verify 100% of all hand-entered data against hardcopy (i.e., the data validation forms). Once data validation is complete, the data from the data validation database will be imported (appended) into the main Everett Smelter Site database.

5.3.5 Retrieval And Transfer Of Database Information

The creation and maintenance of the Everett Smelter Site database will facilitate data dissemination and data interpretation tasks. This will include processing requests for the transfer of analytical data files and summaries to the project team for review and analysis. Possible formats include data reports or inputs to graphical products for sorting, presenting, or evaluating the results. Only the data manager or personnel authorized by the data manager will be permitted to update or edit the database. Other personnel who need to use the computerized data will be prohibited from altering the data and structure of the database; user entry restrictions are built into the database software and will be set to grant read-only privileges to such users.

The master copy of the electronic database will reside on a secure network through the duration of the project. The database will be backed up onto electronic media daily as a precautionary measure. At completion of the project, an electronic copy of the database (e.g., CD ROM) will be stored with the project files and transferred to Ecology.

6.0 QUALITY CONTROL PROCEDURES

6.1 Field QC Procedures

Quality control checks for field sampling will be used to assess and document data quality, and to indicate whether the sample handling process may have introduced error in the results. The collection and analysis of equipment rinsates and field replicates will be used as quality control checks on the representativeness of the environmental samples, and the precision of sample collection and handling procedures. Sample containers, preservation methods, and holding times

will be in accordance with the quality control requirements specified in the analytical methods and the information presented in Section3.

Equipment rinsates will be sampled and analyzed to assess potential contamination of sampling equipment for the analytes of interest. An equipment rinsate is a deionized water sample used to rinse the sampling equipment after decontamination and then sent to the laboratory for analysis. The types and frequencies of equipment rinsates are discussed in Section 3.

Field replicate samples (i.e., two samples from a given sample location) will be collected in order to distinguish between the variability in results introduced by the field and sample handling prior to receipt by the laboratory and the variability introduced by the laboratory procedures. The field replicates will be handled and analyzed in the same manner as the other environmental samples. The types and frequencies of field replicates are discussed in Section 4.

6.2 Laboratory QC Procedures

The analytical laboratory's quality assurance manual and analytical SOPs identify routine internal quality assurance and quality control procedures implemented by the laboratory. The laboratory quality control procedures used for this project are listed in Appendix A. Corrective actions, to be taken in the event of QC outliers, are also specified in Appendix A.

6.3 Data Validation Quality Control

Independent validation of the environmental samples will follow documented quality control and review procedures that include the following elements:

- Primary validation documented on data validation worksheets.
- Secondary review performed by peer reviewer; documented on a secondary review checklist.
- Review of the data validation report by the project QA officer; documented on a Report QC and approval checklist.
- Review and approval for release by the project QA officer; documented on a report QC and approval checklist.

Data validation will be performed in accordance with EPA's functional guidelines for inorganic data review (USEPA, 1994), utilizing the criteria in Appendix A.

7.0 PERFORMANCE AND SYSTEM AUDITS

The designated project QA officer will monitor the performance of the field and laboratory quality assurance program. This will be achieved through regular contact with the contractor's project manager and the designated project data validation chemist.

Since the laboratory used for this project must be certified by the State of Washington (either directly or through reciprocity), and is audited by the certifying agency at least annually, a project audit is not anticipated. On-going project performance will be determined through independent data validation and evaluation of standard reference materials (SRMs).

Data assessment will be based on the data quality objectives discussed in Section 2 and detailed in Appendix A. Data validation procedures and quantitative definitions of precision, accuracy, and completeness are presented in Section 8.

8.0 DATA ASSESSMENT PROCEDURES

8.1 Independent Data Validation

The data validation process quantifies technical data quality, verifies that adequate documentation was performed, and determines whether the analytical data are usable and meet project DQOs. For this project, 100% of the analytical data for the property environmental samples will be evaluated for compliance with the DQOs and analytical requirements described in this QAPP, with data validation levels as discussed in Section 9.2. Data validation will be performed by the designated project data validation chemist following guidance in EPA's functional guidelines for inorganic data review (USEPA, 1994).

8.2 Technical Validity

Technical validation involves comparison of QC and instrument performance standard results to required control limits. Two levels of validation will be performed: a full validation and a summary validation, as defined below.

The following QC elements will be reviewed for data packages undergoing summary validation:

- Analytical holding times (from summary forms).
- Chain of custody and sample handling (from summary forms).
- Preparation Blank contamination (from summary forms).
- Initial and continuing calibration (from summary forms).
- Internal standards, ICP/MS only (from summary forms).
- Instrument tuning standards, ICP/MS only (from summary forms).
- Analytical accuracy [(matrix spike compounds and standard reference materials (SRMs)], expressed as percent recovery (%R) (from summary forms).
- Analytical precision (comparison of duplicate sample results), expressed as relative percent difference (RPD) (from summary forms).
- Reported detection limits (from sample result summaries).

Full validation will include review of all the items listed above for summary validation, plus the following QC element:

- Continuing calibration blanks (CCB) (from summary forms and raw data).
- Interference check sample results (ICSA/ICSAB) (from summary forms and raw data).
- Compound identification (from raw data).
- Compound quantitation, transcription and calculation checks (from raw data).
- Transcription and calculation checks performed at a frequency of 10%. (if an error is noted, 100% of the calculations and transcriptions for that data set will be verified).

Full validation will be performed on the initial data packages (approximately 10% of the data packages produced during this project). If no significant deviations from required protocols and QC criteria are noticed, the remaining data (approximately 90%) will receive a summary validation. If the summary validation results reveal problems or suspected problems, full validation will be performed on additional selected data packages, focusing on those data packages that appear to have problems based on the summary validation.

8.3 Data Usability

The independent validator will determine whether the analytical data meet the data quality objectives discussed in Section 2 and detailed in Appendix A. The validator will apply qualifier flags to data points that may have limited usability or that have been rejected. Calculation of quantitative measures of data quality is discussed in the following subsections.

8.3.1 Precision

The results from field duplicate analyses and laboratory duplicate analyses will be used to determine the relative percent difference (RPD) between the pair of analyses. The RPD for field duplicates will be used as a measure of field precision and the RPD for laboratory duplicates will be used as a measure of analytical precision. The RPDs will be calculated as follows:

$$\text{RPD (\%)} = \frac{100\,(C_1 - C_2)}{[(C_1 + C_2) / 2]}$$

Where:

RPD = relative percent difference
C_1 = the higher concentration measured for the duplicate samples
C_2 = the lower concentration measured for the duplicate samples

8.3.2 Accuracy

For spiked samples (matrix spikes and lab control samples), the percent recovery (% R) will be used as the measure of accuracy and is calculated as follows:

$$\%\,R = [100\,(C_s - C_n)] / C_{sa}$$

Where:

% R = percent recovery
C_s = measured concentration in spiked aliquot
C_n = measured concentration in non-spiked aliquot
C_{sa} = actual concentration due to spike added

The percent difference (% D) for analysis of SRM samples will be used as an additional measure of accuracy and is calculated as follows:

$$\%\,D = [100\,(C_{srm} - C_m)] / C_{srm}$$

Where:

$\%D$ = percent difference
C_m = measured concentration in SRM aliquot
C_{srm} = certified SRM concentration

8.3.3 Completeness

For the reasons explained in Section 3.5, it is not feasible to pre-determine the number of planned samples to be submitted for analysis for this project. Therefore, for the data validation report, the measure of completeness will be based on the number of environmental soil samples actually submitted to the laboratory for analysis, and will be calculated as follows:

$$C\ (\%) = \frac{100\ (\text{Number of acceptable measurements})}{(\text{Number of samples submitted})}$$

Completeness will be further assessed by the contractor's project manager against the project DQOs and sampling objectives, and reported to Ecology, as described in Section 3.5.

9.0 CORRECTIVE ACTION

It is the intent of the quality assurance process to minimize the need for corrective action through the development and implementation of effective internal controls. To accomplish this, corrective action procedures will be implemented, as described in this section for each measurement system. The corrective action procedures will involve the following steps:

(1) Discovery of a nonconformance.

(2) Identification of the cause or responsible party.

(3) Plan and schedule of corrective measures.

(4) Confirmation that the corrective measures achieve the desired results.

Activities subject to quality control and quality assurance will be evaluated for compliance with established procedures and acceptance criteria described in the field sampling plan (SAIC 2000a), this QAPP, and the laboratory quality assurance manual. A lack of compliance with these procedures will constitute nonconformance. Any project team member who discovers or suspects a nonconformance is responsible for initiating a request for corrective action (e.g., using a form such as shown in Appendix D). The contractor's project manager and project QA officer will ensure that no additional work which is dependent on the non-conforming activity is performed until corrective action is implemented.

The project QA officer will be responsible for reviewing any corrective action requests or audit reports to determine areas of nonconformance. Nonconformances will be reported by the project QA officer to the contractor's project manager. The project QA officer will evaluate nonconformances, confer with the field manager and/or senior project chemist, and initiate appropriate corrective measures. Corrective measures will be selected to prevent or reduce the likelihood of future nonconformances and address the causes to the extent identifiable. Selected

measures will be appropriate to the seriousness of the nonconformance and realistic in terms of the resources required for implementation.

9.1 Field Corrective Actions

The initial responsibility for monitoring the quality of field measurements and procedures lies with the field personnel. Each technical staff member is responsible for verifying that all QC procedures are followed. The technical staff member will assess the correctness of the field methods and the ability to meet QA objectives while conducting the work. If a problem occurs which might jeopardize the integrity of the project or cause a quality assurance objective not to be met, the technical staff member will notify the field manager. The field manager will notify the contractor's project manager and project QA officer. Corrective measures will be determined and implemented as appropriate. The technical staff member or field manager, along with the project QA officer, will document the problem, the corrective measures, and the results. Documentation will be done using a corrective action form (e.g., Appendix D) unless the problem is determined to be minor, in which case documentation in a field log book may be done instead. Copies of corrective action forms will be distributed to the field manager, the contractor's project manager, and the project QA officer.

9.2 Laboratory Corrective Actions

The need for corrective actions in the analytical laboratory may come from several sources: equipment malfunction, failure of internal QA/QC checks, method blank contamination, failure of performance or system audits, and/or noncompliance with QA requirements. When measurement equipment or analytical methods fail QC checks, the problem will immediately be brought to the attention of the appropriate laboratory project manager and other persons in the laboratory in accordance with the laboratory's quality assurance manual. If failure is due to equipment malfunction, the equipment will be repaired, precision and accuracy will be reassessed, and the analysis will be rerun. Attempts will be made to reanalyze all affected parts of the analysis so that, in the end, the product is not affected by failure to meet QC checks.

In the following situations, reanalysis will automatically occur:

- Linear range exceeded; sample dilution required.
- Method blank contamination (when blank concentration is greater than 3 times the reporting limit and sample concentrations are less than 10 times the blank concentration).

All incidents of QC failure and the corrective actions will be documented, and reports will be placed in the project file. Corrective actions will also be taken promptly for deficiencies noted during spot-checks of raw data. As soon as sufficient time has elapsed for corrections to be implemented, evidence of correction of deficiencies will be presented to the project QA officer. If, at any time, the QA/QC criteria outlined in this QAPP are not met and the laboratory corrective action does not resolve the problem, the project QA officer will be notified and a corrective action report initiated.

10.0 QUALITY ASSURANCE REPORTING

Since the sampling and analysis schedule for this project is relatively short, periodic (e.g., monthly) QA reports to management or Ecology are not planned. Instead, the designated project data validation chemist will provide a data validation report for each sample deliverables package to the contractor's project manager. Data qualifiers assigned in the report based on laboratory QA/QC requirements will be added to the chemistry database for the project. If additional data qualification is indicated based on the results of the field QC samples, this information will also be discussed in the data validation report, but data qualifiers due to field QC sample results will not be applied to the chemical database.

At the end of the project, an overall data quality assessment will be conducted. The DQO parameters discussed in Section 3 will be evaluated, any anomalies that effect the data will be discussed, and overall trends in the data quality will be examined and discussed. These findings will be submitted in a written report from the designated project QA officer to the contractor's project manager, and will be incorporated as a data quality summary section in the final data report delivered to Ecology.

11.0 REFERENCES

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TABLES

Table 3-1
Data Quality Objectives for Environmental Samples

Analysis	Analytical Methods [a]	Reporting Limits [b] mg/kg	Accuracy [c] %	Precision [d] %	Completeness %
Arsenic in Soil by Method A [e]	ICP/ EPA 6010B	< 40	75 - 125	50	100
Arsenic in Soil by Method B [e]	GFAA/ EPA 7010 ICP-Trace/ EPA 6010B ICP-MS/ EPA 6020A	< 3.3	75 – 125	50	90

[a] ICP/EPA 6010B = Inductively coupled plasma spectroscopy by EPA SW 846 Method 6010B.

GFAA/EPA 7010 = Graphite furnace atomic absorption spectroscopy by EPA SW 846 Method 7010.

ICP-Trace/EPA 6010B = Inductively coupled plasma-trace spectroscopy by EPA SW 846 Method 6010B.

ICP-MS/EPA 6020A = Inductively coupled plasma-mass spectroscopy by EPA SW 846 Method 6020A.

EPA SW 846 Method 3050B or 3051A will be used for sample digestion.

[b] The reporting limit objectives listed in this table are the values that must be met so that the soil removal decisions and implementation can be conducted in accord with the cleanup action plan. The reporting limits specified for each method in the laboratory contracting document are listed in Table 5-1.

[c] The accuracy objectives listed in this table are for the field soil samples. The accuracy objective for standard reference material results is 35%.

[d] The precision objectives listed in this table are for the field soil samples. The precision objective for laboratory duplicates is 20%.

[e] See footnote in Table 1-1 for explanation of Method A and Method B.

Table 4-1
Environmental Sample Collection and Preservation Details

Type of Sample	Estimated Maximum Number of Field Samples	Container Type	Preservation Method
Decision Unit Discretes	3,623	8 oz wide mouth jar with Teflon lined cap	Cool to 4° C
Landscape Unit Discretes	1,304	8 oz wide mouth jar with Teflon lined cap	Cool to 4° C
MANNO Discretes	132	8 oz wide mouth jar with Teflon lined cap	Cool to 4° C
Decision Unit Composites	362	8 oz wide mouth jar with Teflon lined cap	Cool to 4° C
Landscape Unit Composites	0	8 oz wide mouth jar with Teflon lined cap	Cool to 4° C
MANNO Composites	35	8 oz wide mouth jar with Teflon lined cap	Cool to 4° C
Equipment Rinses	110	1 liter HDPE bottle and cap	Nitric Acid to pH<2 Cool to 4° C

NOTES:

All environmental samples will be analyzed for arsenic.

The allowed holding time for all samples is 180 days after sample collection.

CPM = community protection measures

HDPE = high density polyethylene

MANNO = maintenace area not normally occupied

Table 5-1
Analytical Methods and Expected Reporting Limits for Environmental Soil Samples

Analyte	Reporting Limit, mg/kg dry weight			
	ICP	ICP-Trace	ICP-MS	GFAA
Environmental Samples for Arsenic by Method A	n/a	1.0	1.0	1.0
Environmental Samples for Arsenic by Method B	10	n/a	n/a	n/a

ICP = Inductively coupled plasma spectroscopy by EPA SW 846 Method 6010B.
GFAA = Graphite furnace atomic absorption spectroscopy by EPA SW 846 Method 7010.
ICP-Trace = Inductively coupled plasma-trace spectroscopy by EPA SW 846 Method 6010B.
ICP-MS = Inductively coupled plasma-mass spectroscopy by EPA SW 846 Method 6020A.
n/a = Not applicable.

NOTES:

1. The reporting limits listed in this table are limits anticipated to be achievable by most laboratories for each particular method, and are the requirements that were specified in the laboratory statement of work. The reporting limit DQOs to achieve project objectives are listed in Table 3-1.
2. These reporting limits are those that would be attained for a hypothetical 100% dry soil sample (i.e., 0% moisture). Reporting limits attained for actual (wet) soil are expected to be proportionally higher for a given ratio of sample weight to digestate volume (e.g., a very wet actual soil sample with 50% moisture would have a reporting limit two times higher than a soil sample with no moisture).
3. EPA SW 846 Method 3050B or 3051A will be used for sample digestion.

APPENDIX A

REQUIRED QUALITY CONTROL (QC) ELEMENTS AND ACCEPTANCE CRITERIA

Metals by ICP or ICP-T

QC Parameter	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Blank	Every 20 samples or extraction batch, whichever is more frequent.	Absolute value of blank result < RL (soils) or < IDL (waters) or the associated samples must be greater than 10 times the blank concentration.	Reanalyze and/or re-extract associated samples.
Initial Instrument Calibration	Curve must be made of at least a blank plus 1 standard, at initiation of analytical sequence, every 24 hours, or as needed.	Correlation coefficient (r) $\geq$ 0.995 if more than one standard analyzed.	Reanalyze associated samples.
Initial Calibration Check (ICV)	ICV must be analyzed immediately after analysis of the calibration curve and before the analysis of samples.	Must be from an independent source. %D between the true and the measured values $\leq$ 10%.	Stop analysis and reanalyze calibration curve.
Continuing Calibration Verification Standards (CCVs)	CCVs must bracket every 10 analyses.	%D between the true and the measured values $\leq$ 10%.	Reanalyze samples not bracketed by passing CCVs.
Initial Calibration Blank (ICB)	ICB must be analyzed immediately after analysis of the ICV and before the analysis of samples.	Absolute value of blank result < IDL or the associated samples must be greater than 10 times the blank concentration.	Reanalyze all associated samples < 10 times the blank concentration.
Continuing Calibration Blanks (CCBs)	CCBs must bracket every 10 analyses.	Absolute value of blank result < IDL or the associated samples must be greater than 10 times the blank concentration.	Reanalyze all associated samples < 10 times the blank concentration.
ICSA/ICSAB	Beginning and end of analytical sequence.	80% to 120% recovery for spiked analytes;<IDL for unspiked analytes.	Reanalyze associated samples.
Standard Reference Materials (SRMs)	Every 20 samples or extraction batch, whichever is more frequent.	Analyte results must be within 35% of the certified values.	Re-extract and reanalyze associated samples.
Matrix Spike (MS)	Every 20 samples or extraction batch, whichever is more frequent.	Where the native sample concentration is less than 4 X the amount spiked, the %R must be 75% to 125%. For analytes where the native sample concentration is greater than 4 X the amount spiked, no evaluation will be made.	Consult with Chemistry QA Officer for corrective action.

Metals by ICP or ICP-T (Continued)

QC Parameter	Minimum Frequency	Acceptance Criteria	Corrective Action
Sample Duplicate	Every 20 samples or extraction batch, whichever is more frequent.	Where the concentration in the sample and duplicate is > 5 X RL, the RPD ≤ 20%. If either the sample or duplicate result is < 5 X the RL, the difference in the concentrations must be less than 2 X the RL.	Consult with Chemistry QA Officer for corrective action.
Serial Dilution	Every 20 samples or extraction batch, whichever is more frequent.	For analytes where the concentration in the sample is > 50 times IDL, the %D ≤ 10%.	Consult with Chemistry QA Officer for corrective action.

Metals by ICP/MS

QC Parameter	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Blank	Every 20 samples or extraction batch, whichever is more frequent.	Absolute value of blank result < RL (soils) or < IDL (waters) or the associated samples must be greater than 10 times the blank concentration.	Reanalyze and/or re-extract associated samples.
Initial Instrument Calibration	Curve must be made of at least a blank plus 1 standard, at initiation of analytical sequence, every 24 hours, or as needed.	Correlation coefficient (r) $\geq$ 0.995 if more than one standard analyzed.	Reanalyze associated samples.
Initial Calibration Verification Standard (ICV)	ICV must be analyzed immediately after analysis of the calibration curve and before the analysis of samples.	%D between the true and the measured values $\leq$ 10%.	Stop analysis and reanalyze calibration curve.
Continuing Calibration Verification Standards (CCVs)	CCVs must bracket 10 analyses.	%D between the true and the measured values $\leq$ 10%.	Reanalyze samples not bracketed by passing CCVs.
Initial Calibration Blank (ICB)	ICB must be analyzed immediately after analysis of the ICV and before the analysis of samples.	Absolute value of blank result < IDL or the associated samples must be greater than 10 times the blank concentration.	Reanalyze all associated samples < 10 times the blank concentration.
Continuing Calibration Blanks (CCBs)	CCBs must bracket 10 analyses.	Absolute value of blank result < IDL or the associated samples must be greater than 10 times the blank concentration.	Reanalyze all associated samples < 10 times the blank concentration.
Internal Standards	Minimum of three per sample.	Percent recovery of internal standards must be greater than 30% of the intensity of the internal standards in the initial calibration standard.	First, check for instrument drift; terminate analysis, correct problem and reanalyze all samples since last in control CCV/CCB. If no drift, dilute sample and reanalyze.
Memory Effects Determination	Every sample	Assessed by analyzing three replicate integrations of each sample.	If the integrated signal values drop consecutively, stop the analysis, flush the instrument and reanalyze the sample.
Standard Reference Materials (SRMs)	Every 20 samples or extraction batch, whichever is more frequent.	Analyte results must be within 35% of the accepted values.	Re-extract and reanalyze associated samples.

Metals by ICP/MS (Continued)

QC Parameter	Minimum Frequency	Acceptance Criteria	Corrective Action
Matrix Spike (MS)	Every 20 samples or extraction batch, whichever is more frequent.	Where the native sample concentration is less than 4 X the amount spiked, the %R must be 75% to 125%. For analytes where the native sample concentration is greater than 4 X the amount spiked, no evaluation will be made.	Consult with Chemistry QA Officer for corrective action.
Sample Duplicate	Every 20 samples or extraction batch, whichever is more frequent.	Where the concentration in the sample and duplicate is > 5 X RL, the RPD ≤ 20%. If either the sample or duplicate result is < 5 X the RL, the difference in the concentrations must be less than 2 X the RL.	Consult with Chemistry QA Officer for corrective action.
Serial Dilution	Every 20 samples or extraction batch, whichever is more frequent.	For analytes where the concentration in the sample is > 50 times IDL, the %D ≤ 10%.	Consult with Chemistry QA Officer for corrective action.

Metals by GFAA

QC Parameter	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Blank	Every 20 samples or extraction batch, whichever is more frequent.	Absolute value of blank result < RL (soils) or < IDL (waters) or the associated samples must be greater than 10 times the blank concentration.	Reanalyze and/or re-extract associated samples.
Initial Instrument Calibration	Curve must be made of a blank plus 3 standards at initiation of analytical sequence, every 24 hours, or as needed.	Correlation coefficient (r) $\geq$ 0.995.	Reanalyze associated samples.
Initial Calibration Verification Standard (ICV)	ICV must be analyzed immediately after analysis of the calibration curve and before the analysis of samples.	%D between the true and the measured values $\leq$ 10%.	Stop analysis and reanalyze calibration curve.
Continuing Calibration Verification Standards (CCVs)	CCVs must bracket 10 samples.	%D between the true and the measured values $\leq$ 10%.	Reanalyze samples not bracketed by passing CCVs.
Initial Calibration Blank (ICB)	ICB must be analyzed immediately after analysis of the ICV and before the analysis of samples.	Absolute value of blank result < IDL or the associated samples must be greater than 10 times the blank concentration.	Reanalyze all associated samples < 10 times the blank concentration.
Continuing Calibration Blanks (CCBs)	CCBs must bracket 10 samples.	Absolute value of blank result < IDL or the associated samples must be greater than 10 times the blank concentration.	Reanalyze all associated samples < 10 times the blank concentration.
Standard Reference Materials (SRMs)	Every 20 samples or extraction batch, whichever is more frequent.	Analyte results must be within 35% of the accepted values.	Re-extract and reanalyze associated samples.
Matrix Spike (MS)	Every 20 samples or extraction batch, whichever is more frequent.	Where the native sample concentration is less than 4 X the amount spiked, the %R must be 75% to 125%. For analytes where the native sample concentration is greater than 4 X the amount spiked, no evaluation will be made.	Consult with Chemistry QA Officer for corrective action.

Metals by GFAA (Continued)

QC Parameter	Minimum Frequency	Acceptance Criteria	Corrective Action
Sample Duplicate	Every 20 samples or extraction batch, whichever is more frequent.	Where the concentration in the sample and duplicate is > 5 X RL, the RPD ≤ 20%. If either the sample or duplicate result is < 5 X the RL, the difference in the concentrations must be less than 2 X the RL.	Consult with Chemistry QA Officer for corrective action.
Analytical (post digestion) Spike	Every sample.	%R must be between 85% and 115%.	Follow GFAA analysis scheme as presented in ILMO4.0, page E-29.
Duplicate Injections (GFAA only)	All GFAA analyses.	For samples with concentrations > 10 times the IDL, the %RSD between injections < 20%.	Reanalyze samples.

APPENDIX B

SAMPLE NUMBERING SCHEME

SAMPLE NUMBERING SYSTEM

For Discrete Samples:

Example sample numbers: ***005-A-02-H-1***
001-B-10-A-1
001-B-10-A-2

Where fields are:

Property # – DU – Boring # – Depth Interval – "1" (if a primary sample) or "2"(if a split)

- Property #: Preassigned (see Table 2). Example: ***1, 2, . . .***
- Decision Unit (letter): Preassigned. Example: ***A, B, . . .***
- Boring #: Sequential within each Decision Unit. Assign in field. All re-tries get same number as original try. Example: ***1, 2, . . .***
- Depth Interval (letter):

  A = 0.0 – 0.5 ft
  B = 0.5 – 1.0 ft
  C = 1.0 – 1.5 ft
  D = 1.5 – 2.0 ft
  E = 2.0 – 2.5 ft
  F = 2.5 – 3.0 ft
  G = 3.0 – 3.5 ft
  H = 3.5 – 4.0 ft

- "***1***" if a primary sample, "***2***" if a split. Splits of discrete samples will be prepared at a rate of 10% *only* for those discrete samples being sent for analysis.

For Composite Samples:

Example sample numbers: ***Comp-005-A-H-1***
Comp-001-B-A-1
Comp-001-B-A-2

Where field numbers are:

"Comp" – Property # – DU – Depth Interval – "1" (if a primary sample) or, "2"(if a split)

- Property #, Decision Unit, and Depth Unit are same as for discrete samples. (Boring # is not applicable to composite samples).
- "***1***" If a primary sample, "**2**" if a split. Splits of composites will be prepared at rate of 10%.

For Equipment Rinses:

Example sample numbers: ***ER-1, ER-2, etc.***

APPENDIX C

LABORATORY DATA PACKAGE DELIVERABLES

LABORATORY DATA DELIVERABLES PER SAMPLE BATCH

Analyses	Deliverable Requirement
Metals by ICP or Metals by ICP-Trace	Case narrative
	Cross reference of the field sample ID number, laboratory sample number, and analytical batch
	Chain-of-custody forms
	Sample results
	Blank results: Initial, continuing, and preparation
	Initial calibration data
	Continuing calibration verification data
	Interference check
	Matrix spike results
	Duplicate sample results
	SRM results and manufacturer's Certification of Analysis
	Serial dilution results
	Interelement correction factors
	Linear range
	Preparation log (including %S)
	Analysis run log
	Standards preparation sheet/logs
	Raw data and instrument printouts
	All pages must be numbered sequentially.

LABORATORY DATA DELIVERABLES PER SAMPLE BATCH

Analysis	Deliverable Requirement
Metals by ICP/MS	Case narrative
	Cross reference of the field sample ID number, laboratory sample number, and analytical batch
	Chain-of-custody forms
	Sample results
	Blank results: Initial, continuing, and preparation
	Initial calibration data
	Continuing calibration verification data
	Internal standard results
	Matrix spike results
	Duplicate sample results
	SRM results and manufacturer's Certification of Analysis
	Serial dilution results
	Preparation log (including %S)
	Analysis run log
	Standards preparation sheet/logs
	Raw data and instrument printouts
	All pages must be numbered sequentially.

LABORATORY DATA DELIVERABLES PER SAMPLE BATCH

Analysis	Deliverable Requirement
Metals by GFAA	Case narrative
	Cross reference of field sample ID number, laboratory sample number, and analytical batch
	Chain-of-custody forms
	Sample results
	Blank results: Initial, continuing, and preparation
	Initial calibration data
	Continuing calibration verification data
	Matrix spike results
	Duplicate sample results
	SRM results and manufacturer's Certification of Analysis
	Analytical spike results
	Standard addition results (MSA)
	Preparation log (including %S)
	Analysis run log
	Standards preparation sheet/logs
	Raw data and instrument printouts
	All pages must be numbered sequentially.

LABORATORY DATA DELIVERABLES PER SAMPLE BATCH

Analyses	Deliverable Requirement
TCLP, metals, and priority pollutants for sitework samples, as described in Section 5.2	Case narrative
	Cross reference of field sample ID number, laboratory sample number, and analytical batch
	Chain-of-custody forms
	Sample results
	Method blank results
	Surrogate recovery results for appropriate organic methods, including associated acceptance criteria
	Dates of extraction and analysis for all tests

APPENDIX D

CORRECTIVE ACTION REPORT FORM

SHEET _____ OF _____

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

CORRECTIVE ACTION REPORT

CAR NO.	REVISION NO.	DATE

RESPONSIBLE ORGANIZATION

DESCRIPTION OF CONDITION

RECOMMENDED CORRECTIVE ACTION

RESPONSE DUE	QA/QC Officer	Program/ Project Manager
	Signature Date	Signature Date

ROOT CAUSE

MEASURES TO PREVENT RECURRENCE

PLANNED COMPLETION DATE	TASK LEADER	
	Signature Date	
RESPONSE [ ] ACCEPT *[ ] REJECT	QA/QC OFFICER	PROGRAM OR PROJECT MANAGER
	Signature Date	Signature Date
COMPLETION DATE	TASK LEADER	
	Signature Date	
CLOSURE DATE	QA/QC OFFICER	PROGRAM OR PROJECT MANAGER
	Signature Date	Signature Date

*DOCUMENT JUSTIFICATION FOR REJECTION ON CONTINUATION SHEET

Instructions for Completion of the Corrective Action Report

COMPLETE THIS FORM USING BLACK INK ONLY

CAR NO.:	Enter the unique number assigned to this CAR.
Revision No.:	Enter Revision Number “0” for initiation of CAR.
Date:	Enter date of initiation.
Responsible Organization:	Enter name of Organization responsible for the condition adverse to quality.
Description of Condition:	Brief description of the deficiency, nonconformance, or other reported condition adverse to quality.
Recommended Action:	Make recommendations on corrective action measures; i.e., remedial action, root cause determination, and measures to prevent recurrence.
Response Due:	Enter a response due date of thirty working days from date of issue. Sign and date CAR.

Concurrence with CAR by Program or Project Manager: Sign and date CAR

Response to CAR by Responsible Task Leader:

Root Cause:	Enter the determined root cause of the deficiency along with the extent, magnitude, and overall effects of the deficiency.
Meas. Prevent. Recurrence:	Enter corrective actions to eliminate deficiency from recurring.
Planned Completion Date	Enter the planned completion date of all remedial actions and measures to prevent recurrence.

Sign and date CAR.

Concurrence with Response to CAR by Task Leader: Sign and date CAR.

Evaluation of Response to CAR by QA/QC Officer and Program or Project Manager.

Check appropriate box:	{ } Accept or { } Reject. (Document justification for rejection on continuation sheet of CAR.)

Sign and date CAR.

Reporting Completion of Correction Actions by Task Leader and Program or Project Manager.

Completion Date:	Enter date all corrective actions were completed.

Sign and date CAR.

Closure of CAR by QA/QC Officer and Program or Project Manager.

Closure Date:	Enter date it is verified that all corrective actions are adequately completed.

Sign and date CAR:

Use of CAR Continuation Sheet(s):	Use CAR continuation sheet(s) as required if adequate space is not available on the CAR form, or for any additional comments, instructions, justifications, etc.

Appendix B – Letter Sent to Property Owners Declining Cleanup Actions

Date VIA CERTIFIED MAIL

Mr. and Mrs. Property Owners
1234 Elm Street
Everett, Washington 98***

Dear Mr. and Mrs. Property Owner:

RE: Everett Smelter Site – Declination of Cleanup Actions

Ecology contacted you on regarding cleanup of your property. You were contacted because your property is within the Everett Smelter Site, a hazardous waste site being cleaned up by the Washington State Department of Ecology.

This letter documents Ecology's understanding that you have declined cleanup actions on your property. If this is in error, please contact at.

If, in the future, you decide that you would like Ecology to conduct cleanup activities, please contact us. Ecology will include your property with others being considered for clean up as resources become available.

In addition, Ecology believes you should be aware of the following:

(1) Your property will be listed on a site database with the notation that cleanup actions were declined;
(2) Real estate laws and home loan transaction protocols typically require disclosure of the presence of hazardous substances when property is the subject of a real estate transaction. You should consult a real estate professional regarding specific obligations applicable to a sale or loan to which you are a party;
(3) Ecology has the legal authority to compel cleanup actions and will, at some future date, evaluate whether this legal authority should be invoked at properties whose owners declined cleanup;
(4) Ecology will continue to include your property on mailings concerning the site to ensure that future owners are notified of property conditions.

Ecology repeats that should you change your mind at any time you may contact us regarding cleanup actions at your property. So long as we have resources available, we will attempt to address your property at that time.

Sincerely,
Ecology Employee
Site Manager, Everett Smelter Site

Appendix C – Procedures for Home Heating Oil Tanks

The State does not regulate heating oil tanks. The City of Everett Fire Marshal is responsible for permits, inspections, or other regulations applying to tank removal or closure.

The Department of Ecology, under MTCA, could become involved if a tank is discovered to be leaking. If a tank is discovered to be leaking, the property owner is responsible for evaluating the extent of the leak and cleaning it up, per MTCA standards, at their expense. A minor leak, affecting only soil near the tank, does not have to be reported to Ecology, but should be cleaned up per MTCA. If a release has gotten into surface waters, lakes, rivers, or storm sewers, it must be reported to the Washington Emergency Operations Center at 1-800-258-5990.

An extensive (or "non-minor") leak has occurred when a leak has reached adjoining properties, affected a well or ground water, caused vapor problems in nearby buildings, pooled on the ground surface, or caused extensive soil contamination. In this case, the leak must be reported to Ecology's Northwest Regional Office, at 425 649-7229.

Heating oil tanks may be encountered during remediation of residential properties and the remediation contractor must be prepared to handle this occurrence. The following guidelines are reasonable precautions for property owners and contractors to follow to avoid surprises in field excavation.

Pre-Construction Planning

- Based on interviews with property owners, list all tanks on the property. Note the tank locations on the property plans and inform the remediation contractor of the findings.

- For those homes with active tanks, provide a Pollution Liability Insurance Agency (PLIA) application (as a courtesy). Ecology will also provide a copy of Ecology Report R-TC-92-117, which is a fact sheet concerning Residential Heating Oil Tanks (also as a courtesy).

- Through discussions with the property owner, determine if they would prefer the tank be removed. The property owner can make separate arrangements, or discuss removal options with Ecology's remediation contractor. Again, removal costs are the property owner's responsibility. If adjacent soil contamination is encountered, the property owner has the same options available.

During Construction

If tanks are encountered during construction, the following arrangements will apply.

Known Tanks

- Ecology's remediation contractor will be prepared to remove or close a tank, at the property owner's expense, if arrangements have been previously made.

- If the property owner does not wish to have the tank removed, or closed in place, the remediation contractor will remove adjacent soils to the planned excavation depth. At final depth, Ecology will inspect the exposed portion of the tank and exposed soil for visible signs of leakage.

- Ecology will document the open excavation with photographs of exposed tank and will prepare written comments on the condition of the tank and any observations of leakage.

- If the tank is observed to be leaking currently or has leaked in the past, the remediation contractor will leave the excavation open until the property owner is advised and a decision is made by the owner whether to proceed with removal, closure, and cleanup, at their expense, or not. If not, the remediation contractor will proceed with backfill. If the leak appears to be extensive, Ecology will advise the property owner of their requirement to report the spill to Ecology.

- If the tank is not obviously leaking when excavation is at final depth, the remediation contractor will proceed with removal or closure, at the property owner's choice. If no removal or closure has been requested, the remediation contractor will proceed with backfill.

Tanks Discovered During Construction

- Ecology will report discovery of the tank to the property owner, including whether the tank appears to be intact or has been leaking. The remediation contractor will leave the excavation open to final depth until the property owner makes arrangements to leave the tank in place, or have it removed or closed at his expense.

- Ecology will document the conditions of the tank and adjacent soil with photographs and written comments.

- If the exposed tank is leaking and the leak appears to be extensive, Ecology will advise the property owner of their requirement to report this condition to the appropriate office within Ecology.

- Remove or close the tank and conduct cleanup, if necessary, and then proceed with backfill.

- If the property owner elects to not have the tank removed or closed, proceed with backfill.

Appendix D – Field Oversight Checklist

The following is a list of tasks which Ecology field oversight personnel are frequently called upon to perform. Ecology field oversight personnel should be prepared to perform the these tasks, any related tasks, and any other tasks necessary to accomplish the objectives of cleaning up the Everett Smelter Site:

1) Maintain communication with owners throughout the cleanup/restoration project.

2) Prepare or approve field change-orders, as required.

3) Prepare agreements with owners concerning field change-orders to the property-specific cleanup plan.

4) Review and sign-off on contractor's monthly request-for-payment documents.

5) Prepare weekly updates regarding the cleanup and place the updates at the community signs.

6) Coordinate periodic site tours for area residents. Ecology staff and/or Snohomish Health District staff will lead these tours, as appropriate.

7) Observe/supervise excavation and the repair or replacement of utility lines, including photographic documentation.

8) Continuously review cleanup agreements to ensure the provisions of the agreements are being met.

9) Observe and approve of the cleanup and securing of the site at the end of each day, including any additional efforts required for weekends and holidays.

10) Coordinate work to be done by the owner with work being done by Ecology contractors.

11) Approve excavations, noting exceptions, including photographic documentation.

12) Authorize and observe back-filling, topsoil placement and re-landscaping.

13) Observe or confirm placement of geofabric marker/membrane, including photographic documentation

14) Conduct site walks with contractors to review existing site conditions and discuss the planned remediation work.

15) Observe/approve the cleanup activities, including photographic documentation.

16) Conduct site walks with the landscaper.

17) Observe/approve placement of topsoil (confirm at least 6" thick), sod and/or beauty bark, and replacement bushes, trees, and landscaping plants.

18) Provide lawn maintenance instructions to owner. Observe how watering is being done and, in general, how new lawns are doing. Consult with landscaper and owner if necessary.

19) Observe/confirm initial application of fertilizer by landscaper.

20) Provide information concerning selection of fertilizer, application-rate calculations, and schedule to owner.

21) Conduct site walks with the paving contractor.

22) Observe paving.

23) Perform a site walk with the contractor when the contractor notifies Ecology that work has been completed at a property. Prepare a punch list if items which do not conform to contract requirements or otherwise need attention before the contractor leaves the property and perform a final site walk when punch list items have been completed to verify their completion.

24) Maintain all documentation of cleanup activities, including property notebooks, and ensure appropriate information is provided to each property owner and is placed in Ecology files.

25) Compile photo record of completed cleanup and restoration of property.

26) Prepare the summary of cleanup for owner and other parties.

27) Deliver summary to owner.

28) Maintain contact with owner for a period of one year, keeping in mind the warranty period, particularly for sod, trees, bushes, drainage, etc. Make periodic site visits.

29) Maintain contact with general contractor and/or sub-contractors during the warranty period. If a problem arises, arrange for contractor or sub-contractor to make needed adjustments, repairs, or replacements.

Appendix E – List of Attachments

A series of attachments will be developed to implement cleanup actions at properties within the Peripheral Area of the Everett Smelter Site. These attachments are described below.

Project Control Documents

Project control documents will be developed and kept in chronological order. Project control documents will include work plans, field sampling plans, bid specifications, contractor work assignments and contracts, and other documents relating to implementation and control of the remediation work.

The project control documents will relate to work being done in a specific portion of the Everett Smelter Site during a specific time period. Biennial and/or annual work plans will be developed, as appropriate as the project proceeds. It is anticipated that each work plan will cover a funding cycle. Each work plan will describe the work to be performed during the funding cycle, the anticipated schedule, and the estimated budget.

The biennial or annual work plan for property cleanup within the Peripheral Area may be combined with work plans for other tasks into one document. Work plans will be filed by date.

Property List

A Property List will be developed which lists all properties within the Everett Smelter Site. The list will include the address, tax parcel number, whether cleanup actions at the site have been completed or not, and any other pertinent information for each property. The list will contain a table cross-referencing properties by address and tax parcel number.

Accompanying the list will be a map that shows the Everett Smelter Site in sufficient detail that the location of each property may be identified.

Property Notebooks

1) A summary of the overall cleanup conducted during the construction season
2) Name of the property owners;
3) Address, including street, city, ZIP code, County;
4) Tax Parcel Number;
5) A brief discussion of the sampling results and a summary of the cleanup decision for each decision unit, landscape area, crawlspace samples, and other data as appropriate:
6) A copy of the property map, drawn to scale, showing the location of all utilities, permanent structures, paving, landscape features such as flower beds, large trees and

shrubs, terraces, play structures or other features as well as decision units and how the property was measured;

7) A description of the work actually conducted in for each decision unit, landscape area, crawlspace, including repair or removal and replacement of any paving, decks, raised beds, drainage systems, placement of barriers in crawl spaces or other work;
8) Photographs of the property before, during and after cleanup, including documentation of where the photograph was taken;
9) As-built diagrams of any retaining walls or other structures. For any retaining walls or other structures that must be designed or approved by a licensed engineer, a copy of the engineer supporting documentation (PE sign-off) will be included as an attachment;
10) A copy of the tax status letter, which includes taxpayer name, address, property address, tax parcel ID or legal description and the cost of cleanup for the property, including sampling and analysis, Ecology staff, contractor and consultant; and the removal and restoration activities costs, including cost of materials, installation and initial maintenance;
11) Operation & Maintenance information such as brochures for lawn maintenance, site specific information about landscaped areas, that were not excavated, crawl spaces and maintenance areas not normally occupied, the need to seal such areas to prevent entry by animals, including rodents;
12) A cross reference to relevant institutional controls; and
13) Other information as appropriate.

The following documents will be included as attachments to the Property Notebook

- Sampling and access agreements;
- Site-specific scope of work/agreement;
- Field notes;
- Back-fill authorization