1.9.7

FINAL DESIGN REPORT
EVERETT SMELTER SITE

FINAL

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CERTIFICATE OF ENGINEER

This Final Design package was prepared in accordance with the requirements of the Enforcement Order No. 02TCPNR-4059, Agreed Judgment No. 03-2-08502-1, Final Cleanup Action Plan, and Interim Action Report. This Final Design package has incorporated comments from the State of Washington Department of Ecology and is consistent with the requirements of WAC 173-340-400, WAC 173-340-430, and WAC 173-340-840.

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1.0 PURPOSE AND GENERAL REQUIREMENTS

The Final Design Report for the Everett Smelter Site has been prepared to comply with Enforcement Order No. 02TCPNR-4059 issued by the Washington Department of Ecology (Ecology) to ASARCO Incorporated (Asarco) in July 2002. In October 2003, the Snohomish County Superior Court issued Agreed Judgment No. 03-2-08502-1 (October 20, 2003) establishing a schedule for the tasks contained in the Enforcement Order. The Final Design Report is directed primarily at the Enforcement Order tasks but also includes alternatives to implement further remediation of the Fenced Area as described in the Interim Action Report for the Everett Smelter (IAR) approved by Ecology in April 2003.

This document has been prepared to meet the requirements of WAC 173-340-400 (4), applicable to the Fenced Area, and additional project requirements of the City of Everett. It is based on the IAR and subsequent field investigations conducted by Asarco in July and September 2003. The document does not reiterate information previously described in the IAR; however, information or design modifications developed since the approval of the IAR are included in this document.

The WAC requirements addressed by this Final Design Report are comprised of the following three components:

(a) The Engineering Design Report
(b) Construction Plans and Specifications
(c) Operations and Maintenance Plan

The City of Everett of requirements consist of the following:

(a) Transportation Plan
(b) Landscape Plan
(c) Final Site Restoration Plan
(d) Final Program of Institutional Controls & Monitoring

Of these four plans, only the Transportation Plan is included at this time because it directly affects the planned remediation. Asarco and the Everett Housing Authority (EHA) have entered into an agreement that will result in the sale of Asarco's property to the EHA if the conditions in the agreement are satisfied. If the EHA acquires the property it would proceed with redevelopment of the area, which would require the integration of items (b), (c), and (d) above. Asarco and the EHA expect to reach a decision on the purchase and sale of the property in the second quarter of 2004. In light of this potential acquisition, Asarco has not prepared these plans at this time because the ultimate development plans have not been prepared and any plans prepared now would inevitably be inconsistent with the end use and redevelopment. Asarco proposes that it will prepare these plans and submit them either a) as part of the redevelopment permitting process if the property sale is negotiated, b) within 60 days following the termination of negotiations between the EHA and Asarco for acquisition of the property, or c) by July 30, 2004, whichever is sooner, unless otherwise authorized by Ecology.

The project schedule specified by the Agreed Judgment is outlined below:

Submit Engineering Design Report to Ecology	January 30, 2004
Submit associated planning documents to City of Everett	January 30, 2004
Procure Contractor	February 27, 2004
Approval of Final Design by Ecology	March 31, 2004
Approval of planning documents by City of Everett	April 30, 2004
Contractor Mobilization On-site	June 1, 2004
Substantial completion per Enforcement Order	August 20, 2004
Final Completion per Enforcement Order	October 31,2004
Submit Draft As-Built Report to Ecology	December 31, 2004
Submit Final As-Built Report to Ecology	30 days after receipt of Ecology comments

2.0 ENGINEERING DESIGN REPORT

This section presents the basis for the design presented in the Construction Plans and Specifications and supplemental plans. It also incorporates the subsequent site investigations conducted since the IAR and provides the most current site characterization related to the work to be performed.

2.1 SOIL AND DEBRIS EXCAVATION, REMOVAL, AND REPLACEMENT

This section describes the design approach for soil removal and replacement within the Fenced Area. General plans illustrating the sequence and methodology for this activity are included in the construction plans in addition to the rationale for conducting the work as described.

The following subsections of WAC 173-340-400 (4)(a) are addressed in this subsection:

(i) Goals of the cleanup action

(ii) General facility information

(iii) Identification of who will own, operate, and maintain the cleanup

(iv) Sequence and staging flowcharts

(v) Characteristics, quantities, and location of materials to be managed

(vi) Schedule and options for construction

(vii) Description and plans of the excavation, removal, and replacement tasks

2.1.1 Cleanup Goals and Summary of Cleanup Responsibilities

There are two cleanup goals for the cleanup of the Fenced Area:

- Remove the soil and debris greater than 3,000 mg/kg As (i.e., Source Material) with ultimate disposal of this material in the On-site Containment Facility (OCF) at Asarco's former Tacoma smelter.

- Remove the remaining soil greater than 150 mg/kg As (i.e., Residential material or Residential Soils) and dispose of it at the former Tacoma smelter, where it will be used as subgrade backfill and placed underneath the site-wide cap. Following removal of this material, and prior to site development, a marker barrier similar to that used in the surrounding residential areas will be placed and the Fenced Area will be backfilled with at least two feet of soil with arsenic concentrations less than 20 mg/kg or other alternative cap approved by Ecology (e.g., building foundations).

At the completion of the remediation, the requirements of the Final Clean Up Action Plan (FCAP - Washington Department of Ecology, November 1999) for cleanup to residential standards will be satisfied in the Fenced Area (e.g., no material greater than 150 mg/kg arsenic will be within two feet of the final revegetated surface). This will allow subsequent redevelopment of the property within the range of land uses allowed by the City of Everett, including residential development.

Asarco expects that it will be the entity that conducts the cleanup of the Fenced Area, probably through use of its own personnel and independent contractors, both at Everett and at Tacoma. Asarco has not selected a construction contractor for Everett at this time; however, engineering design and field oversight will be performed by ASARCO Consulting, Inc. (ACI). Most of the laboratory analyses will be performed at ACI's XRF lab in Tacoma, a field XRF and/or laboratory XRF on-site at Everett, or samples will be sent to an independent laboratory. Some analyses, such as soil fertility and soil organic content tests, will be performed by local commercial laboratories.

Asarco owns the non-public property in the Fenced Area, several individual properties surrounding the Fenced Area, as well as the former Tacoma smelter property. Streets and an alley are the only public property in the Fenced Area and are owned by the City of Everett. Access to and removal of the streets, overhead electrical distribution lines, and other underground utilities will be needed to complete remediation of the Fenced Area. Asarco expects to use barge loading facilities in Everett owned by others. Access and related

provisions for other privately owned facilities and public areas needed to conduct the cleanup are discussed further in Section 2.3.

2.1.2 Fenced Area Layout and Designations for Cleanup

The Fenced Area and surrounding area has been previously described in the IAR and subsequent site verification investigations. For design and construction purposes, the Fenced Area has been designated at a finer level of detail based on the anticipated excavation methodology:

- The Fenced Area is subdivided into two sub-areas: an Upper (U) area and Lower (L) area (see the Interim Action Report –December, 2002 Figures 3-1 a - c and 3-2 a - f; note these figures also include Tables 3-1 and 3-2). The Upper area is bounded on the east by Pilchuck Path and the west by Hawthorne Dr. The Lower area extends from Pilchuck Path east to East Marine View Dr. and includes 5th St. and the alley east of Pilchuck Path.

- Sub-areas are further designated by the primary type of material that will be removed from it: Source (S) material designates areas likely to have concentrations > 3,000 mg/kg As, and Residential (R) soils that will probably have concentrations <3,000 but > 150 mg/kg As. The Source and Residential designations are the same used to describe similar material at the former Tacoma smelter and will facilitate the correct handling of the material upon receipt there. The U.S. Environmental Protection Agency (EPA) has directed that Source material >30,000 mg/kg As be managed discretely from other Source material (i.e., Subtitle C material).

- Sub-areas are numbered sequentially based on the previous two designations. In the Upper area, sub-areas are designated US-1 through US-12 and UR-1 through UR-24. The Lower area designations are LS-1 through LS-84 and LR-1 through LR-11.

In general, the Upper area consists mainly of R material with well defined areas of S material near the southern portion of the Upper area and west of the north end of Pilchuck Path. In contrast, the Lower area consists primarily of S materials that are underlain by R materials. Additional field investigations were completed in July and September 2003 to refine the likely Source area boundary and quantity estimates. The estimated quantities based on this additional information for the sub-areas expected to contain Source material are shown in Table 2-1. No allowance for shrink/swell are reflected in these quantities; however, these estimates take into account the fact that excavation will not be done in a "neat line" manner (i.e., excavation will not exactly follow the concentration boundaries shown in the Exhibits or Construction Plans) and that some additional material will need to be excavated to assure removal of Source and Residential materials.

The Pre-Excavation Source Material Verification Report issued in September 2003 indicated that a concentration of 2,500 mg/kg As would be used to demarcate Source material. Subsequent field work conducted in September 2003 and reported in Appendix D of this document has provided sufficient information to re-establish a field concentration threshold of 3,000 mg/kg As for Source material. Source material as mapped in this document and the Construction Plans is based on concentration ranges between 3,000 to 30,000 mg/kg As.

The refined estimates of Source material are about 5,000 CY less than the quantities presented in the IAR. Source material removal of about 19,500 CY will be accompanied by the removal, stockpiling, and replacement and/or disposal of about 12,500 CY of Residential soils. There is an estimated 46,440 CY of Residential material in the Fenced Area. If Residential soil associated with Source area excavation is also disposed off-site, there will still be about 33,900 CY of Residential soil remaining in the Fenced Area that will need to be removed at some point to complete the removal action before regrading and capping can occur.

TABLE 2-1. SUMMARY OF ESTIMATED QUANTITIES

Area and Type of Material	*Estimated Quantity (CY)*
Upper Source	3,700
Upper Residential	4,100
Subtotal Upper	**7,800**
Lower Source	15,710
Lower Residential	8,400
Subtotal Lower	**24,110**
Subtotal Source	19,410
Subtotal Residential	12,500
Total Source and Residential	**31,910**

2.1.3 General Plan of Material Excavation and Replacement

The logistics for the excavation, sampling, stockpiling and off-site disposal necessitates a prescribed sequence and schedule to minimize the effort and costs associated with the remedial action. In addition, the cross-contamination potential between S and R areas is much higher due to the greater aerial extent of S material, the deeper excavation depths required, and the surface water drainage paths across the Lower area. As such, smaller sub-areas that can be more easily controlled as they are excavated are needed. The recommended overall sequence of excavation, stockpiling, off-site disposal and interim surface restoration is outlined below (see also Construction Specifications – Appendix F and associated Construction Plan Sheet ES-SL-01). This sequence has been modified from that proposed in the IAR and is focused on removal of the Source material only. If remediation of Residential materials in the Fenced Area is conducted in conjunction with the Source area removals, the plan presented in the IAR can be accomplished with minimal revisions to the sequence described below (see Section 2.4). Also, the remedial contractor may deviate from the proposed plan if the alternate plan offers a benefit to the project and is authorized by Asarco.

STEP 1

a.) Prepare Stockpile A in Area 1.

b.) Construct stormwater controls.

STEP 2

a.) Excavate truck load-out area in Area 2 adjacent to East Marine View Drive (EMVD). The load-out area shall be 60 (+/-) feet wide, parallel to EMVD, and constructed to allow truck access from and onto EMVD. Place Residential soils/concrete in temporary stockpile close to Area 2.

b.) Place Source soils in Stockpile A or use containers.

c.) Place Subtitle C soils in containers for direct shipment to off-site disposal.

d.) Construct stormwater sediment detention pond.

e.) Utilize temporarily stockpiled Residential soils and demolition concrete for construction of load-out pad. Grade to drain to detention pond and cover with filter fabric.

f.) Construct load-out area with surface drainage to detention pond; match grade from EMVD. Construct facilities (scale, hopper, screen, etc.).

g.) Establish remaining surface water BMPS in Area 2.

STEP 3

a.) Excavate Subtitle C soils from Area 3. Some Source material removal will be necessary to access Subtitle C soils but contractor can elect to continue excavating remaining Source soils in Area 3 as field conditions and stockpile/container capacity allow.

b.) Place Residential soils in Stockpile B.

c.) Place Source soils in Stockpile A or containers.

d.) Place Subtitle C soils in containers for direct shipment; stage at rail load-out. Begin load-out of Subtitle C soil and export to Subtitle C facility.

STEP 4

a.) Excavate Subtitle C soils in Area 4, placing in containers for direct disposal per Step 3. Some Source material removal will be necessary to access Subtitle C soils, but do not advance excavation below Subtitle C depths.

b.) Place Source soil in Stockpile A.

c.) Place Subtitle C soils in containers for direct shipment off-site.

d.) Subtitle C excavation limits include the removal of Pilchuck Alley.

STEP 5

a.) Excavate Subtitle C soils from Area 5 and place in containers for direct load-out/disposal. Some source material removal will be necessary to access Subtitle C soils, but do not advance excavation below Subtitle C depths. Maintain Pilchuck Path. Complete load-out of Subtitle C soil and export to Subtitle C facility.

b.) Place Residential soils in Stockpile B.

c.) Place Source soils in Stockpile A.

d.) As Subtitle C load-out is completed, begin loading and transporting containers with Source soil to Tacoma, expanding stockpile in Area 6 as needed to accomplish this task.

e.) Excavate Source soil in Area 4 (area east of Pilchuck Path) to final excavation depths, stockpiling/loading containers in Area 6. Remove Pilchuck Path as required to access Source and/or Subtitle C soils. Remaining Subtitle C soils need to be loaded directly for disposal without stockpiling.

f.) Excavate remaining Source soils in Area 5 and stockpile/load-out for transport.

g.) Excavate Area 1; Residential soils to Stockpile B, Source soils to Stockpile A/load-out as work progresses.

STEP 6

a.) Complete Source soil excavation in Area 6, proceeding south to north. Place soils in Stockpile A as needed, or load to containers for shipment to Tacoma.

b.) Complete excavation of Source soils in Area 6, including the area of Stockpile B. Place in Stockpile A or load-out directly.

c.) Excavate remaining Source material from Pilchuck Path, 5th Street, Area 6 east of the alley, incidental surface material in the load-out area, and sediments from stormwater detention features and export to Tacoma OCF. Export concrete used on-site to Tacoma OCF.

d.) Backfill excavation in Area 5 with stockpiled Residential soils. Slope excavation areas to drain, establish surface water BMPs for winter, hydroseed, and re-establish site-security.

e.) Demobilize from site.

2.1.4 Excavation Volumes

It is estimated that 51,000 tons of soil will be excavated in the process of removing the material with arsenic concentrations above 3,000 mg/kg.

- 3600 tons (2250 cubic yards) of Subtitle C material – arsenic above 30,000 mg/kg.
- 27,500 tons (17,160 cubic yards) of Source material – arsenic above 3,000 mg/kg.
- 20,000 tons (12,500 cubic yards) of Residential material –arsenic above 150 mg/kg.

The soil excavation volumes do not include any material associated with the Clear & Grub or Structure Demolition work scope items. In addition to the quantities listed above, there is another 34,000 CY of Residential material that will need to be removed from the Fenced Area to meet the 150 mg/Kg As criteria.

Excavation of all material outside the Fenced Area and within the Everett Smelter Site with arsenic concentrations greater than 3,000 mg/kg As is required under the Enforcement Order. There is a small area of Source material under the roadway of East Marine View Drive that may not be excavated at this time. The City of Everett expects to reconstruct this street in 2005, although the City prefers that this material be removed as part of the overall removal described above. The location of this material is known and plans for its removal and disposal will either a) be incorporated with the City's design effort and the enforcement order amended to allow removal after October 31, 2004, including provisions for placing sufficient funds with allowance for contingencies in escrow by that date, or b) be incorporated with the work described above and completed under the existing schedule of the Agreed Judgment.

2.2 ENGINEERING DESIGN CRITERIA AND FEATURES

This section describes the engineering design criteria and parameters upon which the overall cleanup is based. The following subsections of WAC 173-340-400 (4)(a) are addressed in this section:

(viii) Engineering justification for the design and operations parameters, including:

(A)Design criteria, assumptions, and calculations for components of the cleanup that have not already been designed.

(B)Containment effectiveness – (see also Record of Decision for the Tacoma Smelter, EPA, March 1995).

(C)Demonstration that cleanup will achieve compliance with cleanup criteria of FCAP.

(ix) Design for control of spills or accidental releases.

(x) Design features to assure long-term safety of workers and local residences.

2.2.1 Engineering Design Evaluation

The plan presented in the IAR and further described in this Final Remedial Design is based on combining the removal actions in the Fenced Area at Everett with the ultimate disposal facilities Asarco has constructed at the former Tacoma smelter, which is being remediated under EPA oversight. At the Tacoma smelter, a much larger amount of the same type of material present at Everett (i.e., Source material) is being excavated and disposed of at the smelter in an OCF. The capacity of the OCF is 260,000 CY and the current estimate of the quantity of material from the Tacoma smelter that will be disposed of in the OCF is expected to range between about 210,000 – 230,000 CY. Under the terms of the ROD for the Tacoma smelter, EPA determined that the OCF must be constructed to exceed RCRA Subtitle C standards for hazardous waste landfills in order for the source area materials to be disposed there without further treatment.

The remaining capacity of the OCF at Tacoma is available to dispose of the same type of material from Everett within the Fenced Area. This volume has been estimated to be about 20,000 CY, less than 10% of the amount of material that will be disposed of from Tacoma and well within the remaining capacity of the OCF.

The key elements of the approach Asarco plans to implement for removal of the Fenced Area material at Everett are:

- The Source material greater than 3,000 mg/kg but less than 30,000 mg/kg arsenic within the Fenced Area will be removed and transported to the Tacoma smelter for disposal in the OCF without treatment.

- The Source material greater than 30,000 mg/kg arsenic within the Fenced Area will be removed and transported off-site for disposal in a RCRA Subtitle C facility or in the Tacoma OCF. Disposal in the OCF may include treatment to minimize arsenic mobility. Smelter residual by-products >30,000 mg/kg arsenic encountered that can be segregated from surrounding soil will be disposed of in a Subtitle C facility.

- Residential material greater than 150 mg/kg arsenic will be handled in one of two ways. It may be removed from the Fenced Area, transported to Tacoma, and placed beneath the smelter site-wide cap along with other soils from the cleanup of residential yards in Ruston and north Tacoma. Alternatively, it will be excavated and stockpiled on-site until the Source material is removed, followed by placement in the Source area excavations until removal with the balance of the Residential soils in the Fenced Area.

- After removal of the all Source and Residential material from the Fenced Area, this area will be remediated consistent with the soil cleanup requirements of FCAP. The site will be backfilled and graded with clean material following remediation. As mentioned previously, it may be possible and advantageous to integrate the final grading of the site with that needed for site development. Specific plans to accomplish this will need to be prepared and approved by Ecology. At that point, the property will be in a condition to support further redevelopment.

This overall concept greatly simplifies the type and extent of engineering design needed to perform the cleanup. The WAC requirements regarding ultimate disposal, particularly containment effectiveness, are met and documented in EPA's ROD for the Tacoma smelter

and the associated design documents submitted to EPA and Ecology during the design process at that site. The Source and Residential material from Everett will be handled in the same fashion as the comparable material at Tacoma. As stated in the IAR, no further documentation or analysis is needed regarding the ultimate disposal of this material at the former Tacoma smelter.

Similarly, the FCAP for the Everett site addressed the issues regarding the cleanup and containment effectiveness for material up to 150 mg/kg As at a depth of 2 feet or more. As this will be the site condition following completion of the remediation of the Fenced Area, it does not need to be further evaluated. Finally, the FCAP specifies removal of material greater than 3,000 mg/kg from the Fenced Area, which is provided for in this design.

The remaining engineering design evaluations needed are:

- Assessment of the removal methodology's ability to achieve cleanup goals;
- Evaluation of surface and groundwater control measures needed during and after the cleanup;
- Materials management issues; and
- Performance sampling to assure compliance with the cleanup standards.

The first two bulleted items are covered in Sections 2.2.2 and 2.2.3 below. The other two items are addressed in Section 2.3.

2.2.2 Assessment of the Removal Methodology

The approach and methodology selected for the Fenced Area have been developed based on Asarco's experience at many other sites with a wide range of soil-metals concentrations. The Everett site, particularly the Fenced Area, has a few key features that provide a high degree of confidence that the removal methodology will achieve cleanup goals:

- ✓ The relatively shallow depth of surface soils/fill which are underlain by glacial till of significantly lower permeability. Previous sampling data, supported by the

supplemental investigations in 2003, shows that metals concentrations decrease rapidly with depth into undisturbed glacial till, limiting excavation depth needed to achieve the 150 mg/kg As cleanup (see Exhibits ES-FDR-2 through 4 and Appendix E).

- ✓ Groundwater flux across the Fenced Area is low (less than 1gpm per 1,000 lineal feet – see Everett Smelter RI) and is mainly confined to the shallow surface fill strata. While some groundwater will be present, quantities are expected to be small and can be managed as part of the surface water control system. Significant groundwater dewatering is not anticipated.

- ✓ The highest concentrations identified in the Fenced Area are closely tied to smelter debris and residual by-products. These areas have been thoroughly mapped previously (see Everett Smelter Site Remedial Investigation, Hydrometrics, Inc. September 1995) and this information provides a clear guide to excavating the Source material. In addition, the debris and by-products are visually distinct from the native material, making it much easier and more reliable to excavate based on a visual as well as a chemical basis. The additional field investigations conducted in 2003 corroborated these conclusions and allowed the excavation sequence to be adjusted to minimize the amount of material excavated to accomplish Source material removal. (See also Appendix D and Exhibits ES-FDR-2 through 4).

- ✓ The residential superstructures in the Fenced Area have been previously demolished and removed. All remaining foundations and soil below them will be removed as part of the cleanup. Also, the portions public roads that bisect the Fenced Area (Pilchuck Path, 5th St., and the alley east of Pilchuck Path), as well as underground and overhead utilities in these roadways and in the Fenced Area proper, will be removed to be able excavate Source and Residential soils in these areas. As such, the removal action will be total in this area; all remaining material will meet the concentration and depth requirements of the FCAP.

The excavation sequence and associated compliance sampling plans have been prepared to take advantage of these site characteristics. The key design elements incorporated into the excavation and removal plan are summarized in Table 2-2.

2.2.3 Evaluation of Surface Water and Groundwater Controls

Surface water and groundwater controls will be implemented during the interim action. As previously discussed, groundwater flux across the Fenced Area is low and is mainly confined to the shallow surface fill. While some groundwater will be present, only small quantities are expected and will be managed as part of the surface water control system. Significant groundwater dewatering is not anticipated.

TABLE 2-2. EXCAVATION AND REMOVAL DESIGN ELEMENTS

Design Element	Issue to Address	How Issue is Addressed in Design
Area and depth of excavation	How large an area to excavate and to what depth?	Source and Residential areas divided into discrete excavation units. Size of areas based on production of 750 to 1,250 CY/day using conventional excavating equipment capable of over-the-road delivery and use. Layout and target depths will allow excavation to proceed in controlled manner while still allowing for unplanned excavation of Source material if is encountered outside of expected areas. Active excavation areas will be minimized, making dust control and ESC provisions more manageable.
Area and depth of excavation	How will debris be handled if encountered outside of S areas?	Based on results of the 2003 investigations, only limited debris will be considered S material, primarily smelter flue dust and residuals as well arsenic trioxide. This type of material will be separated from soil where practical and sent to a Subtitle C facility for disposal. Other debris encountered (e.g., bricks, concrete) is not Source material and can be either disposed of in the Tacoma OCF or under the site-wide cap. Separation of these materials will not be needed; bricks and concrete can be included in residential stockpiles and handled as Residential soils with the exception of concrete foundations in Source areas. This concrete will be used as needed on-site to build ramps and for other construction needs in the excavation areas, after which it will be transported to Tacoma for disposal in the OCF. In the Lower area, almost all of the areas with R material will be excavated to remove S material first. As such, the likelihood of significant amounts of debris from R sites is low. However, a separate stockpile for debris will be established in the Lower area if needed.
Slope Stability	What are the provisions for cut slopes to assure safe excavation?	Previous investigations and Ecology's work in this area show that material can be excavated without excessive slope-back for stability. Shallow cuts (up to 4 ft.) may extend vertically while deeper excavations will need to be sloped back about 1:1. Trenches will be avoided and the contractor will be allowed to cut back or otherwise reduce side-slopes as needed based on conditions encountered. Protection from direct rainfall and runoff on cut slopes will be implemented via temporary sheeting or surface water diversions.

TABLE 2-2 EXCAVATION AND REMOVAL DESIGN ELEMENTS (continued)

Design Element	Issue to Address	How Issue is Addressed in Design
Slope Stability	Final site grading.	The existing Fenced Area topography has several terraced areas running north/south and has a general slope of about 1V:10H across the site from west to east and north to south. The post-cleanup topography will match existing elevations along Hawthorne St., East Marine View Dr., and at the southern limit of the Fenced Area. Final elevations before redevelopment will generally be lower across the site and the north/south slope will be decreased toward the northern end of the Fenced Area. The overall site will have a general slope about 1V:10H from west to east after remediation and will be graded so steeper transitions will be nominally 1V:3H. Redevelopment of the site will likely result in some variation of slopes within the Fenced Area but the overall slopes and match points to the surrounding properties will generally be as described above.
Cross-contamination	How will S and R material be kept from contaminating other areas, particularly those already remediated?	The excavation sequence is based on removal of S material occurring before R material. Source area boundaries extend beyond the neat-line limit established during the smelter area investigation to allow for variations in the distribution of S debris and material. Separate stockpiles for S and R materials will be established. Segregation of the site into clean, R, and S areas with a separate loadout area and traffic control and decontamination stations will limit potential cross-contamination. Surface water controls will be established to route runoff away from disturbed areas and to avoid runoff from S areas flowing across R or clean areas.
Surface Features	How will surface features be addressed?	Surface features include: vegetation and sod layer; concrete foundations; roads/road base; underground and overhead utilities. They will be addressed as shown in the Construction Plans and Specifications.
Confirmation at excavation depth	How will confirmation of cleanup levels be achieved? What if further excavation is needed?	Confirmation sampling is planned as described in Appendices A and C of this Final Design. The general approach for material that fails confirmation testing is to excavate another discrete interval (e.g., 4 – 6 inches) across the sub-area rather than implement a complex and time consuming sampling plan to chase "hot spots". Simply removing another depth interval and retesting provides the best assurance that any material remaining above the cleanup level is removed. This approach may be modified if it is clear that a smaller area is probably the source of higher concentrations (i.e., debris or residual by products) is visually evident and can be excavated and retested without the need for excavating the entire sub-area.

TABLE 2-2. EXCAVATION AND REMOVAL DESIGN ELEMENTS (continued)

Design Element	Issue to Address	How Issue is Addressed in Design
Decontamination	How will contamination be controlled beyond the Fenced Area?	Separate clean and contamination zones will be established at the site and people/equipment subject to decontamination before they exit the contaminated zone. A separate paved loading area along East Marine View Drive will be used to load trucks with containers for transport to the barge staging area. Trucks or other equipment that moves outside the active construction area will be subject to tire washing before they leave the site. Trucks and containers containing S or R material will be covered when they leave the site and during transportation by plastic sheeting or by application of a dust palliative to the surface in the container. Decontamination of this equipment will occur before it is released for other tasks. Decontamination procedures for S and R materials will generally include water wash/street sweeping to remove residual soil and/or physical removal (e.g., brooming, high pressure/low volume washing) to assure appropriate decontamination.
Stockpiling	Where and how will material be stockpiled on-site?	Stockpiling of materials will be needed prior to loadout and transport to Tacoma. Three different types of stockpiles may be used: ✓ Day piles – either S or R materials will be temporarily stockpiled in areas of the same type of material (i.e., no S material in an R sub-area) before loading to truck or container for transport later in the day. These piles should be less than 500 CY capacity. ✓ Accumulation pile – Stockpile A will be constructed to handle up to 4,000 CY nominal that may be used to aggregate sufficient volume to allow the S or R material to be transported and loaded to a barge. ✓ Debris piles – will only be used if necessary and will be kept small. They should be about 50 CY capacity. The existing shed at the north end of Pilchuck Path may also be used for this purpose if needed. All stockpiles will have appropriate surface water diversion and ESC measures (i.e., City of Everett requirements) as part of their construction and operation and will be covered at the end of each work day. Specifications for these stockpiles are included as part of the final design package.

Surface water controls for remediation of the residential properties adjacent to the Fenced Area are specified in the FCAP and will be implemented when remediation of these properties occur. For the remediation of the Fenced Area, surface water controls will be implemented based on the City of Everett Stormwater Management Manual (*Stormwater Management Manual – City of Everett Public Works Department*, Rev. 4/00). For this site, the primary surface water issues are:

- ✓ Minimizing, to the extent practical, the contact of direct precipitation, run-off within the Fenced Area, and run-on from outside the Fenced Area from contacting disturbed or stockpiled soils; and

- ✓ Collecting surface water that has come in contact with disturbed soils and removing suspended sediment before discharge to the City of Everett stormwater system.

The surface water control measures are in conformance with the Everett Stormwater Management Manual and are included in the Construction Specifications (Appendix F). The Everett Stormwater Management Manual provisions are incorporated as part of the final design specifications along with specific provisions to be implemented (see also *City of Everett Design and Construction Standards and Specifications for Development,* Rev. 4/02). The surface water management design is consistent with the Stormwater Management Manual and incorporates both Best Management Practices (BMPs) and Erosion and Sediment Control (ESC) practices. (See also Appendix H).

The remedial excavation is scheduled to be performed from May through August, which is the driest time of the year in Everett. While some rainfall can be expected, the storms are generally of short duration and low to medium intensity. The excavation sequence will allow any surface water that needs to be collected to be routed to the deepest areas excavated or to the on-site stormwater retention basin. Runoff collection, detention, and sediment removal will be needed before discharge. This will be accomplished by constructing a network of diversion dikes or hard-pipelines to route surface water to a detention pond or trap at the

lowest portion of the site adjacent to Marine View Drive. A sedimentation pond 30 ft. X 90 ft. X 6 ft. will treat the design storm runoff. It is feasible to build a facility with sufficient capacity in this area; the actual configuration and design parameters are included as part of the Construction Plans and Specifications. The pond will treat the entire volume of a 10 year -24 hour storm and discharges storm water via constant flow orifice to the storm sewer system. The BMP's and pond will be constructed at the outset of the work and will remain in service until the remediation work in the Fenced Area, including removal of all Residential soils, is completed.

The other key aspects regarding surface water control for the Fenced Area are summarized below:

- ✓ A permit is required by the City of Everett to discharge treated water to the storm sewer during the period from May through August 2004 (see Appendix I). After removal of the Source material is complete, a permit is not needed because the stormwater concentrations of arsenic and other metals will be below threshold at which a permit is required.
- ✓ General BMPs include, but are not limited to sediment detention ponds or traps, filter fabric fences, straw bale barriers, diversion dikes, inlet controls at catch basins, pipe slope drains, terracing, construction entrance rock pads, and hydroseeding.
- ✓ Intercepted groundwater (i.e., groundwater that "daylights") will be routed to the surface water system and handled as surface water from the point of collection on.
- ✓ Excavation, fill, and backfill work areas shall be continually and effectively drained. In particular, water will not be permitted to accumulate in excavations that are receiving material that will be compacted.
- ✓ The contractor shall be required to construct suitable dikes, drainage ways, hard-pipes, or provide portable pumping equipment to divert water flows away from work areas.
- ✓ Off-site water shall be routed around the site if possible; if it must flow across the site it will be prevented from contacting disturbed soils.

- ✓ Surface water originating from R areas will be prevented from contacting S soils insofar as is practical.
- ✓ Existing vegetative cover will remain in each sub-area until active excavation of that area begins.
- ✓ Stockpiles will be covered and BMPs implemented to divert surface water around the stockpile as well as to prevent migration of stockpiled material beyond the stockpile boundary.
- ✓ Periodic testing of surface water discharges will document the metals concentrations of surface water discharged from the Fenced Area during the interim action.

2.3 MATERIALS MANAGEMENT AND DISPOSAL

This section describes how material will be excavated, stockpiled, transported, and disposed of at the former Tacoma smelter and how clean backfill will be placed and graded following remediation. The following subsections of WAC 173-340-400 (4)(a) are addressed in this section:

(xi) Methods for management and disposal of any materials excavated and disposed of at the Tacoma smelter.

(xii) Facility specific characteristics that affect the movement and placement of materials at Everett and Tacoma, including;

(A)Relationship of the cleanup to the surrounding area.

(B)Probability of flooding, seismic, and other local planning and/or development issues that could affect the cleanup.

(C)Soil characteristics and groundwater system interactions with the cleanup.

2.3.1 Unit Operations for Excavation, Removal, and Backfill

Section 2.1.3 describes the excavation, stockpile, and backfill sequence for the Fenced Area. This section describes the individual unit operations associated with these activities. Unit operations are the distinct steps associated with the excavation, stockpiling, transportation and disposal of material from the Fenced Area.

The Fenced Area Excavation Flowcharts (Construction Specifications – Appendix F and Plan Sheet ES-SL-01) illustrate these unit operations for Source and Residential materials. Table 2-3 summarizes the key elements of each unit operation for both types of materials.

TABLE 2-3. UNIT OPERATIONS SUMMARY– EVERETT SMELTER

Unit Operation	Description of Operation and Alternatives
Clearing & Grubbing	Vegetation and sod layer: trees and shrubs within the Fenced Area will be removed and sent for off-site disposal at a permitted Subtitle D facility. The surface sod layer in R areas will be included with R soils for disposal at the Tacoma smelter. Surface sod which is also Source material will be stockpiled separately from other S material and sent for disposal at a Subtitle C facility.
Foundation/Road/ Utilities Demolition	Concrete foundations: these will be removed from S and R areas and handled in the same manner as the soils from the areas in which they are currently located. Foundations from Source areas will be used as needed on-site to build ramps and for other construction needs in the excavation areas, after which it will be transported to Tacoma for disposal in the OCF. Crushing and other size reduction, if needed, may occur at Everett or at the Tacoma smelter. In general, noise levels associated with crushing or any other on-site activities will be typical of a heavy construction site with large earthwork equipment and haul trucks/trailers (see also Construction Specifications, Section 1-5 Control of Noise). Roads and road base: asphalt will be removed and either recycled or disposed of at Tacoma. If the asphalt is recycled it will be sampled and analyzed as required by the recycling facility before excavation and shipment. Road base material will be will be removed from S and R areas and handled in the same manner as the soils from the areas in which they are currently located. Underground and overhead utilities: material will be removed and, if requested by the utility owner, decontaminated (if possible), and returned to them. Otherwise, these systems will be handled in the same manner as the soils from the areas in which they are currently located. Disposal will be at a Subtitle D facility for R material and a Subtitle C facility for S material.
Excavate & Load to Stockpile	Excavation is anticipated to use conventional equipment (e.g., CAT 300 series excavator nominal). More than one excavator may be used if space allows, particularly in deeper excavations. Production is anticipated to be about 750 – 1,250 TPD. The excavator(s) will load to 10 - 15 CY nominal dump trucks for transfer to stockpiles unless they are proximate enough to load to stockpile directly. Excavators will load containers that will subsequently be transported to the Tacoma smelter or to other off-site facilities

TABLE 2-3. UNIT OPERATIONS SUMMARY– EVERETT SMELTER (continued)

Unit Operation	Description of Operation and Alternatives
Stockpile	Three options are available: ✓ Day piles – either S or R materials will be temporarily stockpiled in areas of the same type of material (i.e., no S material in an R sub-area) before loading to truck or container for transport later in the day. These piles should be less than 500 CY capacity. ✓ Accumulation piles – these are larger stockpiles (up to 4,000 CY) that will be used to aggregate sufficient volume to allow the S or R material to be transported and loaded to a barge. ✓ Containers – the option of using shipping containers capable of containing and transporting soil is the preferred choice available; these are typically the size of standard shipping containers and can handle up to 20 CY ±. These will either be loaded from a day pile or directly from the point of excavation and transported to the container staging area adjacent to the barge tie-up. Stockpiles need to be worked and shaped by a loader and will be covered at the end of each workday.
Loadout & Transportation to Tacoma	Loadout and transportation to Tacoma may occur via any or all of the following methods: ✓ Load from either day or accumulation piles via front end loader to containers and transport via truck for short-haul to the barge loading area,. Barge logistics are based on movement of about 75 – 100 containers at a time. Barges containing 1,500 – 2,000 CY of material would be towed to the Tacoma smelter. ✓ Loadout of containers to barge will probably use two fork lifts or a crane in a "pass-pass" method where one forklift or crane picks the container on shore and passes it to another forklift on the barge. ✓ Loadout from stockpiles to 30 ton (nominal) "truck and pup" over-the-road trucks and transport to the Tacoma smelter via road. A front end loader would load the truck.

TABLE 2-3. UNIT OPERATIONS SUMMARY– EVERETT SMELTER (continued)

Unit Operation	Description of Operation and Alternatives
Unload & Stockpile at Tacoma, Decon	Unloading at the Tacoma smelter is essentially the reverse of the previous unit operation: ✓ Container unloading would will probably use two fork lifts or a crane in a "pass-pass" method where one forklift or crane picks the container from the barge and passes it to another forklift on the shore. Empty containers would be loaded in reverse manner. Decon of containers will follow final transfer of Source or Residential materials. ✓ Unloading the containers in the OCF will be accomplished by hauling them into the cell using off-road dump trucks with the chassis modified to accept containers. If possible, unloaded material will be immediately placed in the OCF. Decontamination following delivery of the final shipment for each container will be accomplished at the Tacoma smelter.
Size S or R material	Source material must be less than 24 inches to be placed in the Tacoma OCF; R material must conform to the subgrade cap specifications at Tacoma for placement below the site-wide cap. Material that needs to be sized will be screened and/or crushed at Tacoma after delivery. If material meets the size requirements upon delivery then it may be able to be placed directly.
Place S or R material	Source material that is appropriately sized can be placed in the OCF provided it passes the "paint filter test". As this material is being received essentially dry, this requirement should easily be satisfied. Residential material that is the appropriate size and meets the other requirements for sub-grade backfill can be placed below the site wide cap.

The on-site requirements for material management have previously been discussed. Off-site requirements will be governed by state and federal regulations covering hazardous materials. These requirements are well established for over-the-road transportation of S and R materials to the Tacoma smelter or to other permitted disposal facilities. There are several licensed transporters that can move the material to disposal facilities and comply with all the applicable containment, spill response, and decontamination requirements. While feasible, over-the-road transport may pose disadvantages in terms of higher cost, truck availability to support site work schedules, and traffic disruption, both at Everett and Tacoma. The use of over-the-road trucks to transport the majority material to Tacoma is less preferable than other options; however, trucks and/or rail transport to other facilities will be necessary.

The option of transporting Source and possibly Residential soils to Tacoma utilizing shipping containers and barge has been arranged and the specific logistics will be finalized before contractor mobilization on-site (see Transportation Plan, Appendix G). There are two potentially available barge loadout facilities in Everett close enough to be practical. Figure G-1 (Appendix G) shows the proposed staging areas and transportation routes for truck, rail, and barge. This is the preferred alternative and barging appears to be the most cost effective means to move material from Everett to the Tacoma smelter and will likely reduce or eliminate traffic delays and impacts, both to the public and project-related at Everett and Tacoma. The Tacoma smelter has received material by barge, most recently the import of several hundred thousand tons of material needed to build the OCF berm.

Control of any spillage, decontamination measures, and other steps needed to keep S and R material contained and secure from loading in Everett to its receipt at the Tacoma smelter are greatly reduced with the use of shipping containers. The containers are conventional 8 ft X 8 ft X 20 ft and have a maximum weight capacity of 32 tons (about 20 CY) and will still have about 4 ft of "freeboard" between the top of the container and the top of the material inside. Loadout of the containers at Everett allows the material to be contained until placement in the OCF without any intermediate material transfer steps. Containers can be stacked or tarped to

limit contact with rain during the transport and staging. Additional details regarding the transportation of materials off-site are included in the Transportation Plan (Appendix G).

2.3.2 Other Facility-Specific Characteristics

The FCAP and documents previously submitted to Ecology by Asarco (e.g., the Everett RI/FS and the IAR)) characterize the Everett site in detail and this information is not repeated in this Final Design Report except for supplemental site verification investigations conducted in 2003 (see Appendices D and E and Exhibits ES-FDR-1 through 4). The FCAP also addresses removal of S material from the Fenced Area. The FCAP, as amended, contains provisions for removal of all the R material from the Fenced Area as well as removal of all material outside the Fenced Area with concentrations greater than 3,000 mg/kg As (see *IAR*).

The other facility specific characteristics that affect the movement and placement of materials at Everett and Tacoma are summarized below:

Relationship of the Cleanup to the Surrounding Area

The area surrounding the Fenced Area is primarily residential to the west and south with arterial streets bounding the site to the north and east. Access to the Fenced Area is limited to Hawthorne St., Pilchuck Path, 5th St., and East Marine View Dr. The sequence of remediation activities described in Section 2.1.3 takes this constraint into account. The main transportation routes are via East Marine View Drive, Pilchuck Path, and 5th St. Pilchuck Path, the alley immediately to the east, and 5th St. will all be removed during the interim remedial construction and not replaced until the site development phase. The primary site access loadout and haul will be via East Marine View Drive during this period. Contractor access to the site will be controlled at Hawthorne Drive, Pilchuck Path, and 5th St.

The most noticeable aspect of the remediation with the surrounding area is likely to be the amount of truck traffic to and from the site. Unfortunately, there is no other alternative to remove and deliver material at the site except to use trucks. A similar situation exists at the Tacoma smelter; the primary route for truck traffic between Everett and Tacoma is via

Ruston Way. This two-lane arterial can pose significant delays on truck cycle times, especially during commuting hours or on fair weather days in the spring and summer. Barging the majority of the material to the Tacoma smelter will avoid this problem and will substantially minimize the impacts in Everett and Tacoma. The Transportation Plan has been prepared to deal with the anticipated affects based on the transportation methods(s) selected. Even with barge transport, some over-the-road truck traffic will occur at Everett because not all material will be shipped to the Tacoma smelter. Material that is transported to other disposal facilities will be shipped either by commercial truck or via rail.

The provisions for public health and safety are addressed in the Health and Safety Plan in Appendix B and in the Construction Specifications in Appendix F.

Flooding, Seismic, and Other Local Planning and/or Development Issues

The potential for flooding and seismic issues affecting the cleanup at this site are minimal. The site is geologically stable, on relatively shallow slopes, and at the top of a hill that receives incidental run-on from surrounding areas. The surface water control plan is based on a 10 year-24 hour design storm as required by the City of Everett. Excavation and re-grading will occur during the drier months of the year, avoiding the major potential for storm events and run-off volumes in excess of the stormwater control capacity.

Redevelopment of the site is probable and desirable; however, this remediation design does not incorporate redevelopment features, particularly roads and utility services at this time. Should Asarco and/or a developer pursue redevelopment of the site, these features could be integrated into the final grading, a move that could be cost effective. Any redevelopment would follow the normal process for such activities governed by the City of Everett. The final grading plan will be prepared to accommodate the development if it can be accomplished in conjunction with the backfill of the site.

Soil Characteristics and Groundwater System Interactions with the Cleanup

As previously described, there are no inherent soil characteristics or groundwater conditions that will materially interfere or hinder the cleanup. Excavation to depths of 15 ft. ± into glacial till is expected to be difficult but surmountable with conventional equipment. Smelter debris will probably give rise to some surprises during the excavation; the design acknowledges this potential by keeping production rates reasonable and disturbed areas to a minimum. The material handling flowsheets shown in the Construction Specifications (see Appendix F) further explain how different materials will be handled as they are encountered.

2.4 PROVISIONS FOR REMOVAL OF REMAINING RESIDENTIAL MATERIAL

The IAR provided the overall removal sequence and logistics for Residential material in the Fenced Area and the surrounding residential properties. As discussed in Section 1, the EHA and Asarco are negotiating the purchase and sale of all company-owned properties with provisions for remediation of the associated properties. While this Final Design Report addresses the remediation of the Source material, the planning to incorporate remediation of Residential soils as described in the IAR as part of the Purchase and Sale is proceeding. Because of the timing of the property transactions anticipated and the ongoing revisions to the Residential remediation plans to address property acquisition conditions, it is premature to present plans beyond those described in the IAR.

If the EHA and Asarco reach agreement on the purchase and sale of the property such that Residential soils will be remediated, the following revisions to the plans in this document will be made and submitted to Ecology for approval:

- Construction Specifications (Appendix F) will be revised to incorporate removal of Residential material in the Fenced Area and surrounding properties;
- Construction Plans will be revised in the same manner to incorporate removal of Residential material in the Fenced Area and surrounding properties; and
- The Transportation Plan (Appendix G) will be revised accordingly.

The other plans contained in this document (i.e., Appendices A, B, C, H, and I) already address the potential remediation of Residential soils and will not require further revisions to implement this action.

3.0 REGULATORY COMPLIANCE

This section completes the requirements of the Engineering Design Report and addresses the following subsections of WAC 173-340-400 (4)(a):

(xiii) General Description of construction quality control and testing to be performed

(xiv) General Description of compliance monitoring to meet the requirements of WAC 173-340-410

(xv) General Description of construction procedures to assure the safety and health requirements of WAC 173-340-810 are met

(xvi) Not needed

(xvii) Permitting requirements and access issues

(xviii) Not needed

(xix) Institutional controls per the FCAP (residential properties) and otherwise needed for the Fenced Area

3.1 COMPLIANCE MONITORING

The FCAP describes the procedures and protocols for these items in the residential areas adjacent to the Fenced Area. The FCAP, as amended, addresses removal both S and R material from the Fenced Area. The compliance monitoring requirements for the Fenced Area are addressed in Appendix A and are based on protocols in the Interim Action Report, which are part of the amended FCAP/FEIS..

Quality control (QC) provisions are included in the Compliance Monitoring Plan (Appendix A) and the Sampling and Analysis Plan (Appendix C). The Compliance Monitoring Plan is primarily aimed at chemical data obtained by sampling the excavated surface following removal. It also addresses chemical requirements and basic physical properties of imported material used as backfill as specified in the FCAP. The specifications for backfill material as well as the physical testing to be accomplished during backfilling and final grading have not been finalized yet in expectation that site redevelopment will be integrated with the final cleanup. Once a decision is reached regarding the development

approach and timeline, these specifications, including quality control requirements based on the *City of Everett Design and Construction Standards and Specifications for Development,* Rev. 4/02, will be finalized and incorporated into the attached plans and specifications. Additional quality control requirements applicable to backfill and grading activities may also be included from ASTM or WSDOT protocols as needed.

The Health and Safety Plan (Appendix B) addresses monitoring for field personnel and for the general public. The primary exposure path for both workers and the general public will be via airborne emissions. As such, rigorous dust control provisions will be instituted to control emissions to levels below applicable standards. A general "no visible dust" standard will be imposed to assure that no visible dust is present at the fence line. The contractor will be required to rigorously implement demonstrated dust suppression methods (e.g., water sprays) at the points of dust generation anywhere on the site to assure compliance with the no visible dust standard (see Appendix B-4 Dust Control Plan). Air sampling will be conducted for both field personnel (personal samples) and at the fence line to measure ambient concentrations.

3.2 PERMITTING REQUIREMENTS

MTCA provides an exemption from the procedural requirements of the following state laws, though their substantive requirements must be met:

- RCW 70.94, Washington Clean Air Act
- RCW 70.95, Solid Waste Management Reduction and Recycling
- 70.105, Hazardous Waste management
- RCW 75.20, Construction Projects in State Waters
- RCW 90.48, Water Pollution Control, and
- RC 90.58, Shoreline Management Act of 1971

Ecology's FCAP incorporates the substantive requirements of applicable or relevant and appropriate requirements of the state laws listed above. (FCAP, Section 3.3). Because the proposed interim cleanup action is consistent with and meets or exceeds the requirements of the FCAP, the proposed interim action also complies with the substantive requirements of these laws and regulations.

Regarding local permits for construction activities entailed in the interim cleanup action, MTCA also provides an exemption from the procedural requirements of laws authorizing local government permits or approval for remedial actions. Again, the substantive requirements of local ordinances affecting land use, development and construction must be met. Asarco will provide a copy of all substantive permit requirements to Ecology. These requirements will become part of the Enforcement Order.

The City of Everett has advised Ecology that substantive requirements for grading, storm water control, work in City rights-of-way, and other construction-related requirements will apply to the final cleanup and, by extension, to this interim cleanup action. In Everett, the applicable requirements are implemented through the City's Public Works permit process. Section 4.2 of the IAR (Applicable Permits) addresses how the substantive requirements are met in the design implementation of the interim cleanup action.

Asarco will require access to property that it does not own to complete the interim action. In the vicinity of the Fenced Area, access to roadways and other public areas will need to be obtained from the City of Everett. Utility providers will also need to provide access to their systems or equipment during the cleanup.

A wastewater discharge permit will be needed to allow stormwater discharge during the period which Source material will be removed from the site (i.e., May – August, 2004). This permit application and supporting information is in Appendix I.

3.3 INSTITUTIONAL CONTROLS

The FCAP describes the Institutional Controls required for the residential properties adjacent to the Fenced Area. These will be implemented upon completion of the remediation of these properties, whenever that occurs. Because the Fenced Area is being remediated to the same standard as other residential properties, the Institutional Controls will be the same as for other residential properties under the FCAP, with the exception that Asarco-owned property must have deed covenants to address future handling of any contaminated soil remaining on the property. These will be implemented after the cleanup of the Fenced Area is finished.

4.0 SUPPLEMENTAL PLANS

Per WAC 173-340-44 (4) (b), the following supplemental plans are included in the Construction Plans and Specifications. Theses plans were presented in the IAR but have been updated and revised to incorporate the final design and construction details.

4.1 OPERATION AND MAINTENANCE PLAN

The Operation and Maintenance Plan conforms to the requirements of WAC 173-340-4 (4) (c) for this Interim Action and appropriate O&M provisions are included in the Construction Plans and Specifications (see also the provisions and deadlines for other plans in Section 1).

4.2 AMENDMENT AND SEPA ADDENDUM (DECEMBER 2002)

As required by the *Everett Smelter Site – Amendment and SEPA Addendum to the Integrated Final Cleanup Action Plan and Final Environmental Impact Statement for the Upland Area,* Asarco has prepared a Transportation Plan. This Plan is included in Appendix G.

As discussed in Section 1, the Landscape Buffer Plan, the Final Site Restoration Plan, and the Final Program of Institutional Controls & Monitoring Plan will be completed in conjunction with the site development phase. Asarco is currently exploring potential post-remediation uses with the EHA for the site the remaining plans will be included into the overall site development plan.

4.3 CITY OF EVERETT SUBMITTALS

There are two submittals to the City of Everett included with this document:

- The Site Stormwater Plan (Appendix H)
- The Wastewater Discharge Permit Application (Appendix I)

5.0 CONSTRUCTION PLANS AND SPECIFICATIONS

In accordance with WAC 173-340-4 (4) (b), Construction Plans and Specifications were developed based upon the design criteria described in this report and inclusive of the FCAP remedial goals. Appendix F contains the Construction Specifications. Construction Plans have been prepared and are an additional submittal to Ecology accompanying this report.

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Appendix A

APPENDIX A

COMPLIANCE MONITORING PLAN

COMPLIANCE MONITORING PLAN

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Revision 2

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COMPLIANCE MONITORING PLAN

In accordance with WAC 173-340-410, this plan addresses the compliance monitoring requirements. Compliance monitoring is comprised of three types of monitoring:

I. Protection Monitoring
II. Performance Monitoring
III. Confirmational Monitoring

In addition, the FCAP requires the development of a Contingency Plan to address actions to be taken if protection, performance, or confirmational monitoring identifies environmental conditions which are out of compliance (see Section IV).

I. PROTECTION MONITORING

Protection monitoring is conducted to confirm that human health and the environment are adequately protected during implementation of interim actions. As stated in WAC 173-340-410(3) and the FCAP, protection monitoring requirements may be addressed in the Health and Safety Plan. The Health and Safety Plan is included as Appendix B.

II. PERFORMANCE MONITORING

Performance monitoring is conducted to confirm that the interim actions have attained the identified standards including cleanup and remediation levels. As stated in WAC 173-340-410(3), performance monitoring requirements may be addressed in separate plans. The requirements of WAC 173-340-820 and WAC 173-340-830 as referenced in WAC 173-340-410(3) will be addressed in the Sampling and Analysis Plan which generally includes sample collection, processing, and analysis procedures as well as quality assurance and quality control measures. The Sampling and Analysis Plan is included as Appendix C.

Performance monitoring will be conducted for soil in excavation areas and import material at selected residential properties in the Peripheral Area (properties outside the Fenced Area) and

the Former Arsenic Trioxide Processing Area (Fenced Area). In addition, performance monitoring will be conducted for surface water, groundwater, and storm drain sediment near the areas of remediation. The following describes the performance monitoring requirements.

1.0 SOIL

Performance monitoring for soil will consist of comparing the laboratory results to the selected remediation levels identified in the FCAP. The remediation levels are as follows based on the total arsenic concentration:

Depth	Average (mg/Kg)	Maximum (mg/Kg)
0-1 feet	20	40
1-2 feet	60	150
2-15 feet	150	500

The average remediation levels will be compared with the composite sample results. The maximum remediation levels will be compared with the discrete sample results, if analysis of discrete samples is conducted.

Two exceptions have been identified by Ecology in the FCAP. The first is for gardens at residential properties identified by the owners. At these gardens, the remediation levels are an average of 20 mg/Kg and a maximum of 40 mg/Kg for arsenic concentrations to a depth of 18 inches rather than 12 inches. The second exception is for maintenance areas not normally occupied. At these areas, the remediation level is an average of 200 mg/Kg for arsenic concentrations.

1.1 PERIPHERAL AREA

1.1.1 Sample Collection Strategy

Selected residential properties within the historically owned Asarco property boundary may be remediated in this interim action (see Figure A-1-1). Note that the individual property boundaries depicted on Figure A-1-1 are estimated. Prior to work commencing, Asarco will

confirm actual boundaries by working with the County Assessor's Office regarding property ownership.

Should the properties in the Peripheral Area adjacent to the Fenced Area be remediated, the cleanup will be performed per the requirements of the FCAP. In accordance with the FCAP, sampling criteria will follow the requirements listed for Zone B. The FCAP specifies five sampling locations (bore holes) per 1,125 square foot decision unit. However, the FCAP also allows a decision unit to be larger in size provided additional borings are advanced. To remain consistent with Ecology's original field sampling plan, no decision unit may exceed 6,000 square feet. The sampling frequency for Zone B properties are shown below in Table A-1-1:

TABLE A-1-1 SAMPLE FREQUENCY FOR ZONE B

Decision Unit Size (ft^2)	No. of Bore Holes per Decision Unit
<1,125	5
1,125-1,800	Add 1 per 225 ft^2
1,800-4,000	8
4,000-6,000	Add 1 per 500 ft^2

Sample locations will be distributed evenly to the extent practicable. Samples will be collected at 6-inch intervals. The discrete samples collected from each decision unit will have an equal volume composited by depth interval. Rather than collecting and analyzing samples from the top 24 inches (4 depth intervals), at least two feet of soil will be removed at all the selected properties prior to sample collection and analyses. Therefore, once soil is removed to a depth of 2 feet, two depth intervals (24-30 and 30-36 inch) will be collected and analyzed for each decision unit to determine if additional excavation is required. The samples will be analyzed within 24 hours during the work week (Monday through Friday). Based on the results, additional sampling will be performed if soil removal is required to a

depth of 36 inches or more. This sampling approach will not cause the excavation area to remain open any longer than if all sampling was conducted prior to soil removal. Typically, remediation at a residential yard can be expected to take about two weeks. Table A-1-2 summarizes the estimated sample collection information for the selected residential properties.

Each discrete sample will be archived for possible analysis in case laboratory results for composite samples indicate an arsenic concentration greater than the equation provided in the FCAP. The equation is:

$$As_{comp} > \frac{[RL_{max} + (7\ mg/Kg)(n-1)]}{n}$$

As_{comp} is the arsenic concentration in the composite sample; n is the number of discrete samples which originally were collected and composited for the decision unit; RL_{max} is the maximum arsenic concentration remediation level for the given depth interval; and 7 mg/Kg is an assumed arsenic concentration for n-1 out of the n samples collected.

Gardens identified by the owner will be segregated from the yard and considered unique decision units. Generally, gardens will have two sample locations. In addition, flower beds or landscape areas will be sampled separately in an attempt to avoid soil removal if requested by the owner.

Maintenance areas not normally occupied will be sampled in a different manner. At these areas, four discrete surface samples will be collected from 0-2 inches and composited. Only the composite sample will be compared to the average remediation level to determine if remedial actions are required.

1.1.2 Sample Numbering System

The sample designation for discrete samples will contain the assigned property number (see Figure A-1-1), decision unit number, type of sample (D for discrete), bore hole number, and

depth interval (A=0-6", B=6-12", C=12-18", D=18-24", E=24-30", and F=30-36"). For example, a sample collected from the front yard decision unit (No.1) from the second bore hole from the depth interval 24-30 inches will be "IA01-1-D-B2-E". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification. It is noted that a sufficient amount of sample may not exist from discrete samples for field duplicates or splits once a portion has been removed for the composite sample. If a garden or landscape area is sampled, a "G" or "LS" respectively will be used instead of the decision unit number.

The sample designation for composite samples will contain the assigned property number, decision unit number, type of sample (C for composite), and depth interval. For example, a sample composited from the 24-30 inch interval in the back yard decision unit (No.2) will be "IA01-2-C-E". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification. If a garden, landscape area, or maintenance area not normally occupied is sampled, a "G", "LS", or "MA" respectively will be used instead of the decision unit number.

1.1.3 Property Access and Sample Data Sharing

Property access will be required for residential properties not currently owned by Asarco. Property owners will be identified and asked to sign an access agreement with Asarco. In the event Asarco is unable to obtain access under reasonable terms and conditions, Ecology will be asked to assist in obtaining access.

Once access is granted, an "Existing Configuration" figure for the property will be prepared that includes proposed decision units with their area size in square feet. An Asarco representative will then visit with the owner to prepare a "Proposed Configuration" figure for the property. Asarco will make every attempt to accommodate reasonable changes requested by the owner. At that time, the owner will authorize a "Sign Up" form to begin the work. A copy of the "Existing Configuration" figure, the "Proposed Configuration" figure, and the

"Sign Up" authorization will be given to the owner, Ecology, and the contractor prior to initiating soil removal and replacement.

Upon receipt of passing laboratory results, a "Performance Monitoring" figure (see Figure A-1-2) will be prepared to depict the sample locations and data for each decision unit within a property. Upon completion of backfilling activities including sodding, etc., an Asarco representative will again meet with the owner have them sign off on the authorization form stating that the work has been completed as proposed.

At the end of the project, Asarco will submit a copy of the "Existing Configuration" figure, the "Proposed Configuration" figure, the performance monitoring data summary table, the "Performance Monitoring" figure, and the "Sign Up/Sign Off" authorization to each owner and Ecology.

1.2 FENCED AREA

Performance monitoring at the Fenced Area will be conducted as specified in the Interim Action Report, which is part of the amended FCAP/FEIS. The full scope of the interim action would allow the area to be redeveloped into residential lots by removing all soil containing arsenic concentrations exceeding 150 mg/Kg rather than constructing a consolidation facility. Therefore, a different sampling strategy is required to address all the remediation levels to a depth of 15 feet. A contingency plan is discussed in Section IV should the full potential scope of the interim action not be pursued which includes sample collection as detailed in the FCAP prior to amendment following the removal of material containing arsenic concentrations exceeding 3,000 mg/Kg.

If the full potential scope of the interim action is pursued, three phases of performance monitoring will be conducted. The first phase will consist of sample collection after the soil containing arsenic concentrations above 3,000 mg/Kg have been removed. The second phase will be conducted after the soil containing arsenic concentrations above 150 mg/Kg have been removed. The third phase will be conducted after the final "cut and fill" is completed but before clean import material is placed.

As outlined in the contingency plan (see Section IV), the FCAP requires sample collection to a depth of three feet beneath the limit of excavation once the material believed to contain arsenic concentrations greater than 3,000 mg/Kg has been removed. In lieu of this time consuming and difficult sample collection procedure, Phase 1 will consist of two sampling events should the full potential scope of the interim action be pursued. This strategy will prevent contractor downtime waiting for analytical results with subsequent Ecology approval before moving to Phase 2. In addition, this sampling approach will satisfy the intent of the FCAP addressing soils three feet below the initial excavation thus allowing Ecology to approve the remedial work and Asarco to expedite a potential land transfer.

The first sampling event in Phase 1 will be "Removal A" and consist of collecting samples from the excavation floor and perimeter once the soil is removed as outlined in the final design specification. Once laboratory results indicate that arsenic concentrations are less than 3,000 mg/Kg, an additional three feet of material will be removed from each excavation grid floor and perimeter. Lesser depths may be removed with Ecology approval. A second sampling event in Phase 1, "Removal B", will then be conducted.

It is noted that in some decision units, soil with arsenic concentrations less than 3,000 mg/Kg must be removed in order to remove the source area soils (soil with arsenic concentrations greater than 3,000 mg/Kg) in Phase 1. This soil will be stockpiled and subsequently sampled to confirm that arsenic concentrations are below 3,000 mg/Kg. A "4 X 1" composite sample will be collected and analyzed for every 1,000 cubic yards generated. In addition, the soil removed as part of Phase 1 Removal B will be sampled to confirm its classification of residential soil versus source soil. This soil will also be stockpiled and subsequently sampled to confirm that arsenic concentrations are below 3,000 mg/Kg. A "4 X 1" composite sample will be collected and analyzed for every 1,000 cubic yards generated.

1.2.1 Phase 1 Sample Collection Strategy

Soil samples will be collected from the floor (0-6 inch interval) and the outer perimeter of the excavation grids (i.e., decision units) as shown on Figure A-1-3. These units are the same as the excavation sub-areas described in Section 3 of the Interim Action Report.

Floor samples will be collected from each identified decision unit in accordance with the sample frequency identified in the FCAP. The FCAP specifies five sampling locations per 1,125 square foot decision unit. However, the FCAP also allows a decision unit to be larger in size provided additional borings are advanced.

To remain consistent with Ecology's original field sampling plan, no decision unit may exceed 6,000 square feet. Floor sample locations will be distributed evenly to the extent practicable. In accordance with the FCAP, sampling criteria for floor samples will follow the requirements listed for Zone A. The sampling approach for Zone A properties are shown below in Table A-1-3:

TABLE A-1-3 SAMPLE FREQUENCY FOR ZONE A

Decision Unit Size (ft^2)	No. of Sampling Locations per Decision Unit
<1,125	5
1,125-2,250	Add 1 per 225 ft^2
2,250-4,000	10
4,000-6,000	Add 1 per 400 ft^2

Asarco will collect perimeter samples from decision units that represent the outer side slope of the excavation (see Figure A-1-3). These samples will be collected at two foot depth intervals beginning with the surface to the excavation base at four locations along the decision unit's boundary that forms the perimeter of the excavation, which will usually be a continuation of the excavation boundary with adjacent units. Samples will be collected directly from the excavation cut.

Only composite samples will be collected and analyzed during Phase 1 sampling. For perimeter samples, samples will be composited by depth interval. If a composite sample indicates an arsenic concentration greater than 3,000 mg/Kg, the decision unit will be re-excavated as determined by the Field Engineer (see Section 3 of the Interim Action Report). Table A-1-4 summarizes the estimated sample collection for Phase 1 sampling. The perimeter sample counts in the table are based on an estimated average excavation depth. It is noted that depths sampled will be dependent on the actual depth of the excavation.

1.2.2 Phase 1 Sample Numbering System

To remain consistent with the engineering design, the Fenced Area is divided into two source area excavation zones developed for soil removal. The two source zones will represent the upper and lower areas. The upper area decision units will be designated as "US" (Upper Source) while the lower area will be "LS" (Lower Source).

The sample designation for floor samples will contain the project location (IAFA for interim action in the Fenced Area), sampling phase and event, sample area (F for floor), decision unit, and round of soil removal. The round of soil removal will assist in identifying re-excavations. For example, the first floor sample collected from decision unit US1 during Removal A will be "IAFA-P1A-F-US1-1". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

The sample designation for perimeter samples will contain the project location (IAFA for interim action in the fenced area), sampling phase, sample area (P for perimeter), decision unit, depth (A=surface, B=2', C=4', etc.), and round of soil removal. For example, the perimeter surface sample collected from decision unit US1 during Removal B will be "IAFA-P1B-P-US1-A-1". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

1.2.3 Phase 2 Sample Collection Strategy

Soil samples will be collected from the decision unit's floor (0-6 inch interval) as shown on Figure A-1-4. In addition, where appropriate, samples will be collected from the outer perimeter of the side slope directly from the excavation cut.

Floor samples will be collected from each identified decision unit in accordance with the sample frequency identified in the FCAP. The FCAP specifies five sampling locations per 1,125 square foot decision unit. However, the FCAP also allows a decision unit to be larger in size provided additional sample locations are collected.

To remain consistent with Ecology's original field sampling plan, no decision unit may exceed 6,000 square feet. Floor sample locations will be distributed evenly to the extent practicable. In accordance with the FCAP, sampling criteria for floor samples will follow the requirements listed for Zone A (see Table A-1-3).

Asarco will collect perimeter samples from decision units that represent the outer side slope of the excavation cut (see Figure A-1-4). Samples will be collected at two foot depth intervals beginning with the surface to the excavation base at four locations along the decision unit's boundary that is in common with an adjacent unit.

Discrete samples that are collected from each decision unit will have an equal volume composited. For perimeter samples, samples will be composited by depth interval. Each discrete sample will be archived for possible laboratory analysis in case laboratory results for composite samples indicate an arsenic concentration greater than the equation provided in the FCAP (see Section 1.1.1 above). Table A-1-5 summarizes the estimated sample collection. The perimeter sample counts in the table are based on an estimated average excavation depth. It is noted that depths sampled will be dependent on the actual depth of the excavation.

1.2.4 Phase 2 Sample Numbering System

To remain consistent with the engineering design, the Fenced Area is divided into two source and two residential area excavation zones developed for soil removal. The four zones will represent the type of material in the upper and lower areas. The upper area decision units will be designated as "US" (Upper Source) and "UR" (Upper Residential) while the lower area will be "LS" (Lower Source) and "LR (Lower Residential).

The sample designation for floor samples will contain the project location (IAFA for interim action in the Fenced Area), sampling phase, sample area (F for floor), decision unit, sample type (D for discrete and C for composite), and round of soil removal. For example, the first floor composite sample collected from decision unit US1 will be "IAFA-P2-F-US1-C-1". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification. Discrete samples will also have the sample location identified after the sample type. For example, the same sample collected from the first location will be "IAFA-P2-F-US1-D-L1-1".

The sample designation for perimeter samples will contain the project location (IAFA for interim action in the Fenced Area), sampling phase, sample area (P for perimeter), decision unit, sample type (D for discrete and C for composite), depth (A=surface, B=2', C=4', etc.), and round of soil removal. For example, the perimeter surface composite sample collected at decision unit US1 will be "IAFA-P2-P-US1-C-A-1". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification. Discrete samples will also have the sample location identified after the sample type. For example, the same sample collected from the first location will be "IAFA-P2-F-US1-D-L1-1".

1.2.5 Phase 3 Sample Collection Strategy

A final round of sampling, Phase 3, will be performed at the upper and lower areas once the final "cut and fill" has been completed and prior to site development. This sampling will be performed prior to backfilling clean import material. Although this sampling approach is not specified in the FCAP, Asarco and Ecology agreed to a sampling strategy that would provide data on arsenic concentrations up to a depth of four feet below the final grade. This information will be used in the preparation of deed restrictions. Because at least two feet of clean material will be placed after the final "cut and fill", the Phase 3 sampling will require sample collection to a depth of two feet (two feet of clean material and two feet of existing soil equals a minimum of four feet below the final grade).

A grid system will be used that establishes approximately 2,500 square foot decision units (see Figure A-1-5). A single bore hole will be advanced in each decision unit. A discrete sample will be collected at six inch depth intervals to a depth of two feet. Because two feet of clean material will be brought in, these samples will represent the soil that will be two feet to four feet below the final grade. Therefore, the four depth intervals will be identified as 24-30, 30-36, 36-42, and 42-48 inches. Table A-1-6 summarizes the estimated sample collection for Phase 3.

1.2.6 Phase 3 Sample Numbering System

The sample designation will contain the project location (IAFA for interim action in the Fenced Area), sampling phase, decision unit, and depth (E=24-30", F=30-36", G=36-42", and H=42-48"). For example, the first sample collected from decision unit A1 will be "IAFA-P3-A1-E". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

2.0 IMPORT MATERIAL

2.1 BACKFILL (SUBSOIL)

The FCAP specifies that imported backfill (subsoil) must be sampled for priority pollutant metals including: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. In addition to the chemical analyses, two samples of backfill will be tested for pH and particle size. One sample will be tested prior to work commencing and the second sample will be tested when the project is about 50 percent complete for the construction season. The backfill must be sandy, freely draining material that meets the engineering specifications identified in the Interim Action Report. The pH must be in the range of 5.5 and less than 7.5.

2.1.1 Sample Collection Strategy

In accordance with the FCAP, samples for chemical analyses will be collected and analyzed at the rate of one sample per 1,000 cubic yards. Each sample will be a "4 X 1" composite of a stockpile at the supplier's location. Table A-2-1 summarizes the sample collection for import material.

2.1.2 Sample Numbering System

The sample designation for backfill samples will contain the project identification and soil type (IA for interim action and BF or backfill) and numerical order of sample collection. For example, the first sample collected will be "IABF-1". Field duplicates will have a "D" added

to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

2.2 TOPSOIL

The FCAP specifies that imported topsoil must be sampled for priority pollutant metals including: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. In addition, topsoil must be analyzed for PCBs, organochlorine pesticides, semivolatile organic compounds, volatile organic compounds, and cyanide.

Two samples of topsoil will also be tested for pH, particle size, and fertility. One sample will be tested prior to work commencing and the second sample will be tested when the project is about 50 percent complete for the construction season.

The topsoil must be designated as a sandy loam based on the USDA standards. It should also comply with the criteria shown in Table A-2-2. This criteria is Asarco's preferred specifications and Asarco reserves the right to accept or refuse any topsoil not meeting these criteria. Asarco may allow amending the soil at the supplier's location per the direction and advise of a soil specialist based on the test results.

2.2.1 Sample Collection Strategy

In accordance with the FCAP, samples for chemical analyses will be collected and analyzed at the rate of one sample per 1,000 cubic yards. Each sample will be a "4 X 1" composite of a stockpile at the supplier's location. Table A-2-1 summarizes the sample collection for import material.

2.2.2 Sample Numbering System

The sample designation for topsoil samples will contain the project identification and soil type (IA for interim action and TP or backfill) and numerical order of sample collection. For example, the first sample collected will be "IATS-1". Field duplicates will have a "D" added

to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

3.0 SURFACE WATER

The FCAP requires surface water flowing to the wet locations in the lowland (i.e., east of East Marine View Drive) and to the City of Everett's storm water system be sampled at appropriate locations. Samples from locations within and adjacent to the Fenced Area will not actually be surface water because there are no surface water features in the interim action area other than seeps during prolonged precipitation events in the winter. Therefore, samples will be storm water runoff (samples collected in catch basins) and storm water runoff combined with the sanitary sewer base flow (samples collected in manholes). Samples will be collected from the manholes because previous investigations concluded that these samples contained the highest concentrations of arsenic due to infiltration.

3.1 SAMPLE COLLECTION STRATEGY

Previous investigations concluded that there is no direct storm water runoff from the upland to the lowland. The storm water leaving the interim action area enters a series of catch basins that are connected to the City of Everett's combined sewer/storm water system. It is noted however, that several catch basins on the SR-529 interchange and the portion of East Marine View Drive north of the overpass discharge to the lowland through an outfall. Based on the vicinity of the interim action area, only locations associated with the City's system will be monitored following completion of the final construction season. This includes Stage 2 of the Fenced Area and the adjacent residential properties. Selected sample locations are depicted in Figure A-3-1. Table A-3-1 summarizes the sample collection.

The selected locations accommodate the storm water runoff patterns as well as the base flow of the sanitary sewer which is to the east and eventually to the south in East Marine View Drive to the City's wastewater treatment facility. A grab sample will be collected from each location during a significant precipitation event semi-annually (twice per year) for the first

five years. At the end of five years, Asarco and Ecology will review the data to determine future sampling frequency requirements, if any.

Samples will be analyzed for arsenic, lead, cadmium, antimony, mercury, and thallium. The following are the applicable surface water cleanup levels identified in the FCAP for surface water which enters the City of Everett's storm water sewer system:

- Arsenic: 500 ug/L
- Lead: 1890 ug/L
- Cadmium: 240 ug/L
- Antimony: no level
- Mercury: 100 ug/L
- Thallium: no level

3.2 SAMPLE NUMBERING SYSTEM

The sample designation will contain the project identification and task (IA for interim action and SW for surface water), the sample location, and date (month and year). For example, a storm water sample collected on December 18, 2004 from catch basin number 1 will be "IASW-CB1-1204". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

4.0 GROUNDWATER

The FCAP states that the groundwater is not present in sufficient quantity to serve as a drinking water supply and that the City of Everett has no plans to use groundwater at the interim action area in the future. The FCAP also established cleanup levels which consist of acute and chronic levels largely based on 1 hour and 4 day averages respectively. It is noted that laboratory results for the groundwater samples will not be averages.

Previous investigations have confirmed that the groundwater has been impacted. It is believed that this interim action will remove the source of contamination in the area being remediated, particularly from the Fenced Area. However, the improvement to groundwater quality may take several years to establish trends that confirm decreasing arsenic concentrations. Therefore, groundwater data exceeding cleanup levels will not trigger additional remedial actions in these areas until sufficient data have been collected to assess the effectiveness of the interim action.

4.1 SAMPLE COLLECTION STRATEGY

The FCAP specified monitoring well locations near the Fenced Area based on the area housing a consolidation facility. Because a consolidation facility will not be constructed, available monitoring wells located in the previously identified arsenic plumes will be monitored. Groundwater samples will be collected from the monitoring wells shown on Figure A-4-1 following completion of the final construction season. This includes Stage 2 of the Fenced Area and the adjacent residential properties. These locations represent the downgradient flow and the historically highest detected arsenic concentrations for the shallow and deep groundwater systems. It is noted that some or all of the wells located on the west side of East Marine View Drive may have to be abandoned during soil removal. Abandoned wells, if any, may be replaced after consultation with and/or as directed by Ecology in order to establish an effective monitoring well network.

The monitoring wells will be sampled semi-annually (twice per year) in March and September for the first five years. At the end of five years, Asarco and Ecology will review the data to determine future sampling frequency requirements, if any. Groundwater samples will be analyzed for total and dissolved arsenic, lead, cadmium, antimony, mercury, and thallium. Table A-4-1 summarizes the anticipated samples to be collected.

4.2 SAMPLE NUMBERING SYSTEM

The sample designation will contain the project identification and task (IA for interim action and GW for groundwater), the monitoring well identification, filtered (F) or unfiltered (UF)

sample, and date (month and year). For example, a groundwater sample collected on December 18, 2003 from monitoring well EV13 for dissolved metals will be "IAGW-EV13-F-1203". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

5.0 STORM DRAIN SEDIMENT

The FCAP specifies the cleanup levels for storm drain sediment as follows:

- Arsenic: 20 mg/Kg
- Lead: 250 mg/Kg
- Cadmium: 2 mg/Kg
- Antimony: 32 mg/Kg
- Mercury: 1 mg/Kg
- Thallium: 5.6 mg/Kg

Currently, Asarco inspects numerous catch basins near the interim action area for sediment accumulation. If needed, Asarco removes the sediment and manages it as problem waste through the Community Protection Measures program. It is noted that Asarco's current agreement to inspect and clean out catch basins will end once the performance monitoring has demonstrated catch basin sediment does not contain the above constituents in excess of the cleanup levels.

5.1 SAMPLE COLLECTION STRATEGY

Storm drain sediment will be sampled from all catch basins within and directly adjacent to the interim action area (see Figure A-5-1) following completion of the final construction season. This includes Stage 2 of the Fenced Area and the adjacent residential properties. Table A-5-1 summarizes the sample collection.

The streets will be swept prior to sample collection. If laboratory results indicate an exceedance of a cleanup level, Asarco will request that the City of Everett vacuum the catch

basins and lines and deposit the material at an area to be selected. Asarco will subsequently transport this material to the Tacoma Smelter Site or to another facility for appropriate disposal.

5.2 SAMPLE NUMBERING SYSTEM

The sample designation will contain the project identification and task (IA for interim action and SD for sediment), the sample location, and date (month and year). For example, a storm drain sediment sample collected on December 18, 2004 from catch basin number 1 will be "IASD-CB1-1204". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

III. CONFIRMATIONAL MONITORING

Confirmational monitoring is performed to confirm the long-term effectiveness of the interim actions once cleanup and/or remediation levels have been attained for soil, groundwater, surface water, and storm drain sediment. The FCAP referred to WAC 173-340-420 for specific requirements. WAC 173-340-420 requires Ecology to review the cleanup action no less frequently than every five years at sites with hazardous substances remaining above cleanup levels. Two arsenic remediation levels greater than the cleanup level of 20 mg/Kg (60 and 150 mg/Kg) have been selected for soils at depth. Because these remediation levels exceed the cleanup level, confirmation monitoring will be required.

1.0 SOIL

1.1 PERIPHERAL AREA

If performance monitoring indicates that any of the selected residential properties will have arsenic concentrations above 20 mg/Kg remaining at depths below two feet, three residential properties will be selected for sampling and analysis only of soils in the 0-6 and 6-12 inch depth intervals, not to 36 inches described in the FCAP. These properties will be sampled

again in five years following the completion of all soil removal and replacement activities. The properties to be selected will be approved by Ecology and must be given access by owners. The same number of sample locations will be selected as during the performance monitoring. The same designation will however change slightly. Rather than "IA" for interim action at the beginning, "CM1" will be inserted to identify that it is the first confirmation monitoring sample.

Soil samples will be obtained through the advancement of bore holes with a drill rig. Samples will be collected at 6 inch intervals to a depth of 36 inches or to the maximum depth soil was removed. Laboratory analyses will be conducted in the same manner as with performance monitoring. The bore holes will be abandoned by filling with bentonite pellets or chips to a depth of 1 foot. The top foot will be filled with purchased potting or topsoil and have the root grass turf cap replaced that was removed prior to advancing the bore hole.

1.2 FENCED AREA

It is believed that most of the established decision units will have concentrations above 20 mg/Kg remaining at depths below two feet. However, this area will subsequently be redeveloped and therefore, future sampling points cannot be selected at this time. It is unknown where buildings, streets, etc. will be constructed.

Sampling points will be determined once the redevelopment has been completed (no sooner than five years from the completion of soil removal and replacement). An attempt to re-establish and sample one of the decision units will be made. Soil samples will be obtained through the advancement of bore holes with a drill rig. Samples will be collected at 6 inch intervals to the maximum depth soil was removed. The same designation will however change slightly. Rather than "IA" for interim action at the beginning, "CM1" will be inserted to identify it's the first confirmation monitoring sample.

Laboratory analyses will be conducted in the same manner as with performance monitoring. The bore holes will be abandoned by filling with bentonite pellets or chips to a depth of 1

foot. The top foot will be filled with purchased potting or topsoil and have the root grass turf cap replaced that was removed prior to advancing the bore hole.

2.0 GROUNDWATER

Groundwater quality will be evaluated on a long-term basis (semi-annually for five years) as described in performance monitoring. Therefore, no additional actions will be conducted for confirmational monitoring.

3.0 SURFACE WATER

Surface water quality will be evaluated on a long-term basis (semi-annually for five years) as described in performance monitoring. Therefore, no additional actions will be conducted for confirmational monitoring.

4.0 STORM DRAIN SEDIMENT

The same locations as identified in performance monitoring will be sampled five years from the completion of soil removal and replacement provided that they still exist. Laboratory analyses will be conducted in the same manner as with performance monitoring as well. Rather than "IA" for interim action at the beginning, "CM1" will be inserted to identify it's the first confirmation monitoring sample.

IV. CONTINGENCY PLAN

1.0 PROTECTION MONITORING

Contingency actions for protection monitoring are identified in the Health and Safety Plan (see Appendix B).

2.0 PERFORMANCE MONITORING

2.1 SOIL

2.1.1 Peripheral Area

Samples will be collected at six-inch intervals below the initial 24 inch excavation depth (i.e., 24 - 30 inches and 30 - 36 inches). If the evaluation of laboratory results (composite and/or discrete, if applicable) indicate an exceedance of the remediation level at either of these depth intervals, an additional 6 or 12 inches of soil will be removed as needed for the respective decision unit. If the evaluation of laboratory results (composite and discrete, if applicable) indicates an exceedance of the remediation level at the next depth interval (36 to 42 inches), an additional 12 inches of soil will be removed for the respective decision unit. Upon removal of this soil, samples from the next depth interval (48 – 54 inches) at the same locations will be collected and analyzed. This strategy will be followed until results indicate average arsenic concentrations are less than 150 mg/Kg and maximum arsenic concentrations, if analyzed, are less than 500 mg/Kg.

2.1.2 Fenced Area

If the evaluation of Phase 1 Removal A laboratory results for floor or perimeter samples indicate an exceedance of 3,000 mg/Kg, additional soil will be removed. The lateral and vertical extent of the re-excavation will be determined by the Field Engineer based on site conditions. Upon removal of the soil, samples will be collected following the same procedures outlined in performance monitoring. This strategy will be followed until results indicate arsenic concentrations are less than 3,000 mg/Kg. It is noted that a physical feature such as a street may prevent a lateral re-excavation. However, the source material will be removed eventually even where covered by streets. Upon completion of Removal A, additional soil will be removed as required and Removal B sampling will be performed.

If the evaluation of Phase 2 laboratory results for floor or perimeter samples indicate an exceedance of a remediation level(s), additional soil will be removed. The lateral and vertical extent of the re-excavation will be determined by the Field Engineer based on site conditions. Upon removal of the soil, samples will be collected following the same

procedures outlined in performance monitoring. This strategy will be followed until results indicate average arsenic concentrations are less than 150 mg/Kg and maximum arsenic concentrations are less than 500 mg/Kg up to a depth of 15 feet below final grade. It is noted that a physical feature such as a street may prevent a lateral re-excavation.

If the evaluation of Phase 3 laboratory results indicate an exceedance of the remediation level, additional soil will be removed before clean import material is brought in and backfilled. Re-excavation will be performed to the depth identified by the laboratory results. Upon removal of the soil, samples will be collected again following the same procedures outlined in performance monitoring to confirm remediation levels have been met.

An additional contingency will be administered if only the material with arsenic concentrations greater than 3,000 mg/Kg is removed (Phase 1 Removal A). As specified in the FCAP/FEIS, borings will be advanced to a depth of three feet beneath the limit of excavation at a frequency of one per 400 square feet once the material believed to contain 3,000 mg/Kg is removed. Samples will be collected in six-inch intervals. No single sample may exceed 3,000 mg/Kg arsenic. In case of an exceedance, the excavation will be deepened within the area outlined by a line connecting surrounding locations for which all samples are less than 3,000 mg/Kg arsenic. After excavation, six additional borings will be advanced to a depth of three feet beneath the new limit of excavation, re-sampled, and re-analyzed. In addition, the upper 95% confidence limit will be calculated for each group of six adjacent borings. If the upper 95% confidence limit exceeds 3,000 mg/Kg, the entire area outlined by adjacent clean locations will be excavated. After excavation, six additional borings will be advanced to a depth of three feet beneath the new limit of excavation, re-sampled, and re-analyzed.

2.2 IMPORT MATERIAL

If laboratory results indicate that backfill or topsoil contain chemical concentrations that exceed the criteria, the stockpile will be rejected and the supplier will be asked to investigate

the potential source. Once a new stockpile of at least 1,000 cubic yards is available, it will be sampled following the strategy outlined in performance monitoring.

It will be at Asarco's discretion whether to accept or reject material that does not meet the other criteria such as fertility, grain size, etc.

2.3 SURFACE WATER

Surface water quality will be evaluated on a long-term basis (semi-annually for five years) as described in performance monitoring. Therefore, a contingency plan has not been developed. However, following the five-year periodic review, additional actions may be taken if warranted. If only the material exceeding 3,000 mg/Kg arsenic is removed, additional actions may be required sooner than the five-year review period if groundwater monitoring data indicates such action is necessary.

2.4 GROUNDWATER

Groundwater quality will be evaluated on a long-term basis (semi-annually for five years) as described in performance monitoring. Therefore, a contingency plan has not been developed. However, following the five-year periodic review, additional actions may be taken if warranted. If only the material exceeding 3,000 mg/Kg arsenic is removed, additional actions may be required sooner than the five-year review period if groundwater monitoring data indicates such action is necessary.

2.5 STORM DRAIN SEDIMENT

If laboratory results indicate that storm drain sediment exceeds the identified levels, the material will be managed as described in performance monitoring. In addition, samples will be collected several months later following the same procedures outlined in performance monitoring. If these results exceed the identified criteria, an investigation will be performed to determine the potential source(s). The investigation may include but not limited to the identification of upgradient sources not associated with the interim action and the sanding material, if any, used by the City of Everett during the winter months. Based on the findings,

appropriate action such as testing the sanding material may be taken. If additional action is taken, the material will be removed and disposed of properly and another round of sample collection will be performed during a significant precipitation event the following fall. These samples will be collected following the same procedures outlined in performance monitoring.

3.0 CONFIRMATIONAL MONITORING

A contingency plan has not been developed for confirmational monitoring at this time. A plan will be developed before confirmational monitoring is performed (five years after the soil removal and replacement in the interim action area is complete).

TABLES

TABLE A-1-2. RESIDENTIAL PROPERTY SOIL COLLECTION SUMMARY - EVERETT SMELTER SITE

Sample Location	Estimated No. Decision Units	Estimated No. Bore Holes	Depth Interval	Estimated No. Composite Samples for As	Estimated No. Discrete Samples for As	Estimated No. Field Duplicates (1 in 20)	Estimated No. Confirmation Samples (1 in 50)
Yard	68	544	24-30" 30-36"	68 68	544 544	61	25
Garden	34	68	24-30" 30-36"	34 34	68 68	10	4
Landscape Area	34	68	24-30" 30-36"	34 34	68 68	10	4
Maintenance Areas	17	-	surface	17	-	1	1
				Total: 289	Total: 1360	Total: 82	Total: 34

TABLE A-1-4. FENCED AREA - PHASE 1 SOIL COLLECTION SUMMARY - EVERETT SMELTER SITE

Sample Location	Estimated No. Decision Units	Estimated No. Sample Locations	Depth Interval	Estimated No. Composite Samples for As	Estimated No. Discrete Samples for As	Estimated No. Field Duplicates (1 in 20)	Estimated No. Confirmation Samples (1 in 50)
Removal A Floor	96	960	surface of excavation	96	-	5	2
Perimeter	67 (93 sides)	372	average across site: surface 2' 4' 6' 8'	 93 93 93 93 93	-	24	10
Removal B Floor	96	960	surface of excavation	96	-	5	2
Perimeter	67 (93 sides)	372	average across site: surface 2' 4' 6' 8' 10' 12'	 93 93 93 93 93 93 93	-	33	13
				Total: 1308	Total: 0	Total: 67	Total: 27

Note: At least 30 floor samples with a range of arsenic concentrations will be analyzed for antimony and thallium.

TABLE A-1-5. FENCED AREA - PHASE 2 SOIL COLLECTION SUMMARY - EVERETT SMELTER SITE

Sample Location	Estimated No. Decision Units	Estimated No. Sample Locations	Depth Interval	Estimated No. Composite Samples for As	Estimated No. Discrete Samples for As	Estimated No. Field Duplicates (1 in 20)	Estimated No. Confirmation Samples (1 in 50)
Floor	131	1310	surface of excavation	131	1310	72	29
Perimeter	39	156	average across site:			59	24
			surface	39	156		
			2'	39	156		
			4'	39	156		
			6'	39	156		
			8'	39	156		
			10'	39	156		
				Total: 365	Total: 2246	Total: 131	Total: 53

TABLE A-1-6. FENCED AREA - PHASE 3 SOIL COLLECTION SUMMARY - EVERETT SMELTER SITE

Sample Location	Estimated No. Decision Units	Depth Interval (from final grade)	Estimated No. Composite Samples for As	Estimated No. Discrete Samples for As	Estimated No. Field Duplicates (1 in 20)	Estimated No. Confirmation Samples (1 in 50)
Center of Grid	114	24-30"	-	114	23	10
		30-36"	-	114		
		36-42"	-	114		
		42-48"	-	114		
			Total: 0	Total: 456	Total: 23	Total: 10

TABLE A-2-1. IMPORT MATERIAL COLLECTION SUMMARY - EVERETT SMELTER SITE

Import Material Type	Estimated Minimum Volume Required (CY)	Sample Analyzed for Priority Pollutant Metals (1 per 1,000 CY)	Sample Analyzed for pH and Particle Size per Season	Sample Analyzed for Fertility per Season	Sample Analyzed for PCBs, Organochlorine Pesticides, SVOCs and VOCs (1 per 1,000 CY)
Backfill - Fenced Area Backfill - Residential Yards	14,000 13,000	27	2	-	-
Topsoil - Fenced Area Topsoil - Residential Yards	4,500 4,000	9	2	2	9
		Total: 36	Total: 4	Total: 2	Total: 9

TABLE A-2-2. PREFERRED USDA STANDARDS

Test	Criteria	Specification
Fraction Passing 2 mm Sieve	Coarse Sand (0.5-2 mm)	Max=15%; Min=0%
	All Sand (0.5-2 mm)	Max=85%; Min=65%
	Silt (0.002-0.5 mm)	Max=15%; Min=5%
	Clay (<0.002 mm)	Max=8%; Min=0%
Other Particle Classes	Gravel (2-12 mm)	Max=5%; Min=0%
	Rock (1/2 - 1 inch)	5% by volume with none>1 inch
	Organic (dry wt.<2 mm)	Max=10%; Min=3%
Reaction	PH	5.5-7.5
Infiltration Rate	Water Holding Capacity	*
Fertility	N, P, K, Ca, Mg, Cu, Zn, Mn, Fe, B, and SO4	*

Note: * indicates soil specialist will interpret the results to determine if material can support normal plant growth.

TABLE A-3-1. SURFACE WATER COLLECTION SUMMARY - EVERETT SMELTER SITE
(Per Sampling Event)

Sample Location	Sample For Antimony, Arsenic, Cadmium, Lead, Mercury, and Thallium	Estimated No. Field Duplicates (1 in 20)
CATCH BASINS:		
CB-3	1	1
CB-6	1	
CB-7	1	
CB-8	1	
CB-11	1	
CB-17	1	
CB-18	1	
CB-19	1	
CB-20	1	
MANHOLES:		
MH-1	1	1
MH-2	1	
MH-3	1	
MH-4	1	
MH-5	1	
MH-6	1	
MH-7	1	
MH-8	1	
MH-9	1	
	Total: 18	Total: 2

TABLE A-4-1. GROUNDWATER COLLECTION SUMMARY - EVERETT SMELTER SITE
(Per Sampling Event)

Sample Location	Sample Analyzed For Total Antimony, Arsenic, Cadmium, Hardness, Lead, Mercury, and Thallium	Sample Analyzed For Dissolved Antimony, Arsenic, Cadmium, Lead, Mercury, and Thallium	Estimated No. Field Duplicates (1 in 10)
SHALLOW:			
EV-6A	1	1	4
EV-7A	1	1	
EV-8A	1	1	
EV-9A	1	1	
EV-10	1	1	
EV-11	1	1	
EV-12	1	1	
EV-13	1	1	
EV-15A	1	1	
EV-16	1	1	
EV-17A	1	1	
EV-24A	1	1	
DEEP:			
EV-3	1	1	2
EV-6B	1	1	
EV-7B	1	1	
EV-8B	1	1	
EV-9B	1	1	
EV-15B	1	1	
EV-17B	1	1	
EV-18B	1	1	
EV-19B	1	1	
EV-20B	1	1	
EV-24B	1	1	
	Total: 23	Total: 23	Total: 6

TABLE A-5-1. STORM DRAIN SEDIMENT COLLECTION SUMMARY - EVERETT SMELTER SITE

Sample Location	Sample For Antimony, Arsenic, Cadmium, Lead, Mercury, and Thallium	Estimated No. Field Duplicates (1 in 20)
CB-1	1	1
CB-2	1	
CB-3	1	
CB-4	1	
CB-5	1	
CB-6	1	
CB-7	1	
CB-8	1	
CB-9	1	
CB-10	1	
CB-11	1	
CB-12	1	
CB-13	1	
CB-14	1	
CB-15	1	
CB-16	1	
CB-17	1	
CB-18	1	
CB-19	1	
CB-20	1	
	Total: 20	Total: 1

FIGURES

UPDATE TIME: 8pm
PG \TAC\111902 V:\Land Projects\Everett-01-27-04\Everett-01-27-04-T001

LEGEND

ASARCO OWNED - DEMOLISHED SUPERSTRUCTURE IN FENCED AREA

PROPERTIES TO REMEDIATE

PROPERTIES PREVIOUSLY REMEDIATED BY ECOLOGY

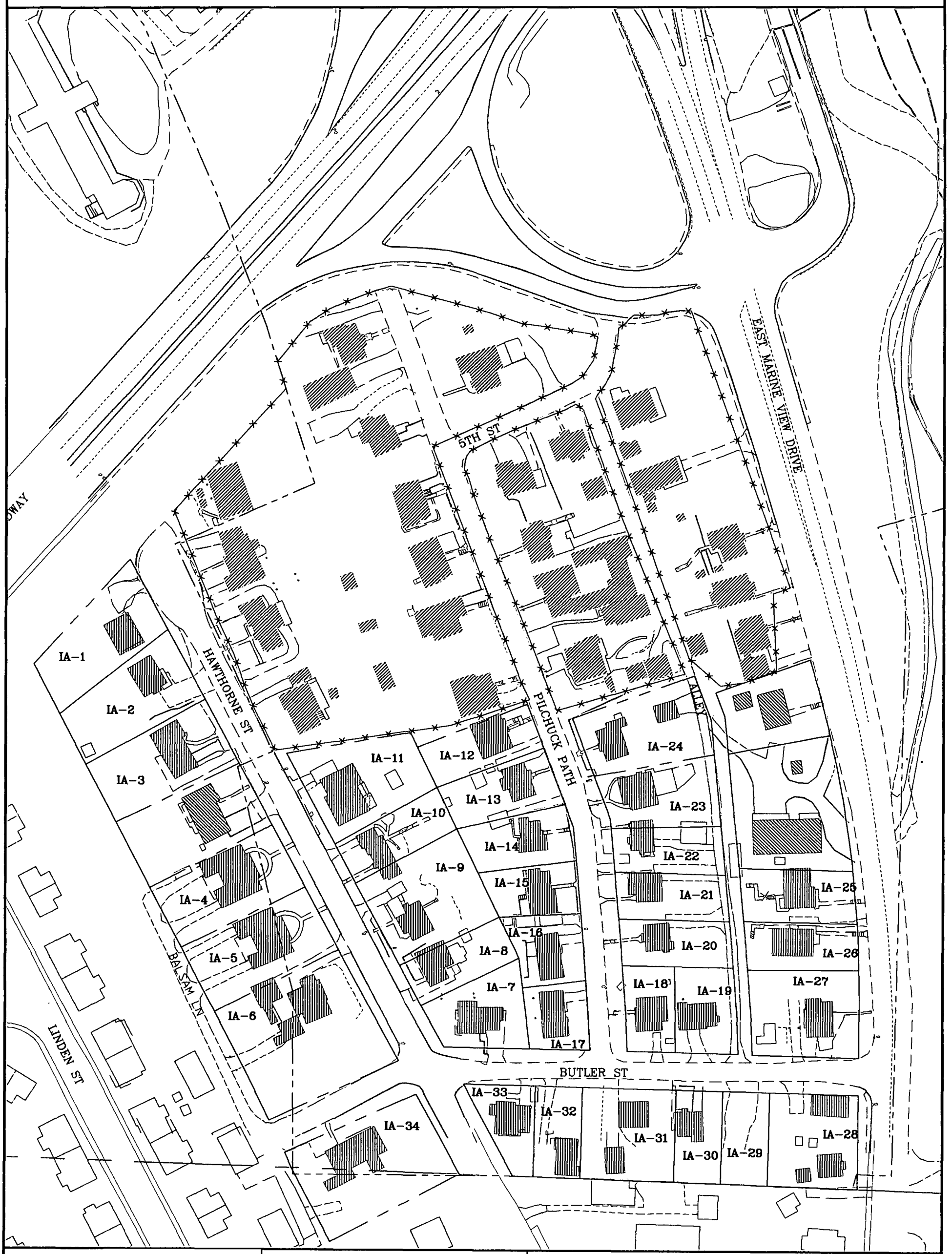
APPROXIMATE LOCATION OF HISTORICALY OWNED ASARCO PROPERTY BOUNDARY

SECURITY FENCE

IA-1 INTERIM ACTION PROPERTY DESIGNATOR

NORTH

SCALE (In Feet) 0 100



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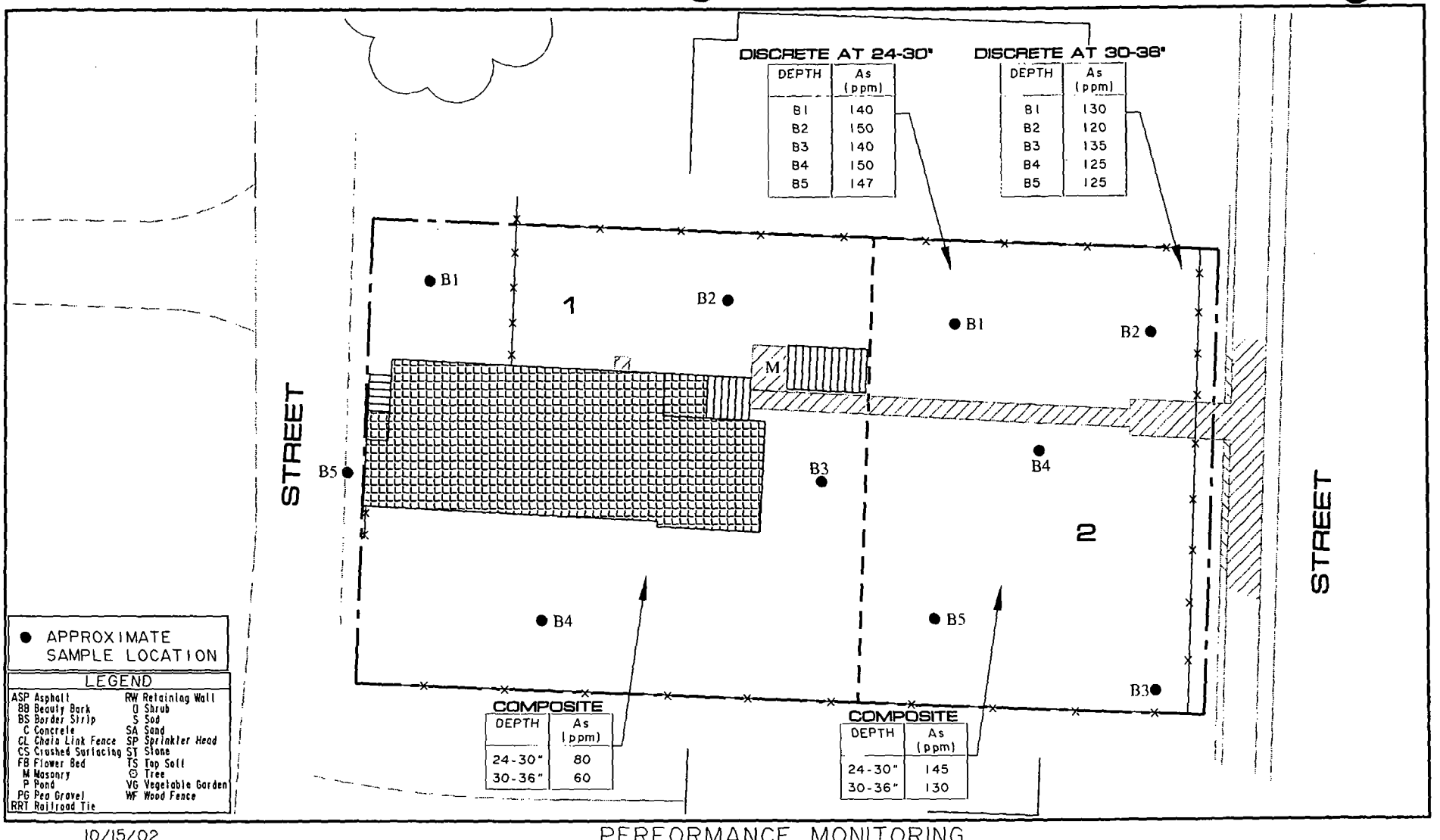
APPENDIX A

RESIDENTIAL PROPERTIES TO REMEDIATE AROUND FENCED AREA

FIGURE A-1-1



10/15/02

PERFORMANCE MONITORING

NORTH

0 5 10

SCALE IN FEET

EXAMPLE

Asarco - Everett

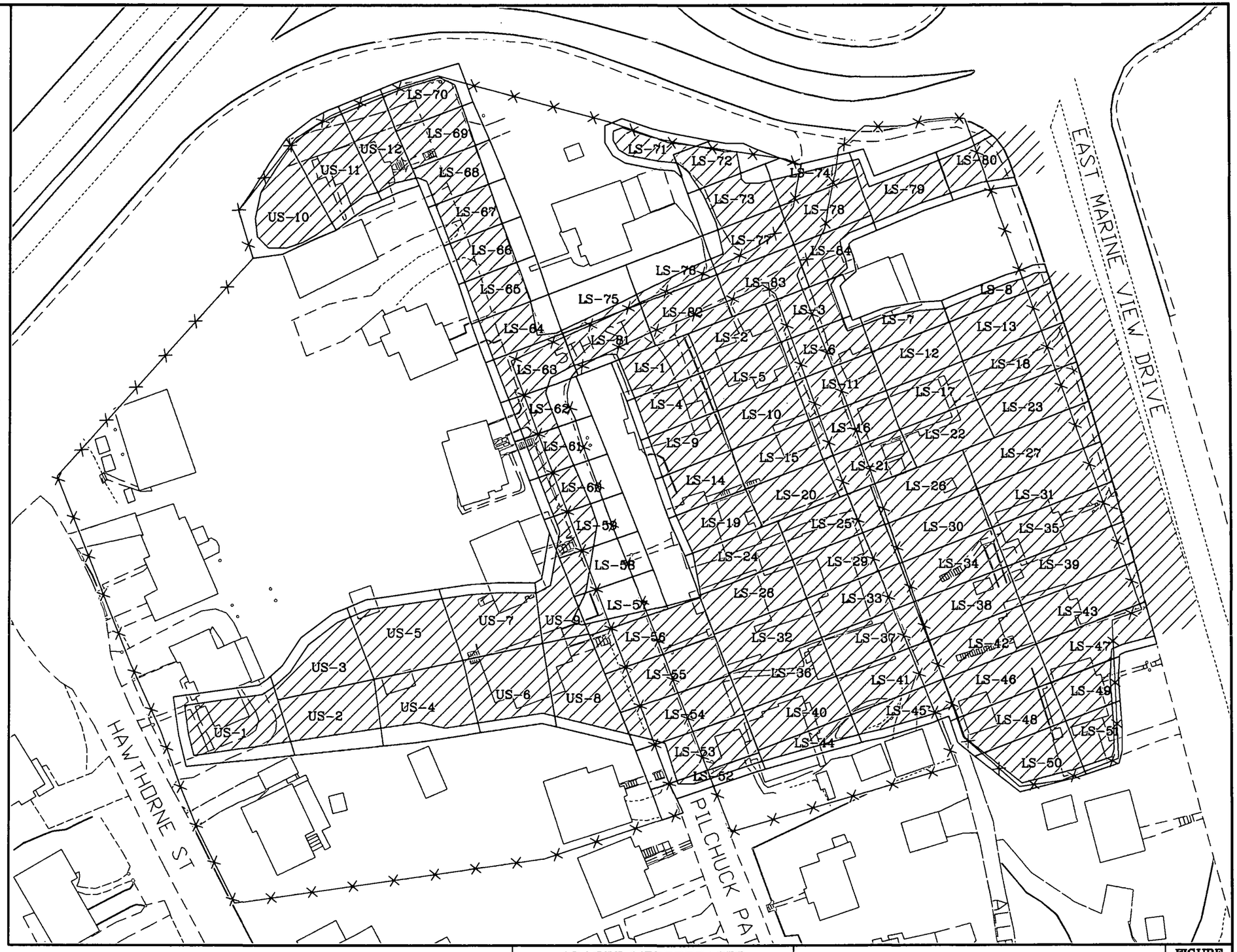
PROPERTY SITE CODE: FDEXAMPLE

SITE ADDRESS: STREET

PROPERTY OWNER: OWNER

Everett-012704-T002

FIGURE A-1-2



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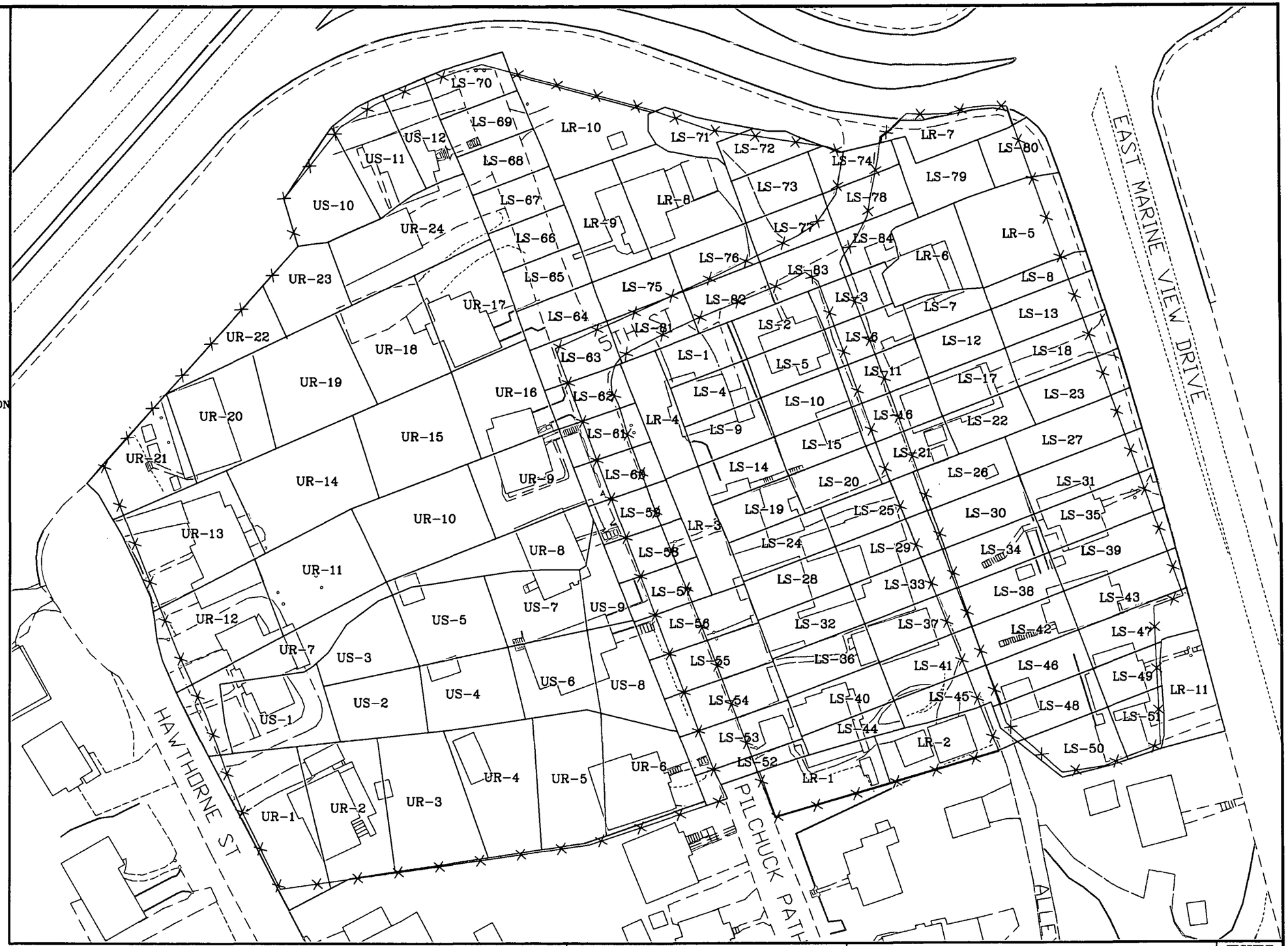
PHASE 1 (3000 mg/kg+) ARSENIC SOIL SAMPLING IN FENCED AREA

FIGURE
A-1-3

UPDATE TIME: 8pm
PG \TAC\012704\I:\Land Projects\Everett-01-27-04\ Everett-01-27-04-T003.dwg



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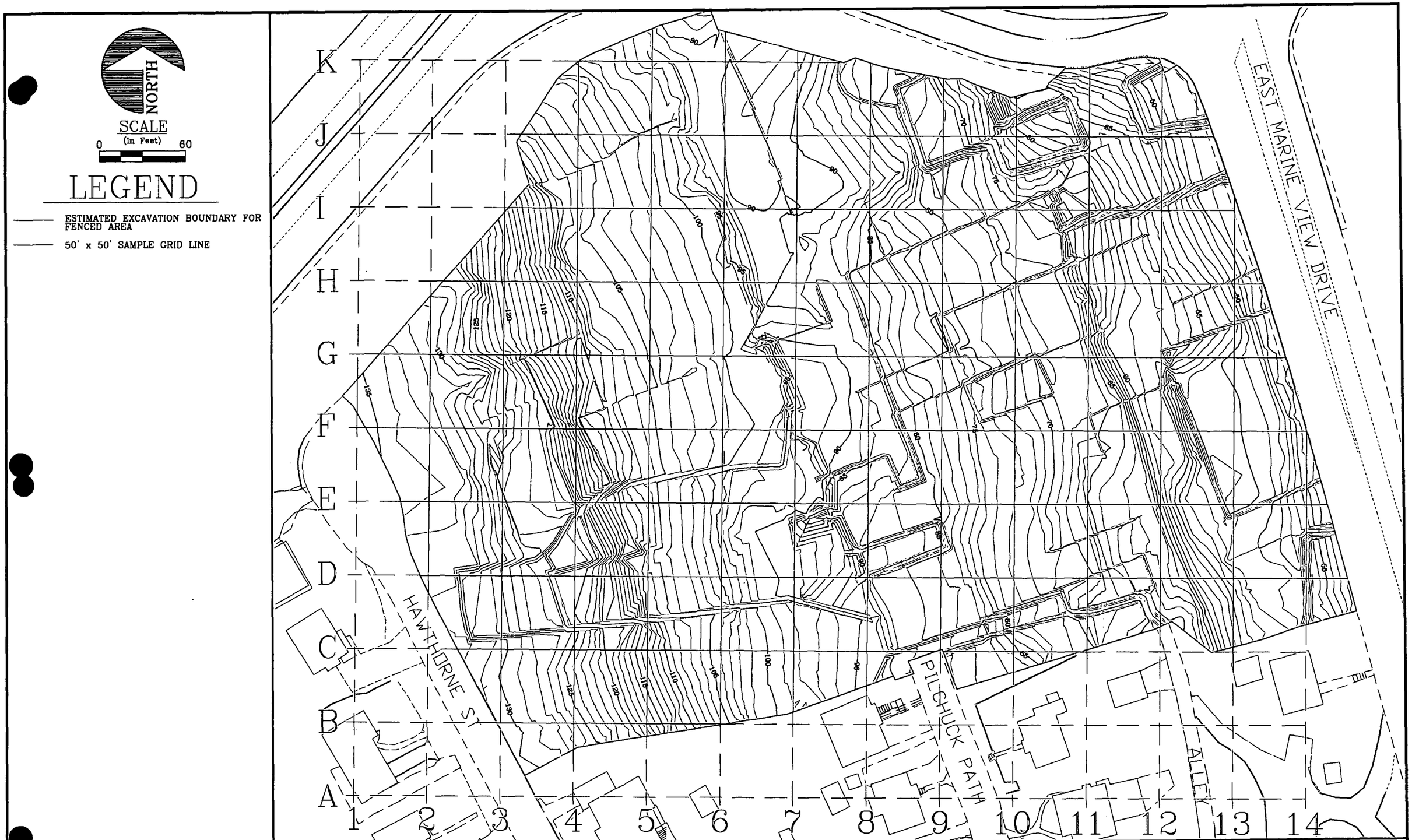
PHASE 2 (150 mg/kg+) ARSENIC
SOIL SAMPLING IN FENCED AREA

FIGURE
A-1-4

UPDATE TIME: 8pm
PG \TAC\012704\I:\Land Projects\Everett-01-27-04\Everett-01-27-04-T004.dwg



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SITE APPENDIX A

PHASE 3 (POST CUT/FILL)
SOIL SAMPLING IN FENCED AREA

FIGURE
A-1-5

UPDATE TIME: 8pm
PG \TAC\012704\I:\Land Projects\Everett-01-27-04\Everett-01-27-04-T005.dwg

UPDATE TIME: 8pm
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LEGEND

- APPROXIMATE LOCATION OF HISTORICALY OWNED ASARCO PROPERTY BOUNDARY
- SECURITY FENCE
- ASARCO OWNED - DEMOLISHED SUPERSTRUCTURE IN FENCED AREA
- PROPERTIES TO REMEDIATE
- PROPERTIES PREVIOUSLY REMEDIATED BY ECOLOGY
- ● MH-3 MANHOLE TO SAMPLE
- ■ CB-17 CATCH BASIN TO SAMPLE
- COMBINED STORMDRAIN/ SANITARY SEWER SYSTEM
- STORM DRAIN SYSTEM

NORTH

SCALE
(In Feet)
0 100

ASARCO Consulting, Inc.

ASARCO INCORPORATED FINAL DESIGN REPORT EVERETT SMELTER SITE APPENDIX A	SURFACE WATER SAMPLE LOCATIONS EVERETT SMELTER	FIGURE A-3-1

LEGEND

APPROXIMATE LOCATION OF HISTORICALY OWNED ASARCO PROPERTY BOUNDARY

SECURITY FENCE

ASARCO OWNED - DEMOLISHED SUPERSTRUCTURE IN FENCED AREA

● EV-24B NEW DEEP MONITORING WELL TO BE INSTALLED

● EV-24A NEW SHALLOW MONITORING WELL TO BE INSTALLED

● EV-13 EXISTING DEEP MONITORING WELL

● EV-12 EXISTING SHALLOW MONITORING WELL

NORTH

SCALE (In Feet) 0 100

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EVERETT SMELTER
SITE APPENDIX A

GROUNDWATER MONITORING WELL LOCATIONS

FIGURE A-4-1

UPDATE TIME: 8am
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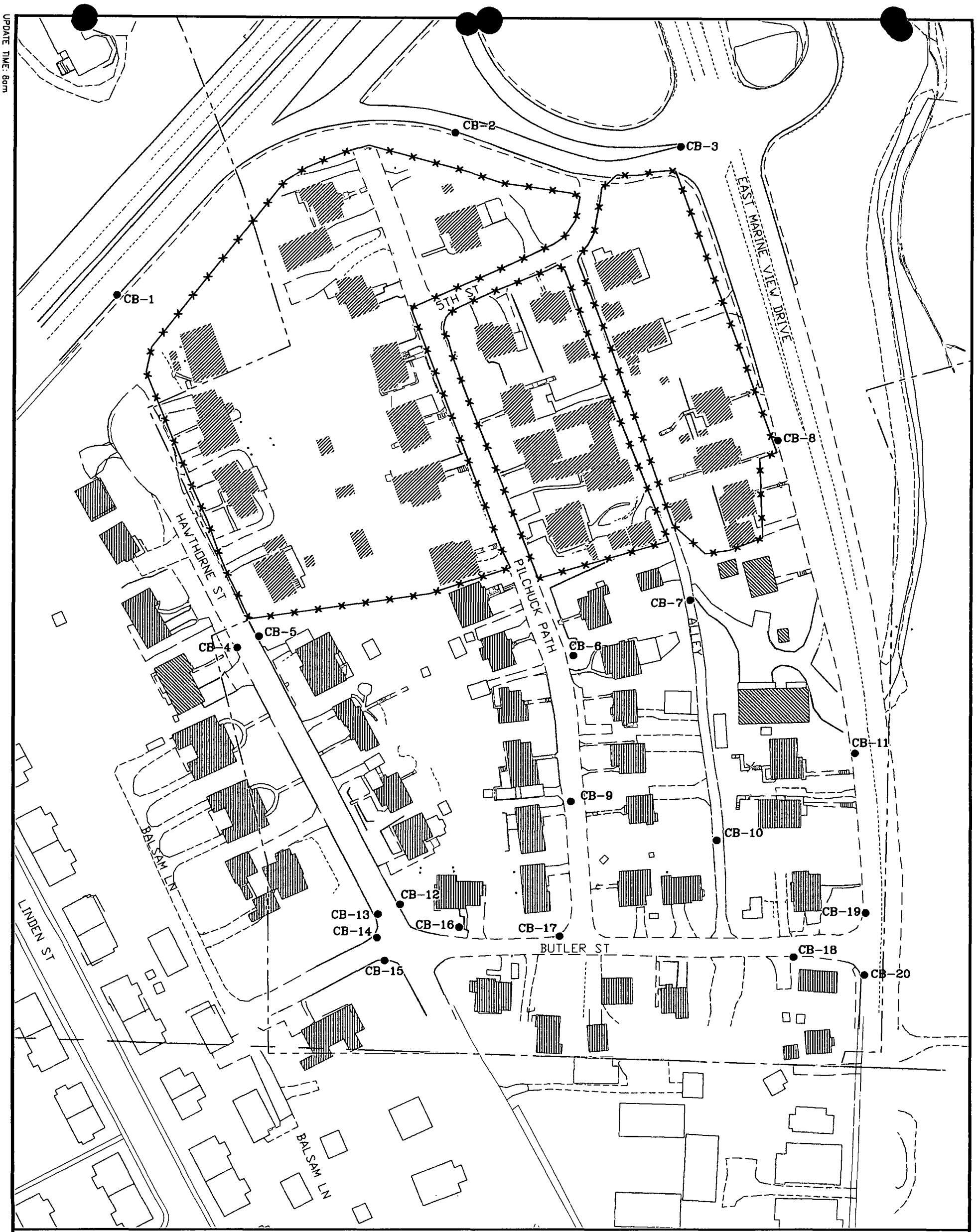

LEGEND

- APPROXIMATE LOCATION OF HISTORICALY OWNED ASARCO PROPERTY BOUNDARY
- SECURITY FENCE
- ASARCO OWNED – DEMOLISHED SUPERSTRUCTURE IN FENCED AREA
- PROPERTIES TO REMEDIATE
- PROPERTIES PREVIOUSLY REMEDIATED BY ECOLOGY
- ● CB-1 CATCH BASIN TO SAMPLE

NORTH

SCALE (In Feet) 0 100

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EVERETT SMELTER
SITE APPENDIX A

STORM DRAIN SEDIMENT SAMPLING LOCATIONS
EVERETT SMELTER

FIGURE A-5-1

UPDATE TIME: 8am
PG \TAC\012704\I:\Land Projects\Everett-01-27-04\Everett-01-27-04-T008.dwg

Appendix B

APPENDIX B

HEALTH AND SAFETY PLAN

APPENDIX B

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

Prepared for:

ASARCO Incorporated

Prepared by:

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5219 N Shirley St
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January 2004
Revision 1

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1.0 INTRODUCTION

This Site Health and Safety Plan (HSP) is for all employees, contractors, visitors, or observers conducting or observing remedial and/or sampling activities associated with the interim action at the Everett Smelter Site located in Everett, Washington. It is intended to satisfy the requirements of WAC 173-340-810.

Any on-site activities associated with soils potentially containing elevated concentrations of arsenic and lead or activities that potentially pose a physical hazard must be performed in accordance with this HSP. This HSP is designed to ensure that field personnel and the surrounding community are adequately protected from chemical and physical hazards present during implementation of the interim action.

2.0 PURPOSE OF THE SITE HEALTH AND SAFETY PLAN

This HSP establishes policies and procedures to protect personnel from the potential hazards posed by field activities associated with the interim action. The HSP provides measures to minimize exposure, accidents, and physical injuries that may occur during daily site activities and details actions to be taken during a site emergency. This HSP complies with provisions of the Washington State Industrial Safety and Health Agency (WISHA) standard for personal safety for hazardous waste investigation personnel as required under WAC 296-62-300, Part P as well as requirements under OSHA 29 CFR 1910.120.

This HSP must be observed by all personnel which includes Asarco employees, contractors, subcontractors, visitors and observers participating in the interim action. To help ensure safety compliance, all field personnel and observers must read this plan and sign a certification stating that they agree to comply with the HSP (see Attachments B-1,

B-2, and B-3). Additional hazards identified by contractors or subcontractors as part of their operations must be addressed in their respective HSP.

3.0 KEY MANAGEMENT

Efficient on-site operation requires that key personnel be identified and that their roles, responsibilities, and scope of authority be clearly defined.

Project Health & Safety Officer

Prior to work commencing, the Project Health & Safety Officer will be identified. This position should not be confused with the Site Health & Safety Officer described later. The Project Health & Safety Officer is responsible for the contents of, distribution of, and modifications to this HSP. The Project Health & Safety Officer is responsible for reviewing all contractor and subcontractor HSPs, for surveying work operations periodically, and for notifying responsible Site Health & Safety Officers or other responsible individuals with oral notification of deviations from the HSP. Weekly progress meetings will be held between the contractors and the Project Health & Safety Officer to report progress and address issues of concern. As the Project Health & Safety Officer, he/she is responsible for providing direction to Site Health & Safety Officer. The Project Health & Safety Officer will also serve as a central contact regarding health and safety issues encountered at the site.

Site Health & Safety Officer

Prior to work commencing, the Site Health & Safety Officer will be identified. The Site Health & Safety Officer is responsible for contractor-specific decisions related to daily field operations. The individual responsible for supervising employees engaged in hazardous waste operations are described in the WISHA Standard for Hazardous Waste Operations and Emergency Response (HAZWOPER) WAC 296-62-3010.

Specific duties shall include the following:

- Stopping work if any operation threatens worker or public health and safety.
- Selecting appropriate protective clothing and equipment in consultation with the Project Health & Safety Officer.
- Periodically inspecting protective clothing and equipment.
- Ensuring that protective clothing and equipment are properly stored and maintained.
- Controlling entry and exit to work zones.
- Coordinating health and safety program activities with the Project Health & Safety Officer.
- Confirming each team member's suitability for work based on a physician's recommendation and training.
- Monitoring the work parties for signs of stress, such as fatigue, cold exposure, or heat stress.
- Monitoring on-site hazards and conditions.
- Participating in the preparation of and implementing the Contractor HSP.
- Conducting periodic inspections to determine if the Contractor's HSP is being adhered to.
- Knowing emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
- Notifying, when necessary, local public emergency officials.
- Coordinating emergency medical care.

The Project Health & Safety Officer reserves the authority to select protective clothing and health and safety monitoring equipment based on the guidelines contained in this HSP or to augment the plans as necessary. The Site Health & Safety Officer may stop work if any activity or conditions threaten worker or public health or safety. The Site Health & Safety Officer will inform the Project Health & Safety Officer as soon as

reasonably possible whenever there are questions regarding the safety of continued operations.

The Site Health & Safety Officer shall also be responsible for overseeing the decontamination of the contractor's personnel, equipment, and samples before they leave the site. These responsibilities shall include:

- Emergency decontamination of contaminated accident victims or warning emergency personnel should this activity be impossible due to increasing the injury to the victim.
- Setting up decontamination areas. Decontamination solutions will consist of tap water or water mixed with common detergents. Water use in decontamination will be minimized.
- Controlling the decontamination of all equipment, personnel, and supplies withdrawn from the contaminated areas.
- Assisting in the disposal of contaminated clothing and materials.
- Ensuring that all required safety equipment is available.
- Advising medical personnel of potential exposures of incident victims and consequences.

Project Manager

Prior to work commencing, the Project Manager will be identified. The Project Manager will be responsible for project oversight and interact with the Project Health & Safety Officer to ensure proper implementation of the required actions.

4.0 SITE CONTROL DURING INTERIM ACTIONS

4.1 FENCED AREA

The Fenced Area will have three work zones established including an exclusion zone, a decontamination zone, and a clean zone. Currently, each block is bordered with a six-foot chain link fence. Work conducted within the fence will be considered an exclusion zone and be under the surveillance of the work crews. To reduce the public's exposure to site physical and chemical hazards, the exclusion zone access will be restricted to trained, authorized personnel with personal protective equipment. Resident or other unauthorized entry into the exclusion zone will cause work to stop until the zone is cleared of the unauthorized personnel. At the end of each day, the contractor will ensure the section of fence, if any, that is removed will be replaced or ensure that temporary fencing is erected to secure the exclusion zone.

A decontamination zone(s) will be set up for equipment and personnel for access ways in and out of the exclusion zones. Decontamination is discussed further in Section 8.

An area outside the security fence, a clean zone, may also be needed for staging operations or for protection of the community. Although they are clean zones, these areas will have restricted access through the use of barricades and/or barricade tape. An attempt will be made to store equipment within the fence at night and on weekends. If equipment is left outside the fence, it cannot interfere with traffic.

It is noted that these three zones will be adjusted as the interim action proceeds. In addition to the established zones, the safety of the general population will also be protected by ensuring that the work performed complies with the Dust Control Plan (see Attachment B-4) and the Peripheral Monitoring Plan (see Attachment B-5).

4.2 RESIDENTIAL PROPERTIES

The area containing the selected residential properties which may be remediated will be considered a general work zone. During soil removal and replacement at a given decision unit(s), the work zone access will be restricted to trained, authorized personnel with personal protective equipment. Most residences are expected to be occupied during remedial activities. Therefore, only reasonable and prudent access will be maintained. However, while equipment is operating, the area will be under the surveillance of the work crews. Resident or other unauthorized entry will cause work to stop.

During soil removal, decision units will be surrounded with yellow barrier tape if not backfilled prior to the end of the work day. Any area backfilled is considered as lacking hazards unless exposed utilities are present. Equipment may be left overnight or over the weekend within the area taped off.

In addition, the safety of the general population will be protected by ensuring that the work performed complies with the Dust Control Plan (see Attachment B-4) and the Peripheral Monitoring Plan (see Attachment B-5).

5.0 HAZARD EVALUATION

5.1 CHEMICAL SUBSTANCES OF CONCERN

Arsenic, lead, and cadmium are known or suspected to be present at elevated concentrations within the interim action area and may affect human health. Concentrations are highest in the Fenced Area. Arsenic and lead are considered the primary chemicals of concern with levels ranging 5 to 727,000 mg/Kg and 5 to 11,000 mg/Kg respectively. Cadmium has also been detected at concentrations from 5 to 230 mg/Kg. Chemical concentrations decrease markedly outside the Fenced Area.

The following describes the primary hazards associated with each chemical:

Chemical	Primary Hazard
Arsenic	Toxic on inhalation, ingestion; skin irritant; known human carcinogen for inhalation and ingestion.
Lead	Toxic on inhalation, ingestion.
Cadmium	Toxic on inhalation, ingestion, suspected human carcinogen through inhalation only.

More detailed information concerning chemical, physical, and toxicological properties of arsenic, lead, and cadmium are contained in Attachments B-6, B-7, and B-8 respectively. A summary of the relevant standards and exposure guidelines for these substances is in Attachment B-9.

5.2 PHYSICAL SAFETY CONCERNS

Work activities may expose field personnel to many physical hazards. To reduce the potential for accidents in the work zones, it is important to identify the hazards. The following is a list of the hazards that may be encountered and that can result in injury:

- Slips, trips, and falls
- Sharp or protruding objects
- Electrical shock
- Burns
- Noise
- Overexertion
- Explosion/ignition hazards (underground gas lines)
- Overhead obstructions
- Domestic animals
- Struck By Falling Objects

Slips, Trips, and Falls - Each area may have its own peculiar hazards for trips and falls, such as uneven steps, slippery ground, debris, and other trip hazards. Personnel must be careful to protect themselves by finding and pointing out hazards.

Sharp and Protruding Objects - Some areas may have hazards such as stakes in the ground, half-buried debris, and projections from fences and buildings which are capable of impaling.

Electrical Shock - All utilities must be located, whether they are overhead or underground, and plans made to avoid them prior to work beginning. If it is suspected that equipment has become energized due to contact with an electrical line, the operator must get away from the equipment, prevent others from approaching it, and contact the power utility to disconnect power.

Burns – Most equipment will create a substantial amount of heat, especially at the muffler. Personnel must avoid contact with the hot parts.

Noise – Some powered equipment, though muffled, may exceed the noise limits under WISHA. Personnel working in the immediate area of these machinery must wear hearing protection.

Overexertion – Some work must be done by hand including shoveling and lifting. When lifting, field personnel must keep the weight carried centered within their bodies and be aware of their limitations. Communication is the key in the coordinated lifting and movement of equipment.

Explosion/Ignition Hazards - Underground utilities such as gas lines must be located and their locations given adequate distance from work. If it is suspected that a gas line has been hit, the operator must turn off the equipment and evacuate the area, including notifying nearby residents. The gas utility must be called to repair the break.

Overhead Obstructions - Each area will be surveyed prior to work beginning for hazards such as overhead obstructions which may contact equipment during operation or movement. Specific plans must be made for avoiding these hazards.

Domestic Animals – At residential properties, personnel must be aware that some pets and neighborhood animals may become aggressive without warning. Any animal on the property which may potentially be a problem must be restrained by the owner or their representative prior to site entry.

Struck By Falling Objects - Debris can fall suddenly or be thrown by equipment. No personnel should go near running equipment until he/she has communicated to the operator to stop.

All field personnel must be continually aware of these hazards and take appropriate precautions as part of their daily activities. Prior to startup of each operation, any hazards discovered by surveying will be noted in a leader/crew meeting.

The interim action requires a variety of tasks including sampling, analysis, excavation, and other construction activities. The following subsections identify potential hazards that may be associated with these tasks.

5.2.1 Soil Sampling

Most soil samples will be collected in excavations. Sampling personnel need to ensure that the excavation is in accordance with Chapter 296-155-WAC, Part N, Excavation Trenching and Shoring. Typically, if excavations are deeper than four feet, shoring or sloping will be required for man-entry. If the excavation area does not meet the requirements of the regulation, samples will be collected from the excavator bucket.

Some residential properties may require samples to be collected from maintenance areas not normally occupied (crawl spaces). Sampling personnel must ensure that there is safe entry in these areas and utilize the "buddy system". In addition, personnel need to be cognizant of structural and electrical hazards as well as rodents.

5.2.2 Sediment and Groundwater Sampling

Traffic control will be required while collecting storm drain sediment from catch basins and groundwater samples from several monitoring wells. Personnel must utilize signs, cones, barriers, and/or flaggers as necessary for protection from traffic.

5.2.3 Surface Water Sampling

Traffic control will be required while collecting storm water runoff samples from catch basins and manholes. Personnel must utilize signs, cones, barriers, and/or flaggers as necessary for protection from traffic. In addition, manholes are considered a confined space. Any personnel entering a manhole must comply with applicable confined space standards.

5.2.4 Soil Removal

The contractor must comply with Chapter 296-155-WAC, Part N, Excavation Trenching and Shoring during soil removal and replacement. Appropriate precautions must be taken to ensure the safety of equipment operators and other field personnel.

5.2.5 Soil Loading and Transportation

Traffic control may be required at some locations while loading soil that is scheduled to be removed and transported off-site. At these locations, personnel must utilize signs, cones, barriers, and/or flaggers as necessary for protection from traffic.

6.0 TRAINING

6.1 GENERAL TRAINING

All field personnel must have the 40 hours of initial safety training (or equivalent in accordance with 29 CFR 1910.120) as required by WISHA under WAC 296-62-300 Part P, Hazardous Waste Operations and Emergency Response (HAZWOPER). Workers and supervisors must maintain eight hours of refresher training annually to re-emphasize the initial training and to get updated on new policies and procedures in accordance with WAC 296-62-3040 (10).

All new field personnel shall receive a minimum of three days of initial field experience under the direct supervision of experienced supervisors, ensuring protection of worker health and safety consistent with the requirements under WAC 296-62-300. The worker's training will be consistent with their job function and responsibilities.

All personnel involved in remedial and/or sampling work will undergo a safety orientation by the Project Health & Safety Officer or the Site Health & Safety Officer. This instruction, held prior to initiating any site activity, is to ensure that employees are apprised of this HSP and includes the following:

- Proper handling of all solid and liquid materials,
- Proper sampling procedures, as appropriate,
- Operation and maintenance of safety equipment,
- Requirements for use of respirators and other PPE,
- Required personal hygiene practices,
- Effective responses to emergencies and emergency procedures, and
- General safety precautions.

Lastly, a minimum of one person for every two working on-site must be trained in first-aid and CPR per WAC 296-155-120. This training, in part, may be included in the eight hour HAZWOPER refresher training.

6.2 RESPIRATOR TRAINING

All field personnel must be trained in the use of half-face mask air purifying respirators with HEPA cartridges. Workers will be administered a fit test and instruction on maintenance, fit, and precautions on at least an annual basis. Respirator-wearing personnel will receive training in the proper use of respirators including techniques used to determine good respirator fit. The use of respirators will be consistent with WAC 296-62-071-07121 and is discussed further in Section 7 and Attachment B-10 (Personnel Monitoring Plan).

6.3 HAZARD COMMUNICATION

A Hazard Communication Program must be provided to field personnel sharing the knowledge of the chemicals they may come in contact with along with the knowledge of hazards in the area required to protect their health. Figure 6-1 shows the Hazard Warning Notification for arsenic and lead, which are the main chemicals of concern, that must be read by all field personnel.

FIGURE 6-1

HAZARD WARNING NOTIFICATION

The Everett Smelter Site is a hazardous waste site with the following hazards in the soils:

ARSENIC is a carcinogen and is toxic to humans if overexposed. Arsenic overexposure by ingestion causes stomach pains, nausea, vomiting, and watery diarrhea. Arsenic overexposure by inhalation can cause cough, chest pain, headache, and the stomach problems above. Long-term symptoms of arsenic overexposure include organ damage. Arsenic cannot be absorbed through the skin.

LEAD is a poison and can cause problems with blood-forming systems and the kidneys if overexposed over a period of time. Lead overexposure by ingestion or inhalation causes loss of appetite, metallic taste in mouth, anxiety, constipation, nausea, and weakness. Lead cannot be absorbed through the skin.

The amount of soil ingested which could cause the symptoms above is more than that which could normally be associated with unintentional ingestion in an industrial setting. The levels of arsenic and lead within the surface of the Everett Smelter Site properties do not present a hazard to health if the procedures below are followed. The areas inside the perimeter fence are exclusion zones. Personnel who are not trained in the hazards of working in hazardous waste sites are not allowed entry unless a specific defined area has been set up as 'clean'.

PROCEDURES to follow include avoid contact with soils and remain outside restricted areas. If soils do contact the skin, wash the area clean. Smoking, drinking, or eating are not allowed in the work areas except in specific break areas.

SIGNATURE STATEMENT

I have read the information above and understand the hazards of working in an area that contains arsenic and lead. I also understand the procedures above and agree to follow these procedures. I also understand that if I experience any of the symptoms listed above for arsenic or lead, that I should report this to my employer immediately.

_____	_____	_____
SIGNATURE	PRINTED NAME	DATE

7.0 SAFETY PROTECTION

7.1 GENERAL PROTECTION REQUIREMENTS

Whenever routine work practices cannot effectively reduce excessive exposures, personal protective equipment (PPE) will be used by field personnel. Work practices using PPE shall be instituted to ensure worker exposure remains below the applicable Permissible Exposure Limits (PELs). Information on PELs is discussed further in Attachment B-10 (Personnel Monitoring Plan).

7.2 PERSONAL PROTECTIVE EQUIPMENT

Basic required PPE for field personnel will be "Level D". Field personnel will be required to wear "Level D" PPE at all times while performing any task in the field related to the interim action. The following safety equipment constitutes "Level D" protection:

- Hard hat
- Steel-toed, steel-shanked safety boots
- Safety glasses and/or goggles
- Work gloves
- Cotton or cotton/poly coveralls
- Foam ear protectors, if noise levels warrant

Any task that exposes field personnel to levels beyond the PEL for any element of concern requires the implementation of "Level C" protection. "Level C" protection will be the same as "Level D" except that a half-face mask air purifying respirator will be used with MSHA-approved HEPA cartridges.

While removing source area soil (soil with arsenic concentrations greater than 3,000 mg/Kg in the Fenced Area), field personnel must wear "Level C" PPE until personnel monitoring results show arsenic and lead levels are less than the PELs for three consecutive days. If any personnel monitoring results show levels above the PELs,

respirators will continued to be worn and activities will be re-evaluated and modified. If levels are less than the PELs for three consecutive days, PPE requirements can be downgraded from "Level C" to "Level D". In addition, respirators will be required during the removal of arsenic trioxide (material designated for Subtitle C disposal) regardless of personnel monitoring results.

In addition, should initial personnel monitoring results show levels above the PELs during residential soil removal, workers will revert from "Level D" to "Level C" PPE until analytical results are below the PELs for three consecutive days.

7.3 SITE STANDARD OPERATING PROCEDURES

Field operations will be conducted in a manner to reduce the exposure of personnel and equipment and to eliminate the potential for airborne dispersion of dust as much as practical. A safety meeting will be held at the start of field work. The meeting will focus on standard operating procedures (SOPs) associated with specific tasks and equipment. A mandatory tailgate safety meeting will be held at the beginning of each week and documented consistent with WISHA requirements.

The following is a list of general site SOPs that will be enforced:

1. Legible and understandable precautionary labels shall be prominently affixed to containers of raw materials, intermediates, products, by-products, mixtures, scrap, waste, debris and protective clothing.
2. PPE shall not be removed until it has been cleaned, stored, or properly packaged and labeled.
3. Employees will not be allowed to exit the exclusion and/or decontamination zones until decontamination has taken place as per procedures listed in Section 8. The exception is a medical emergency, whereby the delay or the extra movement may endanger the employee. However, medical response personnel must be made aware of the chemicals of concern.

4. Removal of materials from PPE by blowing, shaking, or any other means that may disperse materials into the air is prohibited.
5. The clean zone must have potable water with hygienic dispensation available.
6. The clean zone must have a hand cleaning facility. All employees shall be required to clean their hands before eating, drinking, or smoking.
7. No smoking or eating (including the chewing of tobacco, gum and/or sunflower seeds) is permitted in the work zones.
8. As appropriate, equipment on-site shall be bonded and grounded, spark proof, and explosion resistant.
9. All personnel shall avoid contact with potentially contaminated substances. Walking through puddles or mud, kneeling on the ground, or leaning against soiled surfaces should be avoided whenever possible.
10. Monitoring equipment shall not be placed on dusty surfaces.
11. Field personnel must observe each other for signs of chemical exposure. Indications of adverse effects include, but are not limited to:
    a) Changes in complexion and skin discoloration;
    b) Changes in coordination;
    c) Changes in demeanor;
    d) Excessive salivation and pupillary response; and
    e) Changes in speech pattern.
12. Field personnel must inform the Site Health & Safety Officer of non-visual effects of potential chemical exposure such as:
    a) Headaches;
    b) Dizziness;
    c) Nausea;
    d) Blurred vision;
    e) Cramps; and
    f) Irritation of eyes, skin, or respiratory tract.
13. Prompt remedial action shall be taken whenever a spill/ release occurs. Fuel spill response supplies will be at the staging area and will consist of oil absorbent pads

and plastic bags. Wash water spills will be contained and absorbed. Soil spills will be collected and removed immediately.

14. All earth moving, rubber-tired equipment will be equipped with audible backup alarms.
15. All speed limits will be observed by equipment operators.
16. A fire extinguisher (minimum 5A-20BC) will be on-site each day and available whenever gasoline or other flammable material is transferred (with the exception of transfers at a gas station).
17. A first-aid kit, WISHA acceptable (determined by the number of personnel on site) will be on-site each day.
18. All buckets and blades will be lowered to the ground before shutting off the equipment.
19. A minimum of two personnel will be on-site for any activity exclusive of operating peripheral monitoring equipment.
20. Backhoes or other equipment with tall booms shall not be operated within 20 feet of any electrical conductor without first getting approval from the Site Health & Safety Officer.
21. Engines will be shut off while fueling.
22. Unauthorized riding on excavation equipment is prohibited.
23. All personnel must stay clear of the backhoe bucket, and the operator must never swing the bucket over other personnel.
24. Utility companies will be contacted prior to any excavating or drilling to ensure that no underground utilities are present.
25. Dust will be kept at a minimum.
26. All portable electrical equipment that is not double-insulated will be run through a portable ground-fault interrupter.
27. For extended operations that are distant from sanitary facilities, chemical toilets will be provided.

7.4 LUNCHES/BREAKS

All eating must take place in an area specifically provided for that purpose. No food, with the exception of water, will be consumed unless personnel are in a designated "approved" zone. All breaks must also take place in an area specifically provided for that purpose. No eating, chewing, or smoking is to take place at the work site. Personnel must also remove coveralls and wash hands and face before eating.

7.5 HEAT STRESS

Heat stress could potentially affect field personnel. The potential for heat stress depends on the type of protective gear being worn, the ambient temperature, and the amount of activity. Work cycle lengths will be based initially on subjective input from field personnel. Workers will report any cases of dizziness, excessive sweating, increased respiratory rate or pulse and are to leave the work area immediately if these conditions are noted. Work cycle lengths will be reduced and a monitoring program will be initiated if the above symptoms are noted. Work cycles will be reduced if a pulse rate of greater than 110 is noticed at the beginning of the break. Personnel with elevated rates will not return to work until the pulse has lowered to their resting rate. First aid procedures will be used for heat related conditions, as necessary.

7.6 COLD STRESS

During field activities, workers may also become exposed to cold temperatures. Although frostbite is not a likely hazard during expected operation periods, hypothermia can occur any month of the year in northern climates. Factors leading to hypothermia include ambient temperature, wind velocity, precipitation, exposure time, and type of protective gear being worn.

Signs of excess cold exposure include uncontrollable fits of shivering, slurred speech, memory lapses, immobile hands, stumbling, drowsiness, and exhaustion. Treatment for

these symptoms are to remove the victim from the wind and cold, remove wet clothing, supply a warm drink, and keep the victim warm with blankets or clothing.

7.7 NOISE

Field personnel, particularly equipment operators, may be exposed to noise dose levels 85dB or greater. For those employees exposed, hearing protection such as foam ear plugs will be required.

8.0 OTHER REQUIREMENTS

8.1 MEDICAL SURVEILLANCE

A medical surveillance program must be provided for field personnel participating in the interim action. The program includes baseline and routine annual follow-up physical examinations and is specifically designed for personnel working at hazardous waste sites. Field personnel shall also receive a medical examination at the termination of their employment, unless their annual exam has occurred within six months of termination. Specific tests included in the baseline physical examination are detailed in Attachment B-11.

8.2 DECONTAMINATION

8.2.1 Personnel

Field personnel will be required to follow the decontamination procedures prior to leaving the work zone including:

- Gross contamination removal from clothing, boots, and gloves in the exclusion zone.
- Boot wash and glove wash consisting of soap wash tub with a brush and then a rinse tub with a brush in the decontamination zone. Wash waters will be changed frequently as needed.

- Remove respirators, coveralls, then boots, and then gloves in the decontamination zone.
- Contain PPE as appropriate in the decontamination zone (place respirator in storage bag, disposable gloves in trash can, coveralls in storage bin, etc.).
- Leave the decontamination zone. All field personnel are required to thoroughly wash their hands and face before eating, drinking, or smoking. In addition, all field personnel are required to shower at the end of each work day.
- Store used coveralls in containment for laundry service or disposal. Note that coveralls cannot be used more than one day without service while removing source area soils in the Fenced Area.

The decontamination station(s) will be located prior to work commencing. The stations will be discussed at every Monday morning tailgate safety meeting.

8.2.2 Equipment

The decontamination process for equipment leaving the exclusion zone will be:

- Move equipment into the designated wash area.
- Remove the gross contamination.
- Water wash and stiff bristle brush, as necessary.
- Water rinse.

The equipment wash station(s) will be located and wash waters will be managed as specified in the interim action report.

8.2.3 Additional Cleaning for Vehicles

Vehicles shall be cleaned (inside and out) on a regular basis with soap and water outside and vacuuming the interior. Vehicles used continuously in operations are to be cleaned monthly at a minimum. At the conclusion of scheduled work, the construction equipment will be washed thoroughly on-site before de-mobilizing.

9.0 EMERGENCY RESPONSE

9.1 GENERAL ACTIONS

All accidents or potentially hazardous conditions will be handled in a manner to minimize the health risk to personnel. The main emergency contacts are identified in Attachment B-12 while the emergency route to a local medical facility is included as Attachment B-13. In addition, a Fire Protection Plan is included as Attachment B-14.

In the event that an accident or a hazardous condition develops, the following procedures will be followed:

- First-aid or other appropriate actions will be administered by those closest to the accident/event. Those rendering assistance will not be placed in a situation of unacceptable risk.
- All accidents/hazardous conditions will be reported to the Project Health & Safety Officer and to the Project Manager. The Site Health & Safety Officer is responsible for conducting emergency response in an efficient, rapid, and safe manner.

An assessment of the emergency will be made by the Site Health & Safety Officer. First-aid will be administered to victims and, if necessary, an emergency response vehicle will be summoned. Any doubt as to the condition of the injured employee requires the employee to receive a "Doctor's Permit to Return to Work" prior to resuming his/her duties. Some examples of site emergencies are injury to personnel, damage to utilities, damage to a structure, and injuries to bystanders.

9.2 NOTIFICATION

In the event that the Site Health & Safety Officer determines that a site emergency is not limited to a minor first-aid case, he/she will immediately notify any or all of the appropriate contacts listed in Attachment B-12. Communications will be provided by the use of cellular phones and/or radios.

9.3 INCIDENT DOCUMENTATION

As soon as practical following an emergency, an injury report form will be submitted by the Site Health & Safety Officer to the Project Health and Safety Officer. In addition, any site incident involving injury, illness or other emergency will be recorded appropriately within the OSHA logs.

ATTACHMENT B-1

ASARCO EMPLOYEE CONSENT AGREEMENT

EVERETT SMELTER SITE
INTERIM ACTION

B.1 ASARCO EMPLOYEE CONSENT AGREEMENT

I have reviewed the Site Health and Safety Plan for the interim action at Everett, Washington. I understand its purpose and consent to adhere to its policies, procedures and guidelines while an employee on the site.

Employee Signature	Print Name	Date
Employee Signature	Print Name	Date
Employee Signature	Print Name	Date
Employee Signature	Print Name	Date
Employee Signature	Print Name	Date
Employee Signature	Print Name	Date

ATTACHMENT B-2

CONTRACTOR CONSENT AGREEMENT

B.2 CONTRACTOR CONSENT AGREEMENT

I have reviewed the Site Health and Safety Plan for the interim action at Everett, Washington. I understand its purpose and consent to adhere to its policies, procedures and guidelines as a contractor on the site. I also understand that the existence of this plan does not absolve my company of the responsibility to create and comply with our own health & safety policies for our activities on site.

Signature	Date	Company
Signature	Date	Company
Signature	Date	Company
Signature	Date	Company
Signature	Date	Company
Signature	Date	Company

ATTACHMENT B-3

VISITOR OR OBSERVER CONSENT AGREEMENT

EVERETT SMELTER SITE

INTERIM ACTION

B.3 VISITOR OR OBSERVER CONSENT AGREEMENT

I have reviewed the Site Health and Safety Plan for the interim action at Everett, Washington. I understand its purpose and consent to adhere to its policies, procedures and guidelines as a visitor or observer on the site.

Signature	Date	Company
Signature	Date	Company
Signature	Date	Company
Signature	Date	Company
Signature	Date	Company

ATTACHMENT B-4

DUST CONTROL PLAN

B.4 DUST CONTROL PLAN

The dust control plan will be maintained at all times and will be implemented in accordance with PSAPCA requirements Regulation 1, Section 9.15 (see Excerpt B-4-1). This regulation addresses the fugitive dust emission standard. Generally, the standard prohibits fugitive dust unless the best available control technology is employed. Most of the work such as soil removal, grading and filling operations, and material handling will utilize a water spray. Stockpiles may be stabilized with water as well. However, if a stockpile consists of contaminated soil, it may be covered with a tarp rather than spraying with water if determined necessary by the Site Engineer.

The following describes other actions to be taken to control dust:

- The dispersion of materials into the air must be minimized to the extent practical.
- Vehicle tires shall be cleaned prior to entering roadways.
- Any accumulations of materials on equipment undercarriages must be removed.
- Vehicles used continuously in operations must be cleaned at least monthly.
- Loads of contaminated materials must be covered during transportation out of the work zones.
- Street and access ways used will be sprayed and or swept periodically as needed.

Visible dust inspections, peripheral air monitoring (see Attachment B-5), and personnel monitoring (see Attachment B-11) will be used to assess the dust control effectiveness. In addition, the water spray used will be controlled to minimize run-off from the area. This will be accomplished by control the pace of the work and using minimal volumes of water for dust suppression.

EXCERPT B-4-1

PUGET SOUND AIR POLLUTION CONTROL AGENCY

110 Union St., Suite 500 ▪ Seattle, WA 98101-2038
(206) 343-8800 Serving King, Kitsap, Pierce, and Snohomish Counties
1 (800) 552-3565

HYDROMETRICS, INC. Received 1997 TACOMA, WA

EXCERPTS FROM REGULATION I

SECTION 1.07 DEFINITIONS

(e) AIR CONTAMINANT means dust, fumes, mist, smoke, other particulate matter, vapor, gas, odorous substance, or any combination thereof.

(k) BEST AVAILABLE CONTROL TECHNOLOGY means technology that will result in an emission standard, including a visible emission standard, based on the maximum degree of reduction which the Agency, on a case-by-case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable for such source through application of production processes, available methods, systems, and techniques, including fuel cleaning or treatment, clean fuels, or innovative fuel combustion techniques for control of each air contaminant. In no event shall application of the best available control technology result in emissions of any air contaminant that would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60, 61, and 63. The Agency may prescribe a design, equipment, work practice, or operational standard, or combination thereof, to meet the requirements of best available control technology. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice, or operation and shall provide for compliance by means that achieve equivalent results.

(o) CONTROL EQUIPMENT means any device that prevents or controls the emission of any air contaminant.

(q) EMISSION means a direct or indirect release of any air contaminant into the ambient air.

(s) EQUIPMENT means any stationary or portable device or any part thereof that emits or may emit any air contaminant into the atmosphere.

(v) FUEL BURNING EQUIPMENT means equipment that produces hot air, hot water, steam, or other heated fluids by external combustion of fuel.

(w) FUGITIVE DUST means particulate matter or any visible air contaminant other than uncombined water that is not collected by a capture system and emitted from a stack, but is released to the atmosphere at the point of generation.

(ll) PARTICULATE MATTER means any material, except water in an uncombined form, that is, has been, or is likely to become airborne and exists as a liquid or a solid at standard conditions.

(mm) PERSON means and includes any individual, firm, public or private corporation, association, partnership, political subdivision, municipality, or governmental agency.

(qq) REFUSE BURNING EQUIPMENT means equipment employed to burn any solid or liquid combustible refuse.

SECTION 9.03 EMISSION OF AIR CONTAMINANT: VISUAL STANDARD

(a) It shall be unlawful for any person to cause or allow the emission of any air contaminant for a period or periods aggregating more than 3 minutes in any 1 hour, which is:

(1) Darker in shade than that designated as No. 1 (20% density) on the Ringelmann Chart, as published by the United States Bureau of Mines; or

(2) Of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in Section 9.03(a)(1).

(b) The density or opacity of an air contaminant shall be measured at the point of its emission, except when the point of emission cannot be readily observed, it may be measured at an observable point of the plume nearest the point of emission.

(c) This section shall not apply when the presence of uncombined water is the only reason for the failure of the emission to meet the requirements of this section.

(d) This section shall not apply to solid fuel burning devices, permitted fire training facilities, motor vehicles when operated on public roads, or aircraft.

(e) Section 9.03(a) shall not apply to any source which meets the requirements of Section 9.09(c).

SECTION 9.11 EMISSION OF AIR CONTAMINANT: DETRIMENT TO PERSON OR PROPERTY

(a) It shall be unlawful for any person to cause or allow the emission of any air contaminant in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

(b) A Notice of Violation of this section may be issued based upon an affidavit from the person making the complaint and verification by the Control Officer or his duly authorized representative.

(c) Nothing in this Regulation shall be construed to impair any cause of action or legal remedy of any person, or the public for injury or damages arising from the emission of any air contaminant in such place, manner or concentration as to constitute air pollution or a common law nuisance.

SECTION 9.12 ODOR AND NUISANCE CONTROL MEASURES

(a) It is the policy of the Board that effective control equipment and measures shall be installed and operated to control the emission of odor-bearing air contaminants and

(b) It shall be unlawful for any person to cause or allow the emission of odor-bearing air contaminants unless such person uses the best available control technology to control the emissions.

SECTION 9.15 FUGITIVE DUST: EMISSION STANDARD

(a) It shall be unlawful for any person to cause or allow the emission of fugitive dust unless such person uses the best available control technology to control the emissions.

(b) It shall be unlawful for any person to cause or allow a vehicle to be operated on a paved roadway open to the public:

(1) Unless such vehicle is so constructed or loaded as to prevent any of its load from dropping, sifting, leaking, or otherwise escaping therefrom, except that sand may be dropped for the purpose of securing traction, and except road construction and maintenance by public agencies.

(2) With a load of dirt, sand, gravel, or other material susceptible to being dropped, spilled, or otherwise escaping therefrom unless it is covered or has adequate freeboard so as to prevent spillage.

(3) With deposits of mud, dirt, or other debris on the vehicle's body, fenders, frame, undercarriage, wheels, or tires.

Deposits of particulate matter on a paved roadway open to the public shall be prima facie evidence of a violation of Section 9.15(b).

(c) It shall be unlawful for any person to cause or allow the emission of fugitive dust from any refuse burning equipment, fuel burning equipment, equipment used in a manufacturing process, or control equipment.

(d) It shall be unlawful for any person to cause or allow the emission of fugitive dust in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

SECTION 9.20 MAINTENANCE OF EQUIPMENT

(a) It shall be unlawful for any person to cause or allow the operation of any features, machines or devices constituting parts of or called for by plans, specifications, or other information submitted pursuant to Article 6 of Regulation I unless such features, machines or devices are maintained in good working order.

(b) It shall be unlawful for any person to cause or allow the operation of any equipment as defined in Section 1.07 or control equipment not subject to Section 9.20(a) unless the equipment or control equipment is maintained in good

AGENCY POLICY ON FUGITIVE DUST CONTROLS

DEFINITIONS

FUGITIVE DUST means particulate matter or any visible air contaminant other than uncombined water that is not collected by a capture system and emitted from a stack, but is released to the atmosphere at the point of generation.

PARTICULATE MATTER means any material, except water in an uncombined form, that is, has been, or is likely to become airborne and exists as a liquid or a solid at standard conditions.

BEST AVAILABLE CONTROL TECHNOLOGY means technology that will result in an emission standard, including a visible emission standard, based on the maximum degree of reduction which the Agency, on a case-by-case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable for such source through application of production processes, available methods, systems, and techniques, including fuel cleaning or treatment, clean fuels, or innovative fuel combustion techniques for control of each air contaminant. In no event shall application of the best available control technology result in emissions of any air contaminant that would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60, 61, and 63. The Agency may prescribe a design, equipment, work practice, or operational standard, or combination thereof, to meet the requirements of best available control technology. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice, or operation and shall provide for compliance by means that achieve equivalent results.

SECTION 9.15(a)

Prohibits fugitive dust emissions unless the best available control technology is employed. Some examples of fugitive dust control techniques are:

(1) ROADWAYS, ROAD SHOULDERS, PARKING LOTS, AND STORAGE AREAS should be paved, surfaced with gravel, or treated with chemical stabilizers. Good housekeeping measures should be used to minimize the accumulation of mud or dust, to prevent the carry-out of dirt onto paved public roadways, and to prevent the visible emission of dust [see also 9.15(b)].

(2) STORAGE PILES should be stabilized with water spray, chemical stabilizers, or suitable enclosures (e.g., tarps, buildings).

(3) MATERIALS HANDLING AND TRANSFER OPERATIONS should employ control measures such as the use of water sprays at transfer points or total enclosure of the areas in which visible dust is generated (or both). [For transportation requirements, see also 9.15(b).]

(4) DEMOLITION PROJECTS should employ water sprays to prevent visible emission of dust during wrecking. Materials removed during a renovation should be either carefully lowered to the ground (not thrown) or transported to the ground via chutes into dust-tight containers. All demolition and renovation projects involving asbestos should be done in accordance with Article 4 of Regulation I.

(5) GRADE AND FILL OPERATIONS associated with construction and demolition projects should employ water spray as needed to prevent visible dust emissions. [For transport requirements, see 9.15(b).]

(6) ABRASIVE BLASTING AND SPRAY PAINTING OPERATIONS should be performed inside a booth designed to capture the blast grit or overspray. Outdoor blasting or painting of structures or items too large to be reasonably handled indoors should employ control measures such as curtailment during windy periods and enclosure of the area being painted or blasted with tarps. Blasting should be performed with either steel shot or an abrasive containing less than 1% (by mass) which would pass through a #200 sieve. All abrasive blasting with sand must be performed inside a blasting booth or cabinet.

SECTION 9.15(b)

Prohibits the deposition of particulate matter on paved public roads. Some examples of necessary control measures are:

(1) COVERS, WETTING OF MATERIALS, OR ADEQUATE FREEBOARD shall be used to prevent loss of particulate matter in transit [see also RCW 46.61.655(2)(3)].

(2) PAVED ENTRY APRONS AND EFFECTIVE CLEANING TECHNIQUES (e.g., wheel washers) shall be used to prevent carry-out of particulate matter from unpaved areas [see also RCW 46.61.655(4)].

(3) PARTICULATE MATTER deposited on paved public roads shall be cleaned up immediately [see also RCW 46.61.655(1)].

SECTION 9.15(c)

Prohibits fugitive dust emissions from incinerators, boilers, manufacturing equipment (e.g., asphalt plants, electric furnaces), and air pollution control equipment. Sources subject to this section must:

(1) EMPLOY EFFECTIVE CAPTURE SYSTEMS to eliminate fugitive dust. Visible emissions from points other than a stack (e.g., roof monitors, building openings, ductwork) are prohibited.

(2) HANDLE PARTICULATE MATTER collected in air pollution control equipment in a dust-free manner. This means no visible emissions or evidence thereof (e.g., dust accumulation, spills).

SECTION 9.15(d)

Prohibits the emission of fugitive dust in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

NOTE: THE CONTROL MEASURES MENTIONED ABOVE MERELY REPRESENT SOME EXAMPLES OF CONTROL TECHNIQUES NECESSARY TO PREVENT FUGITIVE DUST EMISSIONS AND ARE NOT TO BE CONSTRUED TO REPRESENT THE BEST AVAILABLE CONTROL TECHNOLOGY.

ATTACHMENT B-5

PERIPHERAL MONITORING PLAN

B.5 PERIPHERAL MONITORING PLAN

Peripheral air monitoring will be conducted daily during soil excavation activities to document the adequacy of dust control measures as they relate to the protection of residents. This program monitors the transport of airborne materials beyond the work zones. It is anticipated that three monitors will be required during soil removal activities in the fenced area. Two samplers will be located downwind of prevailing wind and one sampler will be located upwind in case the wind shifts during the day.

At residential properties outside the fenced area, one monitor will be located near the residential properties being remediated while soil is removed. One monitor may cover up to three residences if the decision units are close in proximity.

B.5.1 TRIGGER LEVELS

There are no dust emission standards for arsenic, cadmium, or lead. However, Asarco has developed trigger levels to assess what additional measures, if any, should be used to control sources of dust generated during soil removal. The trigger levels were developed for work at the Tacoma Smelter Site by Ecology, EPA, and Asarco. The levels were determined to be protective of residential areas near the site. The following trigger levels have been established:

Chemical	Level
Arsenic	0.2 ug/m^3
Lead	0.5 ug/m^3

Cadmium will not be sampled because its trigger level would be the same as arsenic. In addition, all data indicate that arsenic concentrations are significantly higher than cadmium. Given similar risk-based trigger levels, arsenic would be the risk driver because it is much more likely to exceed the trigger level than cadmium.

The trigger levels are based on a 5 x 10^{-5} risk for a 10 year exposure scenario. The exposure calculations are based on a 10 hour day, 350 days per year exposure for 10 years. These numbers represent the trigger levels and should not be confused as allowable emission standards.

Parameters used to calculate the target level for arsenic were derived from the standard risk assessment calculation solved for the air concentration:

$$\text{Risk} = 0.2\text{ug/m}^3 \times 20\text{m}^3 \times \frac{1}{70\text{kg}} \times \frac{10\text{hr/day}}{24\text{hr/day}} \times \frac{350\text{day/year}}{365\text{day/year}} \times \frac{10\text{years}}{70\text{years}} \times 15(\text{mg/kg/day})^{-1} \times \frac{1\text{mg}}{1000\text{ug}}$$

$$\text{Trigger Level} = \frac{1}{20\text{m}^3} \times 70\text{kg} \times \frac{24\text{hr/day}}{10\text{hr/day}} \times \frac{365\text{day/year}}{350\text{day/year}} \times \frac{70\text{years}}{10\text{years}} \times \frac{1}{15(\text{mg/kg-day})^{-1}} \times (5\text{x}10^{-5})$$

Trigger Level = 0.0002 mg/m^3

Trigger Level = 0.2 ug/m^3

If trigger levels are exceeded, Asarco will review the contractor's operation including pace and dust control measures being used. Procedures will be modified as determined appropriate.

B.5.2 SAMPLE COLLECTION

Samples will be collected using personal air quality samplers in accordance with NIOSH Method 7300. Standard operating procedures include:

- Sampling will be conducted over approximately seven to 10 hour periods when work is being performed.
- Remove red plug (save) and connect plastic filter cassette to Tygon tubing.
- The sampling location should be within 50 feet downwind of the work between four and six feet above ground with air flow between the sampler and work unrestricted by trees, buildings, etc.
- Record the cassette number, date, approximate sampler location, and pump number (see Figure B-5-1).

- Remove blue inlet plug from the filter holder (save).
- Turn pump on and adjust flow rate using digital readout. The setting on the rotameter will correspond as closely as possible to a flow rate of between 2.0 and 2.5 liters per minute as calibrated. Record flow setting and time to nearest minute on the sample form (see Figure B-5-1).
- Let sampler run during entire work day of operation or for a minimum of seven hours, whichever is longer.
- Turn pump off and record the flow setting on the rotameter and time pump is turned off on sample form (see Figure B-5-1).
- Re-plug the filter cassette, fill out the proper paperwork, and ship cassettes and sample form to a laboratory for analysis. Filters are mounted in cassettes by the laboratory. Therefore, the filter must remain in the cassettes until received and analyzed by the laboratory.

The personal air samplers must be calibrated in accordance with procedures established under NIOSH. Pump-installed rotameters will be calibrated using a precision calibrating rotameter. Airflow on the pumps will be checked before and after sampling with the pump-installed digital rotameter.

B.5.3 LABORATORY ANALYSIS

Samples will be analyzed using Zeeman Graphite Furnace method. Results will be submitted to Ecology in a computer file with the monthly report. Ecology will be immediately notified of any exceedance. During the first week of operation, rush (24 hour turn-around time) analyses will be requested of the laboratory each day. Once data indicate that concentrations are below the trigger levels for at least five consecutive days, subsequent analyses will not be rushed. These samples will be sent to a laboratory once per week, likely on Thursday. The results (samples collected on Thursday, Friday, Monday, Tuesday, and Wednesday) will be available by the following Thursday.

FIGURE B-5-1

PUMP # _____

PERIPHERAL AIR MONITORING

DATE _____

ASARCO REPRESENTATIVE _____

TAG # _____

LOT ADDRESS _____

SITE CODE _____

SAMPLING POINT, RELATIVE TO LOT

_____

EXCAVATION EQUIPMENT

_____

WEATHER

WIND (DIRECTION & SPEED) _____

SKY (CLR, CLDY, PCLDY, FOG) _____

TEMPERATURE (F) _____

PRECIPITATION (RAIN, DRIZZLE, NONE) _____

BAROMETRIC PRESSURE _____

STATION _____

TIME ON _____

ROTO BALL ON 2.3

ROTO BALL OFF _____

TIME OFF _____

ELAPSED TIME _____

MEAN CORRECTED FLOW _____

COMMENTS

CALIBRATION

DATE _____

PUMP ROTAMETER	MANO. AVG FLOW	TRIALS
		6
		6
		6
		6
		6

CALIB. PRESSURE _____

CALIB. TEMPERATURE (F) _____

PUMP READING	MEAN CORRECTED FLOW
2.5	-
2.3	
2.1	-
1.9	
1.7	-

ATTACHMENT B-6

ARSENIC HEALTH DATA

B.6 ARSENIC HEALTH DATA

The following information is quoted from 29 CFR 1910.1018. It is noted that the health hazard of inorganic arsenic is high.

B.6.1 WAYS IN WHICH THE CHEMICAL AFFECTS YOUR BODY

Exposure to airborne concentrations of inorganic arsenic may cause lung cancer, and can be a skin irritant. Inorganic arsenic may also affect your body if swallowed. One compound in particular, arsenic trichloride, is especially dangerous because it can be absorbed readily through the skin. Because inorganic arsenic is a poison, you should wash your hands thoroughly prior to eating or smoking.

The OSHA standard is based on minimizing risk of exposed workers dying of lung cancer from exposure to inorganic arsenic. It will also minimize skin cancer from such exposures.

B.6.2 NONCARCINOGENIC EFFECTS

The following sections quoted from "Occupational Diseases: A Guide to Their Recognition", Revised Edition, June 1977, National Institute for Occupational Safety and Health is included to provide information on the nonneoplastic effects of exposure to inorganic arsenic. Such effects should not occur if the OSHA standards are followed.

B.6.2.1 Local

Trivalent arsenic compounds are corrosive to the skin. Brief contact has no effect but prolonged contact results in a local hyperemia and later vesicular or pustular eruption. The moist mucous membranes are most sensitive to the irritant action. Conjunctiva, moist and macerated areas of skin, the eyelids, the angles of the ears, nose, mouth, and respiratory mucosa are also vulnerable to the irritant effects. The wrists are common sites of dermatitis, as are the genitalia if personal hygiene is poor. Perforations of the nasal septum may occur. Arsenic trioxide and pentoxide are capable of producing skin sensitization and contact dermatitis. Arsenic is also capable of producing keratoses, especially of the palms and soles.

B.6.2.2 Systemic

The acute toxic effects of arsenic are generally seen following ingestion of inorganic arsenic compounds. This rarely occurs in an industrial setting. Symptoms develop within 1/2 to 4 hours following ingestion and are usually characterized by constriction of the throat followed by dysphagia, epigastric pain, vomiting, and watery diarrhea. Blood may appear in vomitus and stools. If the amount ingested is sufficiently high, shock may develop due to severe fluid loss, and death may ensue in 24 hours. If the acute effects are survived, exfoliative dermatitis and peripheral neuritis may develop.

Cases of acute arsenic poisoning due to inhalation are exceedingly rare in industry. When it does occur, respiratory tract symptoms -- cough, chest pain, dyspnea -- giddiness, headache, and extreme general weakness precede gastrointestinal symptoms. The acute toxic symptoms of trivalent arsenic poisoning are due to severe inflammation of the mucous membranes and greatly increased permeability of the blood capillaries.

Chronic arsenic poisoning due to ingestion is rare and generally confined to patients taking prescribed medications. However, it can be a concomitant of inhaled inorganic arsenic from swallowed sputum and improper eating habits. Symptoms are weight loss, nausea and diarrhea alternating with constipation, pigmentation and eruption of the skin, loss of hair, and peripheral neuritis. Chronic hepatitis and cirrhosis have been described. Polyneuritis may be the salient feature, but more frequently there are numbness and parasthenias of "glove and stocking" distribution. The skin lesions are usually melanotic and keratotic and may occasionally take the form of an intradermal cancer of the squamous cell type, but without infiltrative properties. Horizontal white lines (striations) on the fingernails and toenails are commonly seen in chronic arsenic poisoning and are considered to be a diagnostic accompaniment of arsenic polyneuritis.

Inhalation of inorganic arsenic compounds is the most common cause of chronic poisoning in the industrial situation. This condition is divided into three phases based on signs and symptoms.

First Phase: The worker complains of weakness, loss of appetite, some nausea, occasional vomiting, a sense of heaviness in the stomach, and some diarrhea.

Second Phase: The worker complains of conjunctivitis, a catarrhal state of the mucous membranes of the nose, larynx, and respiratory passage. Coryza, hoarseness, and mild tracheobronchitis may occur. Perforation of the nasal septum is common, and is probably the most typical lesion of the upper respiratory tract in occupational exposure to arsenic dust. Skin lesions, eczematoid and allergic in type, are common.

Third Phase: The worker complains of symptoms of peripheral neuritis, initially of hands and feet, which is essentially sensory. In more severe cases, motor paralyses occur; the first muscles affected are usually the toe extensors and the perinea. In only the most severe cases will paralysis of flexor muscles of the feet or of the extensor muscles of hands occur.

Liver damage from chronic arsenic poisoning is still debated, and as yet the question is unanswered. In cases of chronic and acute arsenic poisoning, toxic effects to the myocardium have been reported based on EKG changes. These findings, however, are now largely discounted and the EKG changes are ascribed to electrolyte disturbances concomitant with arsenic overexposure. Inhalation of arsenic trioxide and other inorganic arsenic dusts does not give rise to radiological evidence or pneumoconiosis. Arsenic does have a depressant effect upon the bone marrow, with disturbances of both erythropoiesis and myelopoiesis.

ATTACHMENT B-7

LEAD HEALTH DATA

B.7 LEAD HEALTH DATA

The following information is quoted from 29 CFR 1910.1025.

B.7.1 WAYS IN WHICH LEAD ENTERS YOUR BODY

When absorbed into your body in certain doses, lead is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect you not only from the immediate toxic effects of lead, but also from the serious toxic effects that may not become apparent until years of exposure have passed.

Lead can be absorbed into your body by inhalation (breathing) and ingestion (eating). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through your skin. When lead is scattered in the air as dust, fume or mist it can be inhaled and absorbed through your lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. You can also absorb lead through your digestive system if lead gets into your mouth and is swallowed. If you handle food, cigarettes, chewing tobacco, or makeup which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion.

A significant portion of the lead that you inhale or ingest gets into your blood stream. Once in your blood stream, lead is circulated throughout your body and stored in various organs and body tissues. Some of this lead is quickly filtered out of your body and excreted, but some remains in the blood and other tissues. As exposure to lead continues, the amount stored in your body will increase if you are absorbing more lead than your body is excreting. Even though you may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing irreversible damage, first to individual cells, then to organs and whole body systems.

B.7.2 EFFECTS OF OVEREXPOSURE TO LEAD

B.7.2.1 Short-term (Acute) Overexposure

Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise which develops quickly to seizures, coma, and death from cardio-respiratory arrest. A short-term dose of lead can lead to acute encephalopathy. Short-term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects which take longer to acquire. Lead adversely affects numerous body systems, and causes which arise after periods of exposure as short as days or as long as several years.

B.7.2.2 Long-term (Chronic) Overexposure

Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic, there may be severe abdominal pain. Damage to the central nervous system in general and the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma, and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy.

Chronic overexposure to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine

laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression to kidney dialysis or death is possible.

Chronic overexposure to lead impairs the reproductive systems of both men and women. Overexposure to lead may result in decreased sex drive, impotence and sterility in men. Lead can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood.

Overexposure to lead also disrupts the blood-forming system resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigability as a result of decreased oxygen carrying capacity in the blood. The levels of lead anticipated in the removal activities are not expected to be near the levels which cause the preceding condition.

ATTACHMENT B-8

CADMIUM HEALTH DATA

B.8 CADMIUM HEALTH DATA

B.8.1 GENERAL INFORMATION

A. Routes of Entry

1. Inhalation
2. Ingestion

B. Acute Effects

1. Inhalation of large doses of cadmium can be fatal. Smaller doses can cause nausea, vomiting, and respiratory distress
2. Ingestion can also cause death. Smaller doses can lead to nausea, salivation, vomiting, diarrhea, and abdominal pain and discomfort. Cadmium is an oral poison, but the body's reaction to larger doses is very strong in vomiting and emetic action, rendering acute poisoning unlikely

C. Chronic Effects

1. Inhalation and ingestion of cadmium can have carcinogenic effects. Other long term effects are respiratory system and kidney damage

ATTACHMENT B-9

STANDARDS AND EXPOSURE GUIDE FOR CHEMICAL SUBSTANCES OF CONCERN

B. 9 STANDARDS AND EXPOSURE GUIDE FOR CHEMICAL SUBSTANCES OF CONCERN

B.9.1 RELEVANT STANDARDS AND EXPOSURE GUIDELINES:

- Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs)
- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs)
- Washington Industrial Safety and Health Act (WISHA), General Occupational Health Standards, (PELs)

B.9.2 OCCUPATIONAL STANDARDS AND EXPOSURE GUIDELINES FOR CHEMICAL SUBSTANCES OF CONCERN

CAS No.	Substance	WISHA/ OSHA PEL	ACGIH TLV
7740-38-2	Arsenic and Compounds	10 $\mu g/M^3$ (1) 8-HR (2) TWA (3)	200 $\mu g/M^3$ TLV-TWA (4)
7439-92-1	Lead, Inorganic Fumes and Dusts (as Pb)	50 $\mu g/M^3$ 8-HR TWA	150 $\mu g/M^3$ TLV-TWA
7440-43-9	Cadmium Dust	5 $\mu g/M^3$ 8-HR TWA	5 $\mu g/M^3$ TLV-TWA

NOTES:

(1) $\mu g/M^3$ = micrograms per cubic meter
(2) HR = Hour
(3) TWA = Time Weighted Average, 8 hour day
(4) TLV-TWA = Threshold Limit Value, Time Weighted Average

ATTACHMENT B-10

PERSONNEL MONITORING PLAN

B.10 PERSONNEL MONITORING PLAN

Personnel monitoring will be conducted to monitor the adequacy of protective equipment and procedures selected for safety. This program, often referred to as industrial hygiene monitoring, will monitor the all the chemicals of concern in the air during removal of contaminated soils.

B.10.1 FENCED AREA

Respiratory protection ("Level C" PPE) and personnel monitoring will be required for equipment operators and laborers, if any, at the beginning of Phase 1 source soil removal (soil with arsenic concentrations greater than 3,000 mg/Kg) until analytical results indicate arsenic and lead concentrations are below the PELs for at least three consecutive days. Respiratory protection will also be required for sampling personnel during this period. Once analytical results show levels are less than the PELs for three consecutive days, PPE requirements can be downgraded from "Level C" to "Level D". In addition, respiratory protection will be required during removal of arsenic trioxide material (material designated for Subtitle C disposal) regardless of the analytical results.

If any personnel monitoring results show levels above the PELs, activities will be re-evaluated and modified. Field personnel will remain in or revert to "Level C" PPE until analytical results are below the PELs for three consecutive days.

Personnel monitoring will also be conducted for three days for equipment operators and laborers should weather conditions change significantly (e.g., much drier) during source area soils removal (Phase 1) and at the beginning of residential soil removal (Phase 2). However, respirators will not be worn unless the personnel monitoring results show levels above the PELs. If this occurs, activities will be re-evaluated and modified and field personnel will revert from "Level D" to "Level C" PPE until analytical results are below the PELs for three consecutive days.

Sample collection is discussed further in Section B.10.3. The WISHA standards for chemicals of concern are as follows:

Chemical	PEL
Arsenic	10 ug/m^3, 8 hour TWA (WAC 296-62-07347)
Cadmium	5 ug/m^3, 8 hour TWA (WAC 296-62-07515)
Lead	50 ug/m^3, 8 hour TWA (WAC 296-62-07521)

B.10.2 RESIDENTIAL PROPERTIES

Personnel monitoring will be conducted for three days for equipment operators and laborers at the beginning of soil removal. Respirators will not be worn unless the personnel monitoring results show levels above the PELs. If this occurs, activities will be re-evaluated and modified and field personnel will revert from "Level D" to "Level C" PPE until analytical results are below the PELs for three consecutive days. Sample collection is discussed further in Section B.10.3.

B.10.3 SAMPLE COLLECTION

Samples will be collected using personal air quality samplers in accordance with NIOSH Method 7300. Standard operating procedures include:

- Sampling will be conducted over approximately seven to 10 hour periods when work is being performed.
- Remove red plug (save) and connect plastic filter cassette to Tygon tubing.
- Record the cassette number, date, approximate sampler location, and pump number on the sample form (see Figure B-10-1).
- Remove blue inlet plug from the filter holder (save).
- Turn pump on and adjust flow rate using digital readout. The setting on the rotameter will correspond as closely as possible to a flow rate of between 2.0 and 2.5 liters per minute as calibrated. Record flow setting and time to nearest minute on the sample form (see Figure B-10-1).

- Let sampler run during entire work day of operation or for a minimum of seven hours, whichever is longer.
- Turn pump off and record the flow setting on the rotameter and time pump is turned off on the sample form (see Figure B-10-1).
- Re-plug the filter cassette, fill out the proper paperwork, and ship cassettes and the sample form to a laboratory for analysis. Filters are mounted in cassettes by the laboratory. Therefore, the filter must remain in the cassettes until received and analyzed by the laboratory.

The personal air samplers must be calibrated in accordance with procedures established under NIOSH. Pump-installed rotameters will be calibrated using a precision calibrating rotameter. Airflow on the pumps will be checked before and after sampling with the pump-installed digital rotameter.

B.10.4 LABORATORY ANALYSIS

Samples will be analyzed using NIOSH Method 7900 – flame atomic absorption. Results will be submitted to Ecology in a computer file with the monthly report. Ecology will be immediately notified of any exceedance. Rush (24 hour turn-around time) analyses will be requested of the laboratory.

FIGURE B-10-1

PUMP #
898

PERSONAL AIR MONITORING

DATE _____

CONTRACTOR REPRESENTATIVE _____

TAG # _____

NAME _____

TITLE _____

AREA OF WORK
_____

ACTIVITY
_____

WEATHER

WIND DIRECTION & SPEED _____

SKY CLR, CLDY, PCLDY, FOG _____

TEMPERATURE (F) _____

PRECIPITATION RAIN, DRIZZLE, NONE _____

BAROMETRIC PRESSURE _____

STATION _____

PUMP # **898**

TIME ON _____

ROTO BALL ON 2.3

ROTO BALL OFF _____

TIME OFF _____

ELAPSED TIME _____

MEAN CORRECTED FLOW _____

COMMENTS

CALIBRATION

DATE _____

PUMP ROTAMETER	MANO. AVG FLOW	TRIALS
		6
		6
		6
		6
		6

CALIB. PRESSURE _____

CALIB. TEMPERATURE (F) _____

PUMP READING	MEAN CORRECTED FLOW
2.5	-
2.3	
2.1	-
1.9	
1.7	-

ATTACHMENT B-11

PHYSICAL EXAMINATION PROGRAM

B.11 PHYSICAL EXAMINATION PROGRAM

All field personnel are required to participate in the Medical Surveillance Program and will undergo the following examination:

A. History and physical examination including:

1) Medical and occupational history, including smoking history
2) Vision testing with use of Titmus type instrumentation
3) Blood pressure, pulse rate, oral temperature
4) Height and weight
5) Physician-administered physical examination, including nasal and skin examination as per Arsenic Standard requirements (WAC 296-62-07347)

B. Chest X-ray; minimum of single view, 14"× 17" posterior-anterior, with interpretation (performed on initial examination and then every other year and at termination)

C. Complete blood count (CBC with differential)

D. Blood chemistry profile including:

Sodium Potassium	Uric Acid	SGPT
Creatinine	Glucose	Calcium
Phosphorus	GGT	SGOT
BUN	Alkaline Phosphatase	Cholesterol
HDL/Cholesterol Ratio	Triglyceride	Total Protein
Albumin	Total Bilirubin	T-4
LDH		

E. Urinalysis with microscopic exam

F. Pulmonary function test

G. Electrocardiogram

H. Blood lead

I. Urine arsenic

ATTACHMENT B-12

EMERGENCY NOTIFICATION CONTACTS

B.12 EMERGENCY NOTIFICATION CONTACTS

General Emergency Numbers

Fire Department	911
Ambulance	911
Police	911

Hospitals

Nearest Location:
Everett General Hospital
14th and Colby
Everett, WA
(425) 258-6300

Other Location:
Providence Hospital
916 Pacific Ave
Everett, WA
(425) 258-7123

Poison Control Center

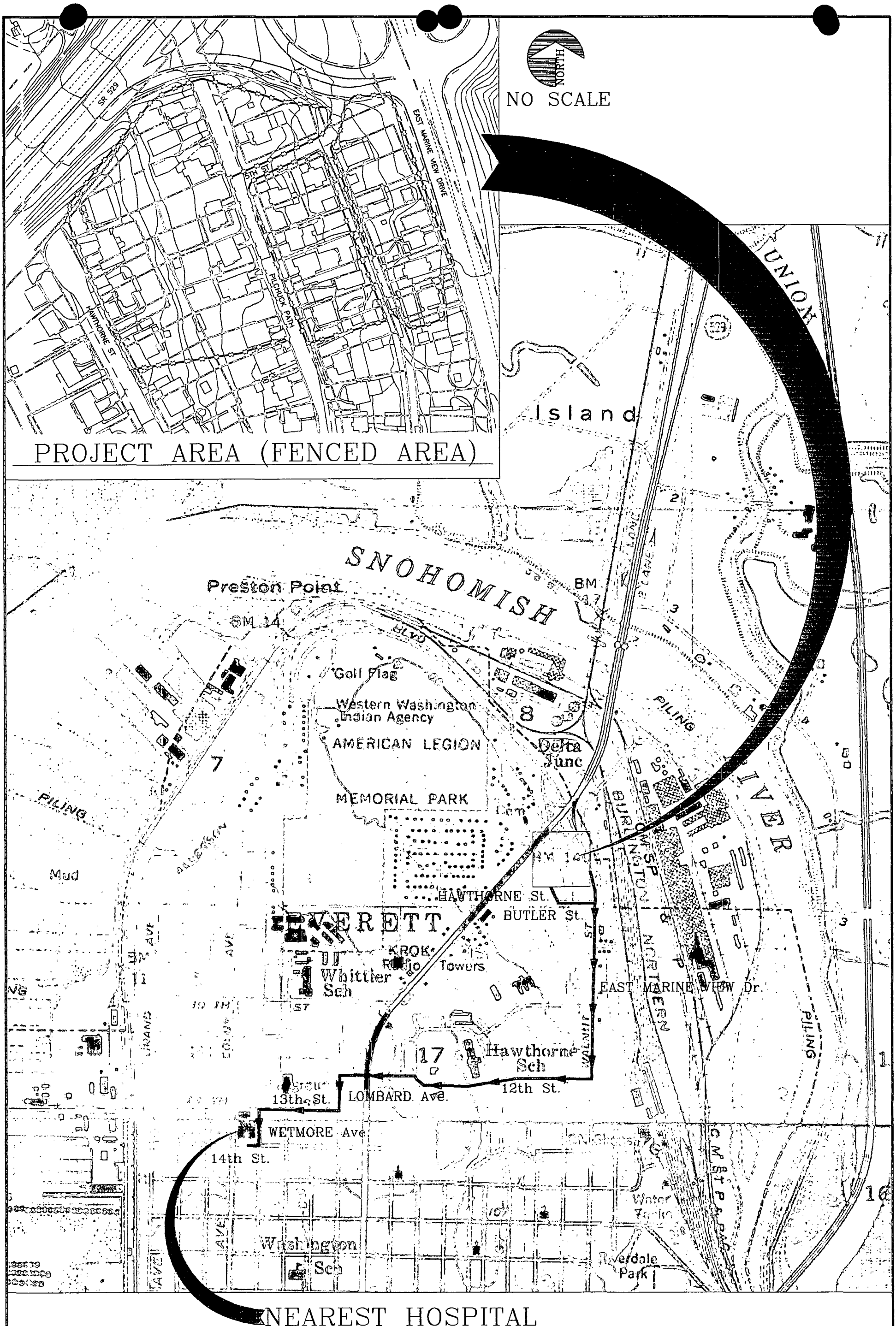
1-800-525-5042

Other Resources

National Response Center		(800) 424-8802
Superfund/RCRA Hotline		(800) 424-9346
TSCA Hotline		(800) 424-9065
Centers for Disease Control	Day:	(404) 329-3311
	Night:	(404) 329-2888
Washington State Department of Ecology General Information		(425) 649-7000
Washington State Department of Ecology Dr. David South, Project Manager		(425) 649-7200

ATTACHMENT B-13

NEAREST HOSPITAL LOCATION MAP



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EVERETT SMELTER SITE
EVERETT, WASHINGTON

NEAREST HOSPITAL LOCATION MAP

FIGURE B-13-1

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ATTACHMENT B-14

FIRE PROTECTION PLAN

B.14 FIRE PROTECTION PLAN

This Fire Protection Plan shall be part of the HSP and is intended to make all field personnel aware of their roles in preventing and controlling fire while conducting interim action operations. Reasonable efforts to mitigate fire danger shall be employed by all personnel visiting or working at the site. The Project Health & Safety Officer shall enforce the provisions contained herein:

Specific precautions include the following:

1) All motor vehicles and equipment on-site shall be provided with exhaust spark arrestors approved by the State Fire Marshal or Underwriters Laboratories.
2) Smoking on-site is prohibited.
3) Welding equipment, grinders and open-flame devices shall not be used without a fire watch posted for a half hour beyond hot work.
4) Electrical equipment shall be maintained in good repair to prevent sparks.
5) All applicable portable extinguisher regulations shall be complied with.
6) All personnel on-site must be diligently observant for signs of fire or fire danger and report any signs of fire to the Site Health & Safety Officer immediately.
7) All visitors must be escorted when on-site.
8) All site SOPs shall be complied with.

The Site Health & Safety Officer, or in his/her absence, the Site Engineer, shall be the Incident Commander for all notification, evacuation, and response activities undertaken from initial discovery to completion of mop up EXCEPT when duly authorized Emergency Response Teams such as the Fire Department are on-site and have assumed that role.

In the event a fire is discovered, the following actions shall be taken:

1) Notice and Evacuation

a) Immediately notify the Site Health & Safety Officer.

b) Notify all personnel to evacuate the area as necessary except for those volunteering to fight the fire.

c) The Site Health & Safety Officer shall notify all other on-site personnel to evacuate the area as necessary.

d) The Site Health & Safety Officer shall notify the Fire Department via the 911 emergency system, and all other emergency contacts as he/she deems appropriate.

e) The Site Safety Officer will account for all personnel and notify emergency response personnel of any missing personnel.

2) Response

a) The Site Health & Safety Officer shall direct personnel and materials in fire suppression response activities until the Fire Department arrives. In cases of localized fire only, he/she may elect to suppress it without the aid of the Fire Department.

b) The Site Health & Safety Officer must prepare an incident report at the conclusion of the event, regardless of who responded to the incident.

Appendix C

APPENDIX C

SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN

Prepared by:

Asarco Consulting, Inc.
5219 N Shirley St
Suite100
Tacoma, WA 98407

March 2004
Revision 2

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Attachment C-1. Users Guide for NITON XL-309 and 700 Series Instruments

SAMPLING AND ANALYSIS PLAN

This Sampling and Analysis Plan (SAP) is prepared to satisfy the requirements of WAC 173-340-820 and WAC 173-340-830 for the interim action. This SAP contains two sections:

- Sample Collection and Handling Procedures, and
- Laboratory Analysis Protocol and Data Management

The objective of this SAP is to provide a framework for sampling and analytical criteria and protocol to ensure that data of sufficient quality are obtained to support remedial action decisions. Soil samples will be collected from selected residential properties in the peripheral area, from the Former Arsenic Trioxide Processing Area (Fenced Area) and from import material sources including backfill and topsoil. In addition, storm drain sediment will be sampled from selected catch basins, storm water will be collected from selected catch basins and manholes, and groundwater will be sampled from selected monitoring wells.

1.0 SAMPLE COLLECTION AND HANDLING PROCEDURES

1.1 SOIL SAMPLING PROCEDURES

1.1.1 Residential Properties

Soil sampling will include the collection of composite and discrete samples for performance monitoring. Discrete samples will be collected from a specific depth interval from a specific borehole. Composite samples will consist of mixing an equal portion by volume of all discrete samples from the same depth interval from boreholes within a unique decision unit. Therefore, composite samples will represent a given depth interval for a specific decision unit (e.g., the 24-30 inch depth interval in a front yard).

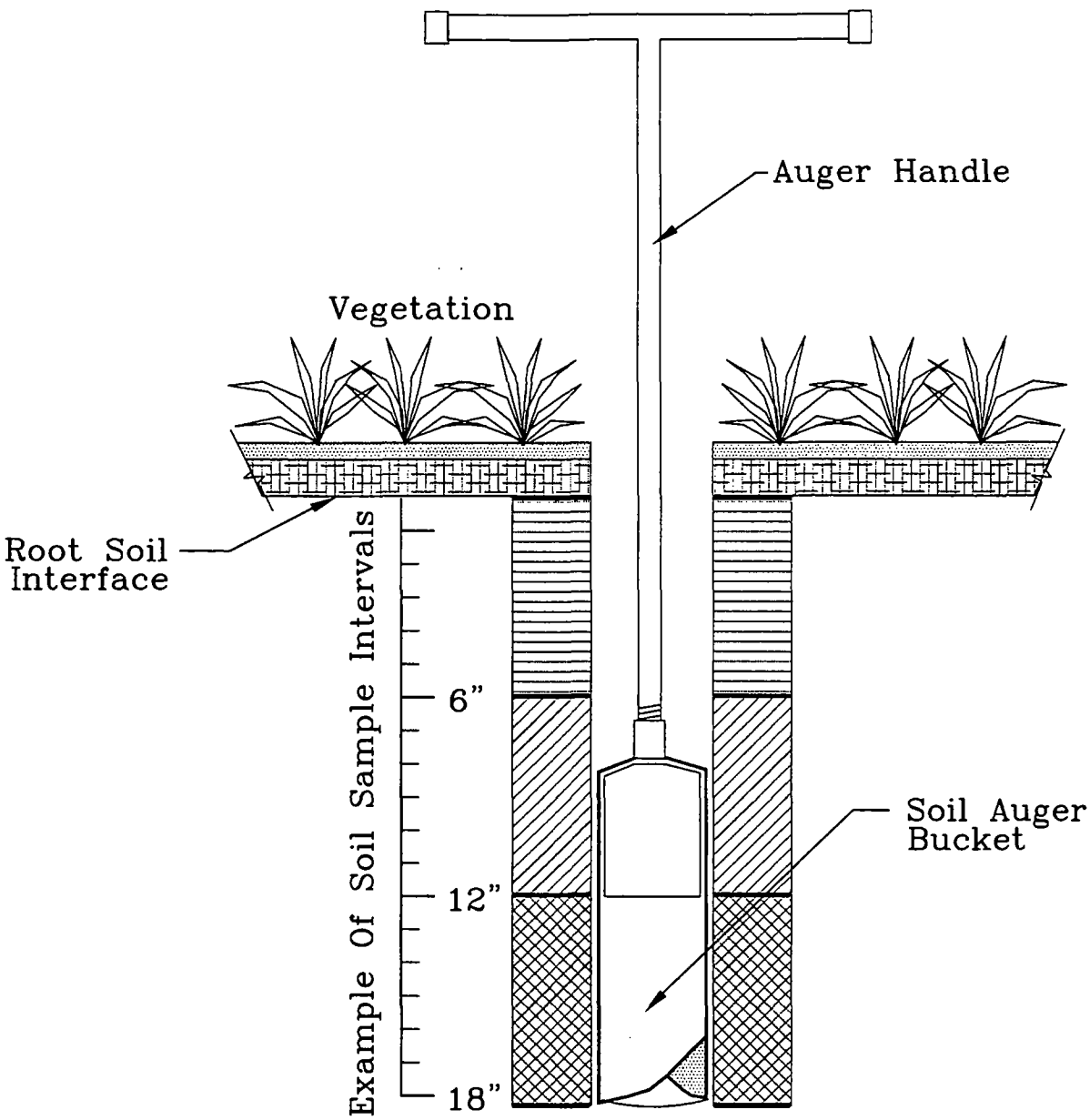
Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the frequency of composite and discrete samples as well as sample designation. All bore hole locations will be documented on site maps. Surveying the boreholes will not be necessary.

It is anticipated that the soil samples will be collected using a soil recovery auger that is 2 inches in diameter by 6 inches long (see Figure C-1-1). Samples collected from the soil recovery auger will be removed with a screwdriver or similar instrument. Debris such as rocks and twigs will be removed. The discrete sample will be placed in a stainless steel bowl and homogenized. An equal portion by volume of each homogenized sample will be placed in another stainless steel bowl designated for compositing. Discrete and composite samples will be double bagged using new, one-gallon size zip-lock storage bags and labeled. Following completion of soil bore sampling, excess soil cuttings, if any, will be returned to the excavation area. Subsequently, the boreholes will be filled with backfill material during soil replacement. Should a location yield poor sample recovery, the location will be moved.

During confirmational monitoring, samples will be collected using a portable powered split spoon sampler (see Figure C-1-2) or a small drill rig. Excess soil cuttings, if any, will be returned to the borehole. Since most of the bore hole soil will have been removed for sampling purposes, the remaining portion of the bore hole will be filled with bentonite chips and potting soil followed by replacement of the root grass turf cap that was previously removed.

1.1.2 Fenced Area

Soil sampling will include the collection of composite and/or discrete samples for all three phases of performance monitoring. Debris such as rocks and twigs will be removed. The discrete sample will be placed in a stainless steel bowl and homogenized. An equal portion by volume of each homogenized sample will be placed in another stainless steel bowl designated for compositing. Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the frequency of composite and discrete samples as well as sample designation. Should a location yield poor recovery, the location will be moved.



Note: The top of the soil profile is defined as that interface between mineral soil and the root mat.

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ASARCO INCORPORATED FINAL DESIGN REPORT EVERETT SMELTER SITE APPENDIX C – EVERETT, WASHINGTON –	SOIL SAMPLE RECOVERY AUGER SCHEMATIC	FIGURE C-1-1

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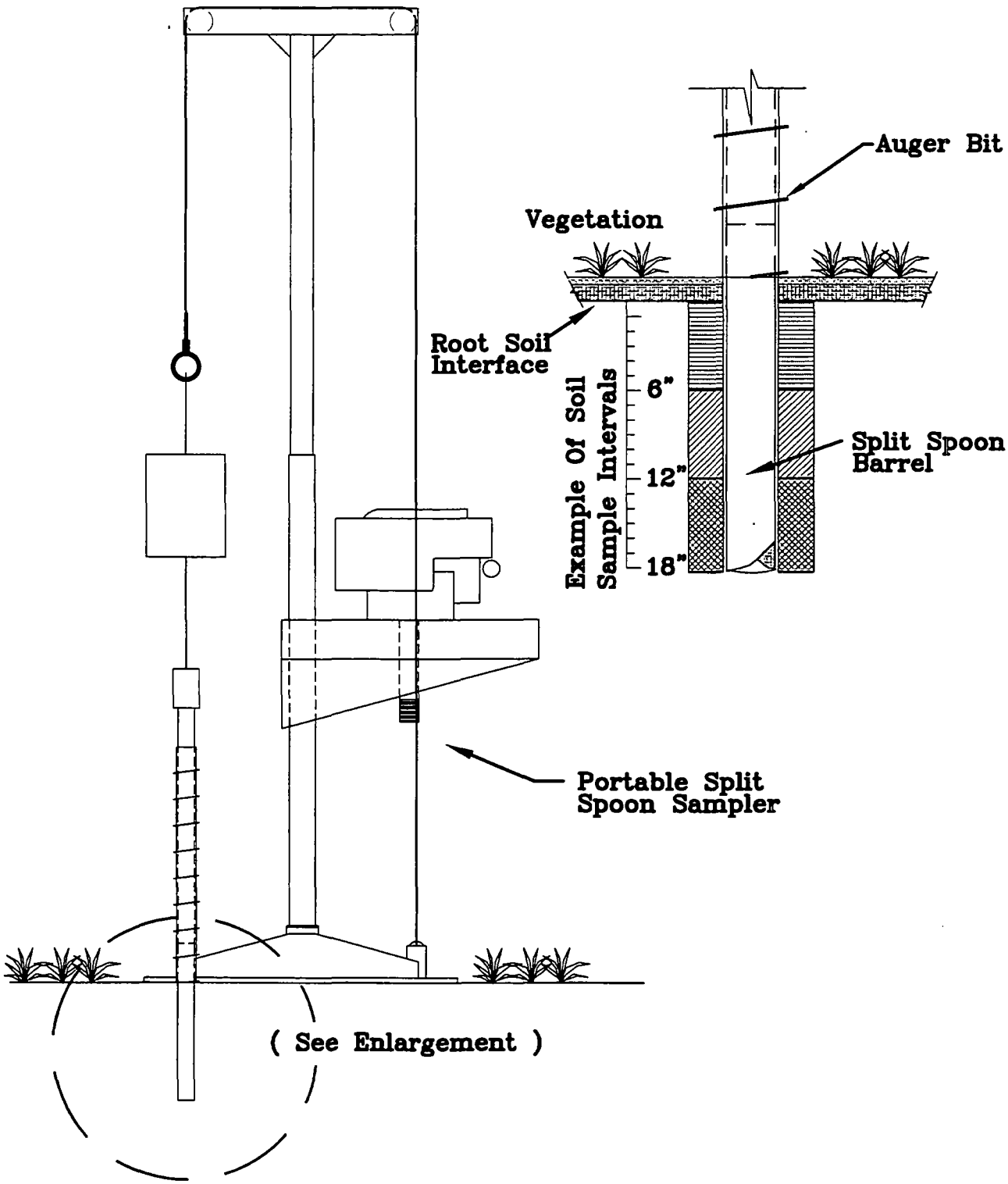

ASARCO Consulting, Inc.

ASARCO INCORPORATED FINAL DESIGN REPORT EVERETT SMELTER SITE APPENDIX C - EVERETT, WASHINGTON -	SPLIT SPOON SAMPLER SCHEMATIC	FIGURE C-1-2

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Phase 1 sampling will be conducted following the removal of soils with arsenic concentrations greater than 3,000 mg/Kg. Phase 2 sampling will be conducted following the removal of soils with arsenic concentrations greater than 150 mg/Kg. Phase 3 sampling will be conducted following the cut and fill operations prior to backfilling import material.

Prior to sampling, the grids (decision units) will be surveyed and marked by the field engineer with either stakes, flags, or paint. The area of the decision unit will be measured and subsequently, will determine the required number of sample locations. All sample locations will be documented on site maps. Surveying the sample locations will not be necessary.

During Phase 1 sampling, only composite samples will be collected from the excavation floor of each decision unit and outer perimeter of certain decision units. During Phase 2 sampling, composite and discrete samples will be collected from the excavation floor of each decision unit and outer perimeter of certain decision units. Composite floor samples will consist of mixing an equal portion by volume of all respective discrete samples from a given decision unit. Composite perimeter samples will represent a specific depth interval from a given decision unit. During Phase 3 sampling, only discrete samples will be collected from each decision unit.

The samples will be collected using a hand trowel or auger. In locations where excavation areas or conditions are not suitable for man entry because of safety concerns, samples will be obtained directly from the backhoe bucket. Discrete and composite samples will be double bagged using new, one-gallon size zip-lock storage bags and labeled.

During confirmational monitoring, samples will be collected using a portable powered split spoon sampler or drill rig, depending on selected location and termination depth. Excess soil cuttings, if any, will be returned to the borehole. Since most of the bore hole soil will have been removed for sampling purposes, the remaining portion of the bore hole will be filled

with bentonite chips and potting soil followed by replacement of the root grass turf cap that was previously removed.

1.1.3 Import Material

Backfill and topsoil samples will be collected with a hand trowel at the supplier's location. Samples will be placed in appropriate sample containers and labeled.

Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the sample frequency and sample designation.

1.1.4 Storm Drain Sediment

Sediment samples will be collected with a hand trowel or a conventional shovel upon removing the catch basin cover. Samples will be double bagged using new, one-gallon size zip-lock storage bags and labeled.

Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the sample frequency and sample designation.

1.2 WATER SAMPLING PROCEDURES

1.2.1 Surface Water

Grab samples of storm water runoff will be collected from catch basins and manholes. Sample bottles will be filled directly from the runoff stream at the selected catch basins. At manholes, a peristaltic pump may be used.

Samples will be preserved and chilled to 4 degrees Celsius in the field. Pre-cleaned, contaminant-free sample containers that are provided by the laboratory will be used.

Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the sample frequency and sample designation.

1.2.2 Groundwater

Prior to sampling, depth to groundwater will be recorded for each monitoring well. The water level elevations will then be calculated to common datum to develop a potentiometric map for interpretation of groundwater flow directions for both the shallow and deep aquifers.

Monitoring wells will be purged and sampled using a portable peristaltic pump or equivalent, which purges water at a slow rate (less than 0.25 gpm) to minimize the potential for turbidity in the sample. Management of purged water is discussed in Section 1.3.2.

Samples collected for dissolved parameters will be filtered in the field using a disposable 0.45-micron filter. Both filtered and unfiltered samples will be preserved and chilled to 4 degrees Celsius in the field. Pre-cleaned, contaminant-free sample containers that are provided by the laboratory will be used for sample collection.

Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the sample frequency and sample designation. In addition to the required analyses specified by the FCAP, samples will have pH, specific conductivity, turbidity, dissolved oxygen, temperature, and salinity measured in the field.

1.3 WASTE MANAGEMENT AND DECONTAMINATION PROCEDURES

1.3.1 Soil and Sediment

Specific waste material management procedures will not be required. Sampling activities will not require containerization of soil waste because excess soil cuttings, if any, will be returned to the excavation area or bore hole. If PPE is worn such as tyvek suits and latex gloves, it will be managed as typical solid waste.

Sampling equipment will be decontaminated between sampling locations and depth intervals using a metal-free detergent wash such as alconox followed by tap water and deionized water rinses. Wash waters will be changed frequently and thereby will not contain significant

concentrations of metals. Wash water from sampling equipment decontamination will be periodically applied to selected areas in a manner so that runoff or ponding does not occur.

1.3.2 Surface Water and Groundwater

Specific waste material management procedures will not be required for surface water sampling. However, the situation is different for groundwater sampling due to the requirement of purging monitoring wells that may contain higher concentrations of contaminants. Purge water will be containerized in 55 gallon drums. Containerized water will be sampled and analyzed for arsenic. If concentrations are less than 0.5 mg/L, it will be discharged to the City of Everett's combined sewer system in accordance with Asarco's discharge authorization permit No. 144-97. If concentrations exceed 0.5 mg/L, the drums will be managed through a permitted disposal facility. If PPE is worn such as tyvek suits and latex gloves, it will be managed as typical solid waste.

Sampling equipment will be decontaminated between monitoring sites using a metal-free detergent wash such as alconox followed by tap water and deionized water rinses. Wash waters will be changed frequently and thereby will not contain significant concentrations of metals. Wash water from sampling equipment decontamination will be periodically applied to selected areas in a manner so that runoff or ponding does not occur.

1.4 SAMPLE DOCUMENTATION

Sampling information including sample numbers, sampling date, and sampling time, will be recorded in the field sampler's log book to allow positive identification of samples.

Documentation of all samples will be an important aspect of the project quality assurance program. Sample documentation will involve use of the following:

- Sample Identification (Labeling Bags or Using Labels)
- Chain-of-Custody Forms
- Field Notebooks

1.4.1 Sample Identification

Sample identification will consist of labeling the bag or labels to identify each sample. Each designated sample number will be written on the respective bag or label as well as being recorded in the field notebook and on the chain-of-custody form. The information recorded will include the following:

- Date. A six-digit number indicating the year, month and day of collection (for example, 07/01/04 for July 1, 2004).
- Time. A four-digit number indicating the 24-hour clock time of collection (for example, 1345 for 1:45 p.m.).
- Sampler. The sampler's name.
- Analysis. The type of analysis requested (for example, total arsenic).
- Sample Number. A unique number as discussed in the Compliance Monitoring Plan (Appendix A).

Since most soil sample containers will consist of two one-gallon zip-lock storage bags (one inside the other), the inside bag with the sample will be labeled. If labels are used, they will be inserted between the outer bag and the inner bag of individual soil samples. After collection, separation, and identification, the sample will be handled using chain-of-custody procedures.

1.4.2 Transfer of Custody and Shipment

Samples collected must be traceable from the time the samples are collected until they are analyzed. To document sample possession, the chain-of-custody procedure is followed.

Samples will be accompanied by a chain-of-custody form. When transferring samples, the individuals relinquishing and receiving will sign, date and note the time on the form. The method of shipment, courier name(s) and other pertinent information is entered in the "Remarks" section of the chain-of-custody form. This form documents sample custody

transfer from the sampler, often through another person (shipper), to the analyst at the laboratory.

The person relinquishing the samples to the laboratory will request the chain-of-custody form, with the signature of a representative of the party acknowledging receipt of the samples. If the samples are not hand-delivered, the laboratory will send the copy of the signed chain-of-custody form to the Project Manger.

All shipments will be accompanied by the chain-of-custody form identifying its contents. The original record will accompany the shipment. Also, freight bills, Postal Service receipts and Bills of Lading will be retained as part of the permanent documentation if used.

1.4.3 Field Notebooks

A bound field notebook(s) must be maintained by the Field Team Leader to provide a daily record of significant events, observations, and measurements during sampling events. All entries will be signed and dated. All members of the field investigation will use this notebook and it will be kept as a permanent record.

1.4.4 Corrections to Documentation

All original data will be recorded in field notebooks or labels and chain-of-custody forms with waterproof ink. None of these documents will be destroyed or discarded.

If an error is made on a document, corrections will be made by crossing a line through the error and entering the correct information. The erroneous information should not be obliterated. All corrections must be initialed.

1.5 SAMPLE HANDLING

An important aspect of obtaining representative samples of some media is proper preservation and storage prior to analysis. All samples will be labeled with waterproof ink and stored in metal or plastic coolers for shipment or delivery to the laboratory along with the

chain-of-custody form. For all coolers that are shipped rather than delivered, a custody seal will be placed on the front and back of the cooler lid and overlapped with clear strapping tape.

No preservatives will be required for soil or sediment samples. The maximum holding time for most soil and sediment samples collected will be six (6) months. Note that the holding time is recommended for general total metal analyses for soil samples. This recommended holding time will not prevent some sample material remaining after analyses from being archived. Archived samples will be kept in a secured area. All water samples will be properly preserved and chilled as discussed in Section 2.4.2.

1.6 FIELD QUALITY CONTROL AND SPLIT SAMPLES

Field quality control samples will be used to provide quality assurance for field sampling and subsequent laboratory analysis. The field quality control sampling will consist of field duplicates and field rinsate blank samples. Field duplicates will assess the reproducibility of sample collection procedures as well as analytical reproducibility. Rinsate blanks will identify the potential for cross-contamination.

For soil and sediment samples, field duplicates will be obtained at a frequency of 1 per 20 collected samples or 1 per day, whichever is greater. For groundwater and surface water samples, field duplicates will be obtained at a frequency of 1 per 10 collected samples or 1 per day, whichever is greater. Field duplicates for soil and sediment samples will be split in the field during sample collection. Field duplicates for water samples will be collected by filling two sample containers consecutively from the sampling location.

For soil and sediment samples, rinsate blanks will be collected by pouring rinsate water over the sampling equipment into the same containers used for water samples when it is being decontaminated. For water samples, rinsate blanks will consist of aqueous rinsate collected into the same containers used for water samples from the filter apparatus prior to the collection of sample. Rinsate samples will be collected once per event including residential

sampling in the Peripheral Area, Phase 1 sampling in the Fenced Area, Phase 2 sampling in the Fenced Area, Phase 3 in the Fenced Area, sediment sampling, all storm water sampling events if a peristaltic pump is used, and each groundwater sampling event.

In addition to duplicate and rinsate samples, blind field standards will be purchased and submitted for groundwater sampling events. Based on availability, one standard will be submitted per major sampling event.

Split samples will be collected for Ecology's field representative upon request at the time of sample collection. Ecology will provide sampling containers for the split samples. Whenever samples are split, it will be noted in the "Remarks" section of the chain-of-custody form. The note indicates with whom the samples are being split and will be signed by both the sampler and recipient.

As noted in the Compliance Monitoring Plan (Appendix A), many discrete samples, particularly with residential properties, may not contain a sufficient quantity of material to split. In addition, split samples for groundwater and or surface water will be obtained by collecting the sample from the same sampling location in immediate succession of the original sample.

2.0 LABORATORY ANALYSIS PROTOCOL AND DATA MANAGEMENT

This section describes laboratory protocol including quality assurance procedures to be employed during sample analysis and data generation. Designation of quality assurance and quality control (QA/QC) objectives and of specific analytical techniques for determining parameter concentrations will ensure that data of known and acceptable quality are collected.

The following subsections present in detail the laboratory analytical requirements and quality assurance objectives including:

- Projected Data Uses and Needs,
- Organization and Responsibilities,
- Custody Procedures,
- Analytical Methods,
- Quality Assurance Objectives,
- Data Reduction, Validation, and Reporting,
- Audits,
- Preventive Maintenance, and
- Corrective Actions.

2.1 DATA USES AND NEEDS

Generally, the soil data collected under this plan from excavation areas will be used to determine what decision units require additional soil removal in order to meet the appropriate remediation level. Data generated from import material, sediment, surface water, and groundwater analyses will be used to assess overall cleanup goals, chemical quality trends, and disposal requirements.

2.2 ORGANIZATION AND RESPONSIBILITIES

This plan will be administered under the Project Manager who is responsible for the content and implementation. The Project Manager will be responsible for assigning each task and ensuring its completion under the plan and will serve as the central contact regarding sample and analysis issues for the site. The Project Manager is also responsible for revisions to the plan or procedures and to ensure that the applicable personnel and agencies are made aware of those revisions.

Field sampling activities will be the responsibility of the Field Supervisor as well as ensuring that the sampling and documentation protocols are provided to the field crews and that the field crews implement these procedures properly. The Field Supervisor will interact with the Project Manager and QA Officer to ensure procedures are up-to-date and correct.

Quality assurance including validation and report preparation is the primary responsibility of the QA Officer. However, meeting QA objectives depends on all project members. The QA Officer's responsibilities include:

- Overview QA/QC documentation
- Conduct detailed data review
- Determine whether to implement laboratory corrective actions

Laboratory Managers are responsible for ensuring the lab resources are available as required and overview preparation of data reports. They are responsible for coordination of project requirements including:

- In-house chain of custody
- Scheduling sample analysis
- Overseeing data review
- Preparation of analytical data reports
- Approval of final reports prior to submission to the field investigation project manager.

- Designate a Laboratory Sample Custodian.

Asarco will identify the Project Manager, Field Supervisor, QA Officer, and Laboratory Managers prior to beginning the work. In addition, Asarco will submit the office locations and telephone numbers of the identified individuals to Ecology.

2.3 CUSTODY PROCEDURES

Custody procedures begin prior to sample analysis and help to satisfy the two major requirements of admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample is under custody if:

- The item is in actual possession of a person; or
- The item is in the view of the person after being in actual possession of the person; or
- The item was in actual physical possession but is locked up to prevent tampering: or
- The item is in a designated and identified secure area.

2.3.1 Field Custody Procedures

Field custody procedures are described in Section 1.4.2.

2.3.2 Laboratory Custody Procedures

Each Laboratory Manager will designate a Laboratory Sample Custodian. The Laboratory Sample Custodian is responsible for internal laboratory custody procedures. Procedures to be followed by the Laboratory Sample Custodian at each laboratory include:

- Receiving and inspecting the incoming sample containers;
- Recording the condition of the incoming sample containers;
- Signing the appropriate documents;
- Verifying chain-of-custody and its correctness;
- Notifying the Laboratory Manager of sample receipt and inspection;

- Entering each sample container into the sample receiving log;
- Transferring samples to appropriate lab sections; and
- Controlling and monitoring access/storage of samples and extracts.

2.3.3 Final Evidence Files

The final evidence file will be the central repository for all documents, which constitute evidence relevant to sampling and analysis activities. The final evidence file will include at a minimum:

- Field logbooks
- Field data and data deliverables
- Photographs, if any
- Drawings
- Data validation reports
- Progress reports
- All custody documentation (tags, forms, airbills, etc.)

2.4 ANALYTICAL METHODS

The majority of the analyses will be soil samples analyzed for arsenic by utilizing an X-Ray Fluorescence Spectrometer (XRF) instrument. This includes the soil samples collected to determine if remediation levels are met at residential properties and the Fenced Area. A Spectrace Model 5000 or 6000 Dispersive XRF (laboratory XRF) or a hand-held NITON 700 series analyzer (portable XRF) will be used. The EPA has approved the use of XRF methods for soil sampling at several Superfund sites and Ecology's Southwest and Northwest Regional Offices have approved the XRF for several MTCA sites as well.

The XRF provides rapid analytical turnaround time, if needed, and accurate, cost-effective measurements of soil metal concentrations. It is also a non-destructive method, allowing samples to be retained for future additional analysis if necessary.

An XRF will also be used to analyze most inorganic chemicals for sediment, backfill, and topsoil samples. Inorganic parameters for soil and sediment samples not analyzed by an XRF is further discussed in Section 2.4.2.

2.4.1 Laboratory XRF Procedures

The following discusses key points of the instrument and procedure.

Theory of Operation

XRF analysis measures the fluorescence intensity of a sample. The XRF analytical procedure uses an X-ray source to bombard the sample with X-rays, which in turn causes elements in the sample to produce a specific spectral emission pattern. Element concentrations in the soil sample are quantified by comparing the intensities of spectral emissions in the sample to an initial calibration curve generated from standards with known concentrations. Concentrations will be determined by using the following equations (derived from regression equations): concentration = (fluorescence intensity – y intercept / slope).

Initial calibrations may be performed with standard reference materials (fundamental parameters method) or with well characterized samples from the area under investigation (site-specific or matrix-specific method).

Initial Instrument Calibration

The fundamental parameters method was chosen for the initial calibration for this interim action. This selection was based on the potential to receive several physical types of soil samples including smelter debris, fill, till, topsoil, sediment, etc. This method is more quickly and easily employed than a matrix specific method which would require a specific calibration for each material type with additional calibration efforts for the large concentration ranges expected.

Detection Limit Performance Requirements

The XRF instrument will be required to achieve specified detection limits in order to provide the necessary information for making remedial decisions. The lowest possible detection limits have been established to attain Ecology requirements for cleanup standards and remediation levels while ensuring the highest possible level of precision. The instrument detection limit (IDL) for the parameters to be analyzed are listed in Table C-2-1.

Because the detection limits are precision (i.e., repeatability) dependent, some parameters cannot be analyzed by the XRF because the listed standard is too low. As XRF results increase numerically, it is easier to attain the required precision. If the IDL is higher than the required standard, then that parameter will be analyzed by wet chemistry methods rather than by the XRF. As shown on Table C-2-1, cadmium and mercury will not be analyzed by the XRF due to the respective IDLs. In addition, beryllium, selenium, and thallium do not have available standards for the XRF. Therefore, required beryllium, cadmium, mercury, selenium, and thallium analyses for import material (backfill and topsoil) will not be analyzed by the XRF. In addition, required thallium analyzes for sediment samples will not be analyzed by the XRF.

A recommended six-month holding time is presented in SW-846 for most inorganic soil analyses using wet chemistry methodologies. The exception is mercury which has a recommended 28 day holding time. It should be noted that these holding times do not affect metal analyses by XRF. Therefore, remaining sample portions will be archived for future analyses, if needed, for the duration of the project. If a sample(s) is selected to be analyzed at a later date that exceeds the holding time, the results will still be acceptable.

TABLE C-2-1. LABORATORY XRF SOIL AND SEDIMENT ANALYSES

Parameter	Digestion Or Extraction	IDL (mg/Kg)	Standard (mg/Kg)	MTCA METHOD	HOLDING TIME
Antimony	None	30	32 (a,b)	B	6 months
Arsenic	None	10	20 (a,b,c)	A	6 months
Beryllium	None	NA	160 (b)	B	6 months
Cadmium	None	10	2 (a,b)	A	6 months
Chromium	None	20	100 (b)	A	6 months
Copper	None	10	2,960 (b)	B	6 months
Lead	None	10	250 (a,b)	A	6 months
Mercury	None	10	1 (a,b)	A	28 days
Nickel	None	20	1,600 (b)	B	6 months
Selenium	None	NA	400 (b)	B	6 months
Silver	None	20	400 (b)	B	6 months
Thallium	None	NA	5.6 (a,b)	B	6 months
Zinc	None	10	24,000 (b)	B	6 months

Note: NA – not analyzed by XRF method

Method B value obtained from CLARC spreadsheet

(a) - sediment
(b) - backfill and topsoil
(c) - soil in excavation area

Quality Control Checks

In addition to XRF detection limit performance requirements, laboratory quality control measures will be employed to ensure data quality. Quality control measures used to ensure the integrity of the XRF calibration will include using the laboratory control standard (LCS), continuing calibration verification (CCV) samples, and confirmation samples.

Use of LCS and CCV samples will determine the accuracy of XRF analyses. See Section 2.5.2 for a more detailed discussion on accuracy. A summary of XRF data quality control limits is presented in Table C-2-2.

TABLE C-2-2. LABORATORY XRF QUALITY CONTROL LIMITS

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Instrument Calibration	Yearly	Acceptable correlation coefficient of ≥ 0.995	Recalibrate
Instrument Detection Limit (IDL) determination	Once per year following calibration	IDL less than the identified standard	Recalibrate
Check system status display	Daily, before calibration check standard run	No unusual changes in system status	Correct problem, recheck system status
Energy Calibration	Daily	Successful completion	Correct problem, recalibrate
Intensity Correction Standard	Daily, before sample runs	Within ±5% of standard's intensity at the time of calibration	Correct problem, rerun intensity correction standard
Laboratory Control Standard (LCS)	Minimum of 1 per 24 hour, prior to analyses run	Recovery of 75% to 125% or within 95% confidence limits for standard	Rerun standard, if still not within limits, correct problem and rerun standard
Continuing Calibration Verification (CCV)	One per run (up to 20 samples)	Recovery of 75% to 125% or within 95% confidence limits for standard	Rerun samples associated with CCV, if still not within limits, correct problem and rerun associated samples
Laboratory Duplicates	One per run (up to 20 samples)	RPD of $\leq$ 35% or ±2X PDLG for samples <5X PDLG	Flag associated sample results with "OUT"

Results of QC checks will be evaluated during the data validation procedure (see Section 2.6.2).

XRF results will also be confirmed by wet chemistry analytical methodologies. At a frequency of 1 per 50 samples analyzed by XRF, randomly selected samples will be split and submitted for traditional wet chemistry analyses. The purpose of confirmation sample analysis is to evaluate the comparability of XRF-generated data to data generated by wet chemical methods, thereby ensuring that systematic errors in quantification are not occurring. In general, experience with XRF soil analysis has shown that XRF provides results that are equivalent to other analytical methods (wet chemistry) for the determination of total element concentrations in soil. However, is should be noted that sample inhomogeneity and difficulties associated with complete digestion of a solid sample may contribute to differences between reported XRF and wet chemistry sample concentrations.

The results of wet chemistry analysis will be compared to XRF results using the following data analysis techniques:

- Calculation of relative percent differences (RPD) will be calculated for XRF sample/confirmation sample pairs using the same formula used for field and laboratory duplicated pairs.
- Calculation of Recovery Rate - percent recoveries, calculated as [(XRF concentration/wet chemistry concentration) x 100], will be determined for each confirmation pair.
- Linear Regression - regression analysis of XRF vs. wet chemistry data will be performed and the resulting coefficient of determination (R^2) and slope and intercept of the regression line will be compared to the "ideal" comparison values of slope = 1 and y-intercept = 0.

Confirmation sample results will be presented as part of the validation report. It should be noted that RPDs calculations will not be used to qualify (flag) samples in the database.

Sample Preparation

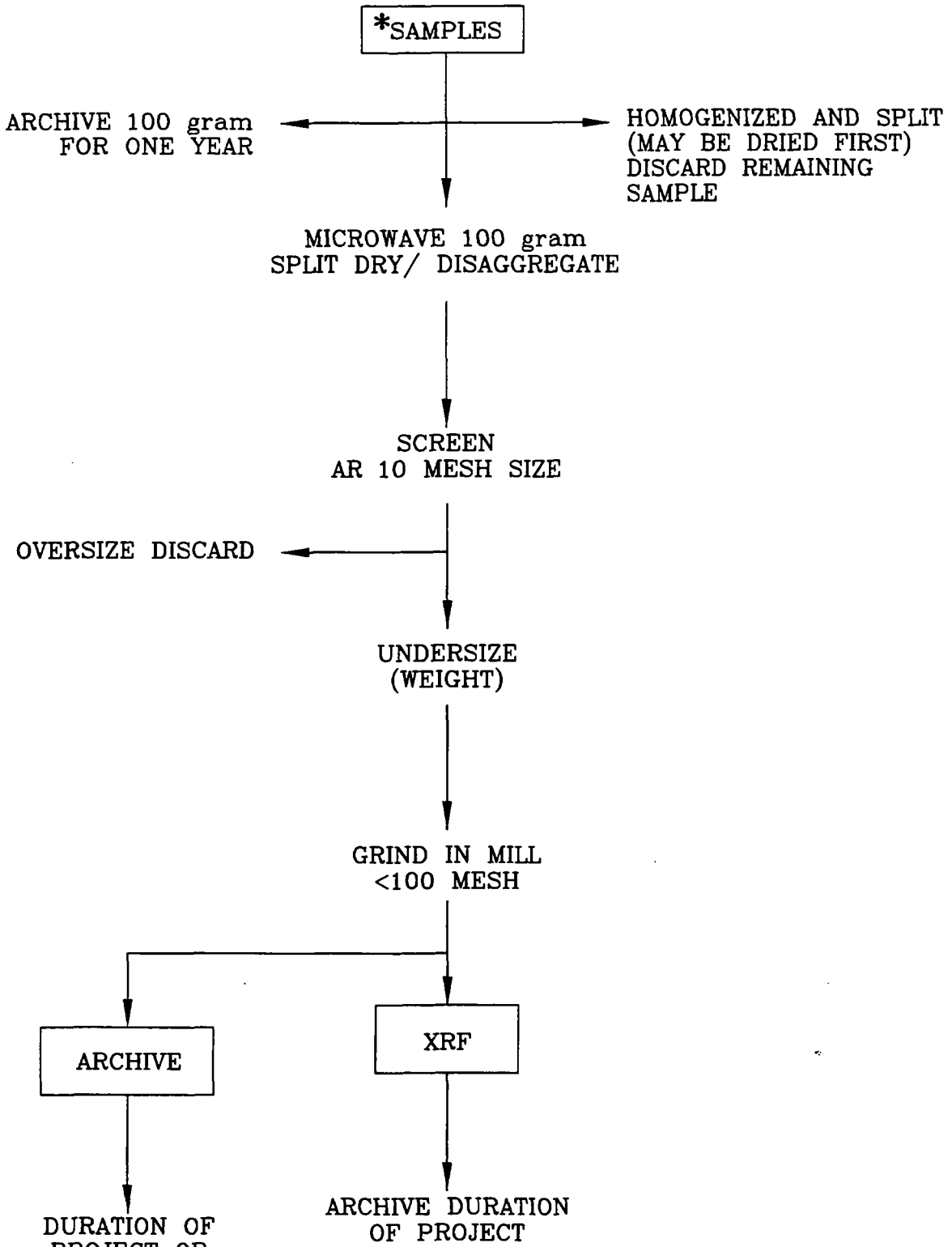
A sample preparation diagram for analysis is shown in Figure C-2-1. Samples will be homogenized and split using the "cone and quartering" method. A split of 100 grams will be dried in a microwave or conventional soil drying oven and disaggregated using a 10-mesh sieve.

The sample portion that remains on the 10-mesh sieve will be discarded and the portion of the sample that passes through the sieve will be mill ground to less than 100-mesh size. The remaining unused sample will be archived for the duration of the project.

Ten grams of ground sample will be used for analysis. The remaining ground sample will be marked and archived for the duration of the project or sent for confirmation wet chemistry analysis. Prepared XRF samples will be marked and archived in XRF sample cups for the duration of the project.

Sample Cleanup

Sample handling equipment will be decontaminated between samples by cleaning the preparation area with a fine bristled brush. Disposable containers will be used for sample drying and compressed air will be used to remove fine-grained soil and dust material. The sample-grinding mill will be decontaminated using compressed air to remove residual dust. Archived samples will be stored and locked in a secure area, and will be available for additional testing, if necessary.



*Minimum sample requirements for the laboratory are 200 g. However, a sampling target of 400 g will be collected for archiving purposes.

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ASARCO INCORPORATED FINAL DESIGN REPORT EVERETT SMELTER SITE APPENDIX C – EVERETT, WASHINGTON –	**SOIL SAMPLE PREPARATION AND HANDLING FOR XRF ANALYSIS**	**FIGURE** **C-2-1**

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2.4.2 Wet Chemistry Procedures

Wet chemistry analytical procedures will be used to analyze soil and sediment samples for inorganic parameters that cannot be analyzed by the XRF (beryllium, cadmium, mercury, selenium, and thallium) as well as laboratory XRF confirmation samples. In addition, wet chemistry procedures will be used to analyze all water samples and soil samples for organic parameters.

Soil and sediment samples will be digested in accordance with the appropriate mineral acid digestion procedure. However, XRF confirmation sample analyses will use a strong or total acid (HF) digestion.

Selected laboratories will implement standard operating procedures and following appropriate methods based on SW-846 for sample analyses. A summary of test methods that will be employed for soil and sediment samples are listed in Table C-2-3 while water sample tests are in Table C-2-4.

Calibration Procedures

The laboratories will maintain sample logbooks for each instrument which will contain the following information: instrument identification, serial number, date of calibration, analyst, calibration solutions run and the samples associated with these calibrations. Calibration of laboratory equipment will be performed in accordance with SW-846 procedures. Records of calibration, repairs, or replacement will be filed and maintained. These records will be filed at the location where the work is performed.

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES

Parameter	Digestion Or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
Antimony	3050	6010B	1.16	32 [a,b,d]	B	6 months
Arsenic	3050	6010B	1.49	20 [a,b,c,d]	A	6 months
Beryllium	3050	6010B	0.009	160 [b,d]	B	6 months
Cadmium	3050	6010B	0.029	2 [a,b,d]	A	6 months
Chromium	3050	6010B	0.048	100 [b,d]	A	6 months
Copper	3050	6010B	0.2	2,960 [b,d]	B	6 months
Cyanide	335.2	335.2	0.13	1,600 [d]	B	6 months
Lead	3050	6010B	0.62	250 [a,b,d]	A	6 months
Mercury	7471	7471	0.0047	1 [a,b,d]	A	28 days
Nickel	3050	6010B	0.093	1,600 [b,d]	B	6 months
PCBs (Aroclor's 1016, 1221, 1232, 1242, 1248, 1254, 1260)	3550	8082	0.003	1 [d]	A	14 days
Selenium	3050	6010B	1.45	400 [b,d]	B	6 months
Silver	3050	6010B	0.058	400 [b,d]	B	6 months
Thallium	3050	6010B	1.78	5.6 [a,b,d]	B	6 months
Zinc	3050	6010B	0.16	24,000 [b,d]	B	6 months
Organochlorine Pesticides						
Aldrin	3550	8081	0.0001	0.0588 [d]	B	14 days
alpha-BHC	3550	8081	0.00004	NL	-	14 days
Alpha-Chlordane	3550	8081	0.0001	NL	-	14 days
beta-BHC	3550	8081	0.0003	NL	-	14 days
Chlordane	3550	8081	0.0025	2.86 [d]	B	14 days
4,4-DDD	3550	8081	0.0002	547 [d]	B	14 days
4,4-DDE	3550	8081	0.0002	386 [d]	B	14 days
4,4-DDT	3550	8081	0.0004	1 [d]	A	14 days
delta-BHC	3550	8081	0.0002	NL	-	14 days
Dieldrin	3550	8081	0.0004	0.0625 [d]	B	14 days
Endosulfan I	3550	8081	0.00009	480 [d]	B	14 days
Endosulfan II	3550	8081	0.0001	480 [d]	B	14 days
Endosulfan Sulfate	3550	8081	0.0006	NL	-	14 days
Endrin	3550	8081	0.0002	24 [d]	B	14 days
Endrin Aldehyde	3550	8081	0.0004	NL	-	14 days
Endrin Ketone	3550	8081	0.0003	NL	-	14 days
gamma-BHC (Lindane)	3550	8081	0.0001	1 [d]	A	14 days
Gamma-Chlordane	3550	8081	0.0001	NL	-	14 days
Heptachlor	3550	8081	0.0002	0.222 [d]	B	14 days
Heptachlor Epoxide	3550	8081	0.00009	0.11 [d]	B	14 days
Methoxychlor	3550	8081	0.0014	400 [d]	B	14 days
Toxaphene	3550	8081	0.0161	0.909 [d]	B	14 days

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES
Continued

Parameter	Digestion or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
SVOCs						
Acenaphthene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Acenaphthylene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Anthracene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Benzidine	3550	8270	0.677	0.043 [d]	B	14 days
Benzo(a)anthracene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Benzofluoranthene (PAH)	3550	8270	0.0267	1 [d]	A	14 days
Benzoic Acid	3550	8270	0.667	320,000 [d]	B	14 days
Benzo(ghi)perylene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Benzo(a)pyrene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Benzyl Alcohol	3550	8270	0.133	24,000 [d]	B	14 days
bis(2-Chloroethoxy)methane	3550	8270	0.133	NL	-	14 days
bis(2-Chloroethyl)ether	3550	8270	0.133	0.909 [d]	B	14 days
bis(2-Chloroisopropyl)ether	3550	8270	0.133	3,200 [d]	B	14 days
bis(2-Ethlyhexyl)phthalate	3550	8270	0.133	71.4 [d]	B	14 days
4-Bromophenylphenylether	3550	8270	0.133	NL	-	14 days
Butylbenzylphthalate	3550	8270	0.133	16,000 [d]	B	14 days
Carbazole	3550	8270	0.133	50 [d]	B	14 days
4-Chloroaniline	3550	8270	0.133	320 [d]	B	14 days
4-Chloro-3-methylphenol	3550	8270	0.133	NL	-	14 days
2-Chloronaphthalene (PAH)	3550	8270	0.013	1 [d]	A	14 days
2-Chlorophenol	3550	8270	0.013	400 [d]	B	14 days
4-Chlorophenylphenylether	3550	8270	0.133	NL	-	14 days
Chrysene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Decane	3550	8270	0.133	NL	-	14 days
Dibenzo(a,h)anthracene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Dibenzofuran	3550	8270	0.133	-	NS	14 days
2,3-Dichloroaniline	3550	8270	0.133	NL	-	14 days
1,2-Dichlorobenzene	3550	8270	0.133	7,200 [d]	B	14 days
1,3-Dichlorobenzene	3550	8270	0.133	NL	-	14 days
1,4-Dichlorobenzene	3550	8270	0.133	41.7 [d]	B	14 days
3,3-Dichlorobenzidine	3550	8270	0.133	2.22 [d]	B	14 days
2,4-Dichlorophenol	3550	8270	0.133	240 [d]	B	14 days
Diethylphthalate	3550	8270	0.133	64,000 [d]	B	14 days
Dimethylphenol	3550	8270	0.133	48 [d]	B	14 days
Dimethylphthalate	3550	8270	0.133	80,000 [d]	B	14 days
Di-N-butylphthalate	3550	8270	0.133	8,000 [d]	B	14 days
Di-N-octylphthalate	3550	8270	0.133	NL	-	14 days

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES
Continued

Parameter	Digestion or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
SVOCs Continued						
4,6-Dinitro-2-methylphenol	3550	8270	0.677	NL	-	14 days
2,4-Dinotrophenol	3550	8270	0.677	160 [d]	B	14 days
2,4-Dinitrotolune	3550	8270	0.133	160 [d]	B	14 days
2,6-Dinitrotolune	3550	8270	0.133	80 [d]	B	14 days
1,2-Diphenylhydrazine	3550	8270	0.133	1.25 [d]	B	14 days
Fluoranthene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Fluorene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Hexachlorobenzene	3550	8270	0.133	0.625 [d]	B	14 days
Hexachlorobutadiene	3550	8270	0.133	12.8 [d]	B	14 days
Hexachlorocyclopentadiene	3550	8270	0.133	480 [d]	B	14 days
Hexachloroethane	3550	8270	0.133	71.4 [d]	B	14 days
Indeno(1,2,3-cd)pyrene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Isophorone	3550	8270	0.133	1,050 [d]	B	14 days
1-Methylnaphthalene (PAH)	3550	8270	0.013	1 [d]	A	14 days
2-Methylnaphthalene (PAH)	3550	8270	0.033	1 [d]	A	14 days
2-Methylphenol (o-cresol)	3550	8270	0.133	4,000 [d]	B	14 days
3 and 4-Methylphenol (s-cresol)	3550	8270	0.267	400 [d]	B	14 days
Naphthalene (PAH)	3550	8270	0.033	1 [d]	A	14 days
2-Nitroaniline	3550	8270	0.133	-	NS	14 days
3-Nitroaniline	3550	8270	0.133	NL	-	14 days
4-Nitroaniline	3550	8270	0.133	NL	-	14 days
Nitrobenzene	3550	8270	0.133	4 [d]	B	14 days
2-Nitrophenol	3550	8270	0.133	NL	-	14 days
4-Nitrophenol	3550	8270	0.677	NL	-	14 days
N-nitrosodimethylamine	3550	8270	0.677	2.57 [d]	B	14 days
N-nitroso-di-n-propylamine	3550	8270	0.133	1.88 [d]	B	14 days
N-nitrosodiphenylamine	3550	8270	0.133	26,800 [d]	B	14 days
Octadecane	3550	8270	0.133	NL	-	14 days
Pentachlorophenol	3550	8270	0.133	8.33 [d]	B	14 days
Phenanthrene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Phenol	3550	8270	0.133	48,000 [d]	B	14 days
Pyrene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Pyridine	3550	8270	0.677	3,500 [d]	B	14 days
2,3,4,6-Tetrachlorophenol	3550	8270	0.133	105,000 [d]	B	14 days
2,3,5,6-Tetrachlorophenol	3550	8270	0.133	NL	-	14 days
1,2,4-Trichlorobenzene	3550	8270	0.133	NL	-	14 days
2,4,5-Trichlorophenol	3550	8270	0.133	350,000 [d]	B	14 days
2,4,6-Trichlorophenol	3550	8270	0.133	11,900 [d]	B	14 days

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES
Continued

Parameter	Digestion or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
VOCs						
Acetone	5035	8260B	1	8,000 [d]	B	14 days
Acrolein	5035	8260B	1	1,600 [d]	B	14 days
Acrylonitrile	5035	8260B	1	1.85 [d]	B	14 days
Benzene	5035	8260B	0.2	0.5 [d]	A	14 days
Benzyl Chloride	5035	8260B	0.2	5.88 [d]	B	14 days
Bromobenzene	5035	8260B	0.2	NL	-	14 days
Bromochloromethane	5035	8260B	0.2	NL	-	14 days
Bromodichloromethane	5035	8260B	0.2	1.61 [d]	B	14 days
Bromoform	5035	8260B	0.2	127 [d]	B	14 days
Bromomethane	5035	8260B	0.4	112 [d]	B	14 days
2-Butanone	5035	8260B	1	NL	-	14 days
n-Butylbenzene	5035	8260B	0.2	NL	-	14 days
sec-Butylbenzene	5035	8260B	0.2	NL	-	14 days
t-Butylbenzene	5035	8260B	0.2	NL	-	14 days
Carbon Disulfide	5035	8260B	0.2	8,000 [d]	B	14 days
Carbon Tetrachloride	5035	8260B	0.2	7.69 [d]	B	14 days
Chlorobenzene	5035	8260B	0.2	1,600 [d]	B	14 days
Chloroethane	5035	8260B	0.2	NL	-	14 days
2-Chloroethyl vinyl ether	5035	8260B	2	NL	-	14 days
Chloroform	5035	8260B	0.2	164 [d]	B	14 days
Chloromethane	5035	8260B	0.4	76.9 [d]	B	14 days
2-Chlorotoluene	5035	8260B	0.2	1,600 [d]	B	14 days
4-Chlorotoluene	5035	8260B	0.2	1,600 [d]	B	14 days
Dibromochloromethane	5035	8260B	0.2	11.9 [d]	B	14 days
1,2-Dibromo-3-chloropropane	5035	8260B	0.4	0.714 [d]	B	14 days
1,2-Dibromoethane	5035	8260B	0.2	NL	-	14 days
Dibromomethane	5035	8260B	0.2	NL	-	14 days
1,2-Dichlorobenzene	5035	8260B	0.2	7,200 [d]	B	14 days
1,3-Dichlorobenzene	5035	8260B	0.2	NL	-	14 days
1,4-Dichlorobenzene	5035	8260B	0.2	41.7 [d]	B	14 days
Cis-1,4-Dichloro-2-butene	5035	8260B	2	-	NS	14 days
Trans-1,4-Dichloro-2-butene	5035	8260B	2	-	NS	14 days
Dichlorodifluoromethane	5035	8260B	0.2	16,000 [d]	B	14 days
1,1-Dichloroethane	5035	8260B	0.2	8,000 [d]	B	14 days
1,2-Dichloroethane (Ethlyene Dibromide)	5035	8260B	0.2	0.001 [d]	A	14 days
1,1-Dichloroethene	5035	8260B	0.2	1.67 [d]	B	14 days

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES
Continued

Parameter	Digestion or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
VOCs Continued						
Cis-1,2-Dichloroethene	5035	8260B	0.2	800 [d]	B	14 days
Trans-1,2-Dichloroethene	5035	8260B	0.2	1,600 [d]	B	14 days
1,2-Dichloropropane	5035	8260B	0.2	14.7 [d]	B	14 days
1,3-Dichloropropane	5035	8260B	0.2	NL	-	14 days
2,2-Dichloropropane	5035	8260B	0.2	NL	-	14 days
1,1-Dichloropropene	5035	8260B	0.2	5.56 [d]	B	14 days
Cis-1,3-Dichloropropene	5035	8260B	0.2	5.56 [d]	B	14 days
Trans-1,3-Dichloropropene	5035	8260B	0.2	5.56 [d]	B	14 days
1,4-Dioxane	5035	8260B	4	90.9 [d]	B	14 days
Ethlybenzene	5035	8260B	0.2	20 [d]	A	14 days
Hexanone	5035	8260B	1	NL	-	14 days
Hexachlorobutadiene	5035	8260B	0.2	12.8 [d]	B	14 days
Hexane	5035	8260B	0.2	4,800 [d]	B	14 days
Iodomethane	5035	8260B	1	NL	-	14 days
Isopropylbenzene	5035	8260B	0.2	NL	-	14 days
Isopropyltoluene	5035	8260B	0.2	NL	-	14 days
Methacrylonitrile	5035	8260B	1	8 [d]	B	14 days
Methylene Chloride	5035	8260B	0.2	0.5 [d]	A	14 days
4-Methly-2-pentanone	5035	8260B	1	NL	-	14 days
Methyl Tert-Butyl Ether	5035	8260B	0.2	NL	-	14 days
Naphthalene	5035	8260B	0.2	1,600 [d]	B	14 days
n-Propylbenzene	5035	8260B	0.2	NL	-	14 days
Styrene	5035	8260B	0.2	33.3 [d]	B	14 days
1,1,1,2-Tetrachloroethane	5035	8260B	0.2	38.5 [d]	B	14 days
1,1,2,2-Tetrachloroethane	5035	8260B	0.2	5 [d]	B	14 days
Tetrachloroethene	5035	8260B	0.2	0.5 [d]	A	14 days
Tetrahydrofuran	5035	8260B	1	NL	-	14 days
Toluene	5035	8260B	0.2	40 [d]	A	14 days
1,2,3-Trichlorobenzene	5035	8260B	0.2	NL	-	14 days
1,2,4-Trichlorobenzene	5035	8260B	0.2	800 [d]	B	14 days
1,3,5-Trichlorobenzene	5035	8260B	0.2	NL	-	14 days
1,1,1-Trichloroethane	5035	8260B	0.2	20 [d]	A	14 days
1,1,2-Trichloroethane	5035	8260B	0.2	17.5 [d]	B	14 days
Trichloroethene	5035	8260B	0.2	0.5 [d]	A	14 days
Trichlorofluoromethane	5035	8260B	0.2	24,000 [d]	B	14 days
1,2,3-Trichloropropane	5035	8260B	0.2	0.143 [d]	B	14 days
1,1,2-Trichlorotrifluoroethane	5035	8260B	0.2	2,400,000 [d]	B	14 days

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES
Continued

Parameter	Digestion or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
VOCs Continued						
1,2,4-Trimethlybenzene	5035	8260B	0.2	NL	-	14 days
1,3,5-Trimethlybenzene	5035	8260B	0.2	NL	-	14 days
Vinyl Acetate	5035	8260B	1	80,000 (d)	B	14 days
Vinyl Chloride	5035	8260B	0.2	0.667 (d)	B	14 days
m,p-Xylenes	5035	8260B	0.4	20 (d)	A	14 days
o-Xylene	5035	8260B	0.2	20 (d)	A	14 days

Note: MTCA Method B obtained from "unrestricted land use" in CLARC spreadsheet (carcinogen value used if carcinogen and non-carcinogen values listed)
NL – chemical not listed in Method A table or CLARC
NS – no standard identified for Method A or Method B
a - sediment
b - backfill
c - soil in excavation area
d - topsoil

TABLE C-2-4. WET CHEMISTRY WATER ANALYSES

Parameter	Method	MDL (mg/L)	Ground Water Standard (mg/L)	Surface Water Standard (mg/L)	Preservative	Holding Time
Antimony	6020	0.00018	Background	NS	HNO_3	6 months
Arsenic	6020	0.000128	0.19 (a)	0.5	HNO_3	6 months
Cadmium	6020	0.000021	(a,b)	0.24	HNO_3	6 months
Lead	6020	0.000163	(a,c)	1.89	HNO_3	6 months
Hardness as Calcium Carbonate	2340B	0.086	(d)	NS	HNO_3	6 months
Mercury	245.1	0.000047	0.000012 (a)	0.1	HNO_3	28 days
Thallium	6020	0.000045	Background	NS	HNO_3	6 months

Note: Groundwater and Surface Water Standards are from the FCAP
NS - no standard listed in FCAP
a - chronic level
b - $\leq (0.687)(e^{(1.273[\ln(hardness)]-4.705)})$
c - $\leq (0.865)(e^{(0.7852[\ln(hardness)]-3.49)})$
d - value used for b and c equation

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List of Project Target Compounds and Detection Limits

A complete listing of project target compounds, method detection limits (MDLs), and holding times for each chemical of concern are listed in Table C-2-3 for soil and sediment samples and Table C-2-4 for water samples. The detection limits are at concentrations normally achieved by routine analytical testing in the absence of unusual matrix interference. Laboratory MDLs will be determined in accordance with 40 CFR Part 136 Appendix B procedures.

Quality Control Checks

Each laboratory has QC programs that address the minimum QC requirements for the procedure as outlined in SW-846. The internal quality control checks might differ slightly for individual procedures, but in general the QC requirements include the following:

- Reagent/preparation blanks (applicable to inorganic analysis)
- Instrument blanks (applicable to inorganic analysis)
- Matrix spikes and matrix spike duplicates
- Laboratory control standards
- Serial Dilutions

A summary of wet chemistry data quality control limits is presented in Tables C-2-5, C-2-6, and C-2-7.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. Any samples analyzed in nonconformance with the QC criteria will be reanalyzed by the laboratory, if sufficient volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary. Results of the QC checks will be evaluated during the data validation procedure (see Section 2.6.2).

TABLE C-2-5. QUALITY CONTROL PROCEDURES FOR WET CHEMISTRY INORGANIC ANALYSES

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Detection Limit (MDL) Determination	Annually, or if instrument is adjusted in any way that may affect MDLs	Less than PRDL	Review and use alternative methodology
Initial multipoint calibration • ICP, ICP-MS- 1 standard and 1 blank • AA - 3 standards (1 at contract required detection limit (CRDL level) and 1 blank • CVAA – 4 standards (1 at CRDL level) and 1 blank	Daily (per 24 hours), prior to sample analyses	Correlation coefficient ≥ 0.995 for linear regression	Correct problem; recalibrate
Initial/Continuing calibration verification (ICV/CCV)	All instruments – after calibration, after every 10 samples, and at the end of the sample run	Recovery of 90% to 110% of true value	Correct problem; recalibrate, and reanalyze all samples since last successful calibration
Initial/Continuing calibration blank (ICB/CCB)	After ICV/CCV	No analytes detected ≥ PRDL	Correct problem; analyze calibration blank and previous 10 samples
CRDL Standard • ICP, ICP-MS - 2 times the CRDL or 2 times the MDL, whichever is greater • AA, CVAA – at CRDL or MDL, whichever is greater	• Beginning and end of analytical run (immediately preceding interference check sample) • Beginning of each analytical run (after ICV)	ICP/MS only – recovery of 50% to 150% (no criteria is specified by the other methods)	ICP/MS only – terminate analysis and recalibrate; if corrective action is not taken, flag associated samples with "C"
Matrix Spikes	One per analytical batch, per method	Spike recovery of 75% to 125%	Flag associated sample results with "N" for values less than 4X the spike concentration
Laboratory Blank (Prep or Method)	One per analytical batch, per method	No analytes detected ≥ PRDL	Correct Problem. Redigest and reanalyze associated samples unless sample concentrations are 10X the blank value
Matrix Spike Duplicate	One per analytical batch, per method	Soil samples – RPD of ≤35% for values ≥5X PDLG; ±PDLG for values <5X PDLG	Flag associated sample results with "*"
Laboratory Control Sample (LCS)	One per analytical batch, per method	Recovery of 80% to 120% of true value, or within the 95% confidence level for the true value	Terminate analyses; correct problem; reanalyze LCS and associated samples

TABLE C-2-6. ADDITIONAL QUALITY CONTROL PROCEDURES FOR ICP/CP-MS

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Interelement Corrections – determination of interelement correction factors	Annually, or when instrument is adjusted in any way that may affect the correction factors	N/A	N/A
Linear Range Analysis – standard run to determine upper concentration limit	Annually, or when instrument is adjusted in any way that may affect the linear range	The highest standard with a recovery rate of 95% to 105%, determines the upper concentration limit which may be reported without dilution	N/A
Memory Test Solution and Memory Test Blank (ICP-MS only)	Daily, after calibration and before sample run	Memory Test Blank target analytes <PDLG	Rerun test until criteria is met before running samples
• ICP Interference Check Sample (ICS) • ICP/MS Interference Check Sample (ICS)	• Beginning and end of analytical run • Beginning or end of analytical run (right before CCV)	ICS AB solution analytes recovery of 80% to 120% of true value	Terminate analysis correct problem; reanalyze ICS and affected analytes
Serial Dilution	One per analytical batch	Percent difference within ±10% for concentrations >50X the IDL (>20X the CRDL for ICP-MS)	Flag associated sample results with "E"
Internal Standard(s) (ICP-MS only) – must be in the same mass bracket as the target analyte(s)	Analyzed with every sample	≥30% of the intensity of 1st standard used for the initial calibration	Sample must be diluted fivefold (1+4) and reanalyzed for affected analytes

TABLE C-2-7. QUALITY CONTROL PROCEDURES FOR WET CHEMISTRY ORGANIC ANALYSES

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Detection Limit (MDL) Determination	Annually, or if instrument is adjusted in any way that may affect MDLs	Less than PRDL	Review and use alternative methodology
Initial multipoint calibration • 3 standards	As needed	Correlation coefficient ≥ 0.995 for linear regression	Correct problem; recalibrate
Matrix Spikes	One per analytical batch, per method	In-house calculated limits as specified by SW-846	Flag associated sample results with "N" for values less than 4X the spike concentration
Laboratory Blank (Prep or Method)	One per analytical batch, per method	Common laboratory contaminants must be <5xPQL	Correct Problem. Redigest and reanalyze associated samples unless sample concentrations are 10X the blank value
Matrix Spike Duplicate	One per analytical batch, per method	In-house calculated limits as specified by SW-846	Flag associated sample results with "*"
Laboratory Control Sample (LCS)	One per analytical batch, per method	In-house calculated limits as specified by SW-846	Terminate analyses; correct problem; reanalyze LCS and associated samples

Sample Preparation and Cleanup

Each laboratory will implement standard operating procedures for sample preparation and cleanup based on SW-846 requirements.

2.4.3 Portable XRF Procedures

The manufacturer's users guide for the NITON portable element spectrum analyzer is included as Attachment C-1. The portable XRF may be used for screening soils during removal or for performance monitoring during Phase 1 source soil removal in the Fenced Area. It is noted that analyses intended for performance monitoring will be conducted by utilizing prepared samples not in-situ field screening as field screening is typically used to profile an area and may not correlate as well for non-homogeneous samples.

Instrument Calibration

The NITON portable element spectrum analyzer has an internal calibration mechanism. Niton has calibrated the instrument at the factory. The instrument performs a second self-calibration check every time the instrument is turned on or when the reset button is pressed. The self-calibration will be performed hourly during testing.

In addition, several standard samples are available to check both the initial and self-calibrations. These tests against known standards insure the instrument is functioning properly and buttress the results with a permanent record of regular calibrations. At least two standards will be tested at the beginning of the work day.

Detection Limit Performance Requirements

NITON XRFs are calibrated to give accurate values for most elements in concentrations of 10,000 parts per million (ppm) or less. The listed detection limit for arsenic is 275 ppm. Phase 1 sampling at the Fenced Area requires soil removal to a level of 3,000 ppm. Therefore, the detection limit of 275 ppm will be sufficient for performance monitoring should it be used. Ecology will be consulted should Asarco consider using the portable XRF for any other sampling events other than screening soils.

Quality Control Checks

For performance monitoring, quality control measures used will include using the laboratory control standard (LCS), continuing calibration verification (CCV) samples, and confirmation samples. LCS and CCV samples will be analyzed at a frequency of 1 per 20 samples analyzed or 1 per day, whichever is greater.

Portable XRF data will be confirmed by laboratory XRF analyses at a frequency of 1 per 20 samples analyzed. The purpose of confirmation sample analysis is to evaluate the comparability of the portable and laboratory XRF instruments, thereby ensuring that systematic errors in quantification are not occurring. The results of the laboratory XRF analyses will be compared to the portable XRF results using the following data analysis techniques:

- Calculation of relative percent differences (RPD) will be calculated for sample pairs using the same formula used for field and laboratory duplicated pairs.
- Calculation of Recovery Rate - percent recoveries, calculated as [(portable XRF concentration / laboratory XRF concentration) x 100], will be determined for each confirmation pair.
- Linear Regression - regression analysis of portable XRF vs. laboratory XRF data will be performed and the resulting coefficient of determination (R^2) and slope and intercept of the regression line will be compared to the "ideal" comparison values of slope = 1 and y-intercept = 0.

Confirmation sample results will be presented as part of the validation report. It should be noted that RPDs calculations will not be used to qualify (flag) samples in the database.

Sample Preparation

Samples collected for performance monitoring will be prepared similarly as for a laboratory XRF. Samples will be homogenized and split using the "cone and quartering" method. A split of 100 grams will be dried in a microwave or conventional soil drying oven and disaggregated using a 10-mesh sieve.

The sample portion that remains on the 10-mesh sieve will be discarded and the portion of the sample that passes through the sieve will be mill ground to less than 120-mesh size. The remaining unused sample will be archived for the duration of the project.

Ten grams of ground sample will be used for analysis. The remaining ground sample will be marked and archived for the duration of the project or sent for confirmation wet chemistry analysis. Prepared XRF samples will be marked and archived in XRF sample cups for the duration of the project.

Sample Cleanup

The mortar, pestle, and grinding mill will be cleaned with dry paper towels. Water may also be used to clean the mortar, pestle, and the mill's container. The sieves will be cleaned with a short bristle brush. Archived samples will be stored and locked in a secure area, and will be available for additional testing, if necessary.

2.5 QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to ensure that data are acceptable for use in remediation decisions. Several evaluations have been formulated for this objective that includes precision, accuracy, completeness, representativeness, and comparability.

2.5.1 Precision

Precision is a measure of the degree to which two or more measurements are in agreement. To evaluate precision, the following effort will be conducted:

Field Effort

Field precision will be assessed through the collection and measurement of field duplicates. For soil and sediment samples, the control limit for field precision is a RPD of 35 percent or less for field duplicates with concentrations greater than 5 times the Project Required Detection Limit (PRDL). For this interim action, the PRDLs are essentially the identified cleanup standards. Control limits for low concentration data (< 5 x PRDL) are ± 2 x PRDL. For water

samples, the control limit for field precision is a RPD of 20 percent or less for field duplicates with concentrations greater than 5 times the PRDL. Control limits for low concentration data (< 5 x PRDL) are ± 1 x PRDL.

The target precision for the project is acceptance of 90 percent of the field duplicates as valid and within control limits.

Laboratory Effort

Precision in the laboratory is assessed through the calculation of RPD for laboratory duplicates and/or laboratory matrix spike duplicates (MSD). For soil, the control limit for laboratory precision is a RPD of 35 percent or less or in-house calculated limits as specified by SW-846. For water samples, the control limit for precision is a RPD of 20 percent or less.

The target precision for the project is acceptance of 90 percent of the laboratory duplicates or MSD as valid and within control limits.

Laboratory XRF Analyses

Laboratory duplicate samples for XRF analyses will consist of using the last sample from the previous run (sample tray). The RPD between the two analyses will be calculated and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{|\text{Original} - \text{Duplicate}|}{0.5(\text{Amount in Original} + \text{Duplicate})} \times 100$$

Wet Chemistry Analyses

For soil samples, laboratory MSD samples will be prepared by choosing a sample at random from a shipment received and dividing the sample into equal aliquots. In general, MSD samples will be prepared at a frequency of 1 per 20 samples tested. The RPD between the sample and the duplicate will be calculated in the same manner as with the XRF. For water samples a split is taken prior to sample digestion with a frequency of 1 per 20 samples tested.

Portable XRF Analyses

For performance monitoring, laboratory duplicate samples for analyses will consist of using a previously analyzed sample at a frequency of one per day. The RPD between the two analyses will be calculated and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{|\text{Original} - \text{Duplicate}|}{0.5(\text{Amount in Original} + \text{Duplicate})} \times 100$$

2.5.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference value. To evaluate accuracy, the following effort will be conducted:

Field Effort

Field accuracy will be evaluated by ensuring the sampling procedures and sample handling requirements are met. In addition, for groundwater sampling, blind field standards will be used. The blind field standards will be standard reference materials (SRM) of known concentrations and will be treated as field samples. The control limits for these standards will be a recovery of 80 to 120 percent.

The target accuracy for the project is acceptance of 90 percent of the blind field standards as valid and within control limits.

Laboratory Effort

Laboratory XRF Analyses

Accuracy of XRF data will be assessed using laboratory control samples (LCS) and calibration verification standards (CCV). The control limits for both LCS and CCV will be a recovery of 75 percent to 125 percent. The target accuracy for the project is acceptance of 90 percent of the laboratory control samples and 90 percent of the calibration verifications as valid and within control limits.

Additional information on accuracy of XRF soil analyses will be evaluated by submitting selected samples (confirmation samples) to a laboratory for traditional wet chemistry analytical

techniques. Confirmation samples will be sent off for wet chemistry analyses at a frequency of one per 50 samples analyzed by the XRF.

Wet Chemistry Analyses

Accuracy of wet chemistry data will be assessed through the analysis of matrix spikes (MS) and MSD samples and SRM samples. The control limits for MS/MSD will be a recovery of 75 percent to 125 percent or in-house calculated limits as specified by SW-846. The control limits for SRM samples will be a recovery of 80 percent to 120 percent or the 95 percent confidence interval as established by the reference material provider. The target accuracy for the project is acceptance of 90 percent as valid and within control limits.

A spike will consist of randomly selecting a sample from a shipment. It will be spiked, prior to digestion, with a known amount of the analyte or analytes to be evaluated. The spike sample will be then analyzed. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery.

The percent recovery for a spiked sample is calculated according to the following formula (excluding ICP-MS):

$$\%R = \frac{\text{Amount in Spiked Sample} - \text{Amount in Sample}}{\text{Known Amount Added}} \times 100$$

The percent recovery for a spiked sample is calculated according to the following formula for ICP-MS:

$$\%R = \frac{\text{Amount in Spiked Sample}}{\text{Known Amount Added} + \text{Amount in Sample}} \times 100$$

Portable XRF Analyses

For performance monitoring, accuracy of data will be assessed using laboratory control samples (LCS) and calibration verification standards (CCV). The control limits for both LCS and CCV will be a recovery of 75 percent to 125 percent. The target accuracy for the project is acceptance of 90 percent of the laboratory control samples and 90 percent of the calibration verifications as valid and within control limits.

Analyses will also be evaluated by submitting selected samples (confirmation samples) for laboratory XRF analyses. Confirmation samples will be sent off at a frequency of one per 20 samples analyzed by the portable XRF.

2.5.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Completeness will be the ratio of the number of valid sample results to the total number of samples submitted for analysis with a specific matrix and/or analysis.

Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{\text{(Number of Valid Measurements)}}{\text{(Number of Measurements Requested)}} \times 100$$

The target completeness for the project is greater than 95 percent.

2.5.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the proper procedures are

followed. This may include using proper sampling techniques, using proper analytical procedures, meeting holding times, and analyzing field duplicates.

2.5.5 Comparability

Comparability is an expression of the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. Comparability is dependent upon the proper design of the sampling and analysis program and will be satisfied by ensuring that the procedures specified by this plan are followed. This goal may be achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units.

2.6 DATA REDUCTION, VALIDATION, AND REPORTING

All data generated through field activities or by the laboratory operation shall be reduced, validated, and reported.

2.6.1 Data Reduction and Evaluation

Data reduction procedures will be followed according to the following protocol. All raw analytical data will be recorded in numerically identified laboratory notebooks. The notebooks will be issued by the Laboratory Manager. Data are recorded in this notebook along with other pertinent information such as the sample identification number. Other details will also be recorded in the lab notebook such as the analytical method used, name of analyst, date of analysis, matrix sampled, reagent concentrations, instrument settings, and the raw data. Each page of the notebook shall be signed and dated by the analyst. Periodic review of those notebooks by the Laboratory Manager takes place prior to final data reporting.

The equations that will be employed in reducing data are those specified in the laboratory standard operating procedures and/or EPA method documents. Any errors will be noted and corrections made but the original notations will be crossed out legibly.

Quality control data will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the QA Officer for review. If approved, data are logged into the project database format. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. After the QA Officer approves these data, they are considered ready for validation.

2.6.2 Data Validation

Laboratory XRF Results

Laboratory XRF results will be validated using an automated validation computer program (AutoVal). AutoVal extracts data directly from data diskettes provided by the XRF laboratory, processes the information into temporary files, reviews and flags data in the temporary files, and transfers validated data to a database (DataMan). Briefly stated, the program:

- Summarizes the flagged data including reason for flagging (see Table C-2-8);
- Summarizes overall completeness including percent rejected, percent without flags, and percent without frequency violation;
- Summarizes completeness of quality control sample types including the percent in control limits and percent without quality control frequency violations;
- Summarizes accuracy calculations for laboratory control samples and calibration verifications for all parameters using Chauvenet's Criterion to identify outliers; and
- Summarizes precision calculation for laboratory and field duplicates for all parameters using Dixon's Q test to identify outliers.

TABLE C-2-8. DATA VALIDATION CODES AND DEFINITIONS

CODE		DEFINITION
J	-	The associated numerical value is an estimated quantity because quality control criteria were not met. Subscripts for the "J" qualifier: 2- Deviation from required calibration procedures, calibration range exceeded or poor recovery on a known standard. Possible bias. 3- Holding time not met. Indicates low bias. 4 - Other quality control outside control limits.
UJ	-	The "U" indicates that the material was analyzed for, but was not detected. The "J" indicates that the associated value is an estimate. Subscripts for the "UJ" qualifier are applied as follows: 1- Blank contamination. Indicates possible high bias and/or false positive. 2- Deviation from required calibration procedures, calibration range exceeded or poor recovery on a known standard. Possible bias. 3- Holding time not met. Indicates low bias. 4 - Other quality control outside control limits.
R	-	Quality control indicates that the data are unusable (compound may or may not be present). Resampling and/or reanalysis are necessary for verification.
A	-	An anomalous result as defined by the Laboratory QA Officer.

All entries made at the laboratory will be compared by the QA Officer to hard copy reports to ensure hand entries are free of transcription errors. In addition, the validation procedure for the QA Officer will include ensuring that specific requirements have been fulfilled and also include an assessment of data quality and usability. The QA Officer will identify any quality control exceedences and data omissions and interact with the laboratory to correct data deficiencies. Data qualifiers will be assigned to any data which are associated with quality control exceedences.

Wet Chemistry Results

Wet chemistry batch QC data will be reviewed for compliance with the specified control limits. The QA Officer will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Data qualifiers will be assigned to any data which are associated with quality control exceedences.

If results of data quality review indicate that corrective action is required, several options are available to the QA Officer:

- Notify the laboratory of the problem and initiate laboratory corrective action.
- Flag the data with the appropriate codes to indicate data is qualified.
- Re-sample or re-analyze, if necessary. Decisions to repeat sample collection and/or analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

All data generated for the project will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags as well as additional comments of the QA Officer. The QA Officer's comments will indicate that the data are: 1) usable as a quantitative concentration, 2) usable with caution as an estimated concentration, or 3) unusable due to out-of-control QC results.

Portable XRF Results

Performance monitoring QC data will be reviewed for compliance with the specified control limits. The QA Officer will identify any out-of-control data points and data omissions and

interact with the field engineer to correct data deficiencies. Data qualifiers will be assigned to any data which are associated with quality control exceedences.

2.6.3 Data Reporting

The task of reporting laboratory data begins after the analysis has been concluded. All data will be reported to Ecology as hard copy and electronically on disk. Hard copy reports or tables and site maps, when applicable, will be submitted to Ecology as data becomes available and remedial decisions are made. Several summary reports will be submitted to Ecology at the end of each monitoring task. In addition, the residential property-specific summary will also be submitted to the respective homeowner (existing site map, proposed site map, site map with arsenic results, and copy of "Sign Up/Sign Off" authorization form).

Electronic data will be submitted to Ecology after the data is validated along with a hard copy validation report. The electronic data will be organized in a tabular format to facilitate cross-referencing of sample results to sample locations. The database will include the following information:

- Sample Number
- Sample Date
- Laboratory Number
- Analysis Date
- Parameter(s)
- Concentration
- Unit
- Data Qualifier

<u>Data Validation Reports</u>

Reports summarizing the overall quality of the data in terms of meeting the data quality objectives will be prepared for each construction season's collected data and/or monitoring event. These reports shall consist of a summary of all the data validation quality review conducted for laboratory XRF and/or wet chemistry analyses, an assessment of the overall

completeness objectives, and a summary of any relevant corrective action measures that were implemented.

Schedule

Data will be submitted to Ecology in the form of summary reports and data validation reports. The summary reports will include a brief description of work performed, laboratory results, site maps, and other pertinent information. Validation reports will include the validated data along with a CD containing data in an electronic format. The following is the anticipated schedule:

Fenced Area-Phase 1

- Performance Monitoring Summary Report as soon as possible following completion of sampling activities.
- Data Validation Report as soon as possible following completion of sampling activities.

Fenced Area-Phase 2

- Performance Monitoring Summary Report as soon as possible following completion of sampling activities.
- Data Validation Report as soon as possible following completion of sampling activities.

Fenced Area-Phase 3

- Performance Monitoring Summary Report as soon as possible following completion of sampling activities.
- Data Validation Report as soon as possible following completion of sampling activities.

Fenced Area-Confirmation

- Confirmational Monitoring Summary and Data Validation Report within six months of sample collection.

Residential Properties in Peripheral Area

- Performance Monitoring Summary Report as soon as possible following completion of sampling activities. Note that the report may be prepared for a selected group of properties and not all identified properties should remediation be performed in different years.
- Data Validation Report as soon as possible following completion of sampling activities. Note that the report may be prepared for a selected group of properties and not all identified properties should remediation be performed in different years.
- Confirmational Monitoring Summary and Data Validation Report within six months of sample collection.

Storm Drain Sediment

- Performance Monitoring Summary and Data Validation Report within six months of sample collection.
- Confirmational Monitoring Summary and Data Validation Report within six months of sample collection.

Storm Water

- Data Validation Report for each sampling episode within six months of sample collection.

Groundwater

- Data Validation Report for each sampling episode within six months of sample collection. These reports will also provide a water level table, field measurement data table, two potentiometric figures for both aquifers (shallow and deep), and two arsenic concentration figures for each aquifer.

2.7 AUDITS

Audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in this plan. The audits of field and laboratory activities include two independent parts: internal and external audits.

2.7.1 Field Audits

Internal Field Audits

Internal audits of field activities will be conducted. These audits will verify that all established procedures are being followed. Internal field audits will be conducted by the Project Manager at least once at the beginning of each sample collection activity.

The audits will include examination of field sampling records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, etc. Follow up audits may be conducted if necessary to correct deficiencies, and to verify that QA procedures are maintained throughout the project.

External Field Audits

External field audits may be conducted by Ecology. External field audits may occur any time during the field operations by Ecology with notification to the Project Manager.

2.7.2 Laboratory Audits

Internal Laboratory Audits

Internal laboratory audits (system audits) are qualitative on-site evaluations conducted for the purpose of determining compliance with the organizational procedural requirements presented in this plan. These audits will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc. These audits may be conducted at the beginning of the project and during start-up of major operational elements. Non-compliance with procedures and corrective actions will be documented and reported to Ecology.

Performance audits are quantitative determinations consisting of the separation and assessment of data used to monitor the performance of the total measurement system (i.e., including errors associated with field sample handling procedures and laboratory analytical processes). For this project, performance audits shall be conducted by the use of field duplicate samples.

External Laboratory Audits

An external audit may be conducted by Ecology with notification to the Project Manager. External lab audits will include (but not be limited to) review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

2.8 PREVENTATIVE MAINTENANCE AT LABORATORIES

As part of their QA/QC programs, a routine preventative maintenance program will be conducted by the laboratories to minimize the occurrence of instrument failure and other system malfunctions. For all instruments, including the XRF, each laboratory will perform routine scheduled maintenance and perform necessary repairs or coordinate with the vendor for such repairs. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service logbook for each instrument. Emergency repair or scheduled manufacture's maintenance is typically provided under a repair and maintenance contract with factory representatives.

2.9 CORRECTIVE ACTIONS

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out of quality control performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All corrective action proposed and implemented will be documented in the regular QA reports to management. Corrective action should only be implemented after approval by the Project Manager, or his designee. If immediate corrective action is required, approvals from the Project Manager should be documented in an additional memorandum. Any nonconformance with the established quality control procedures will be identified and corrected.

2.9.1 Field Corrective Action

Corrective action in the field may be needed if the sample network is changed (e.g., more/less samples, sampling locations other than those specified in the plan, etc.) and/or sampling procedures are modified due to unexpected conditions. Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the Field Manager or designee. The Field Manager will be responsible for assessing the suspected problems in consultation with the QA Officer on making a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the Project Manager and sent to Ecology.

The Project Manager will be responsible for ensuring that corrective action for nonconformances are initiated by:

- Evaluating all reported nonconformances;
- Controlling additional work on nonconforming items;
- Determining disposition or action to be taken;
- Maintaining a log of nonconformances;
- Reviewing nonconformance reports and corrective actions taken;
- Ensuring nonconformance reports are included in the final site documentation in project files.

If appropriate, the Field Manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The QA Officer will identify deficiencies and recommended corrective action to the Project Manager. Implementation of corrective actions will be performed by the Field Manager and field team. Corrective action will be documented in QA reports.

2.9.2 Laboratory Corrective Action

Corrective action in the laboratory may occur prior to, during, and after analyses. A number of conditions such as broken sample containers may be identified during sample log-in or just prior to analysis. These conditions must be immediately reported by the laboratory to the Project Manager. Other conditions such as analyte concentrations not in instrument range may not be apparent until sample analysis. Following consultation with lab analysts, it may be necessary for the Laboratory Manager to approve the implementation of corrective action. Some conditions that may trigger corrective action or optional procedures during or after analysis include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain quality control criteria are not met, etc.

Corrective action for any nonconformance identified by audits or data validation may include:

- Re-analyzing the samples, if holding time criteria permits;
- Re-sampling and analyzing,
- Evaluating and amending sample procedures,
- Evaluating and amending analytical procedures,
- Accepting data and acknowledging the level of uncertainty.

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The action taken is somewhat dependent on the analysis and the event. If re-sampling is deemed necessary due to laboratory problems, the Project Manager must identify the necessary approach.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- Blanks contain target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or RPD between duplicates;
- There are unusual changes in detection limits;

- Deficiencies are detected during internal or external audits or from the results of performance evaluation samples; or
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the Laboratory Manager and/or QA Department for further investigation. Once resolved, full documentation of the corrective action procedure is filed. These corrective actions are performed prior to release of the data from the laboratory. The corrective actions will be documented in narrative data report sent from the laboratory to the QA Officer.

2.9.3 Corrective Action During Data Validation and Data Assessment

The need for additional corrective action may be identified during either the data validation or data assessment by the QA Officer. Potential types of corrective action may include re-sampling by the field team or re-analysis of samples by the laboratory.

These actions depend upon the ability to mobilize the field team and or whether the data are necessary to meet the project's objectives and QA requirements. When the QA Officer identifies a corrective action situation, it is the Project Manager who will be responsible for approving the implementation of corrective action, including re-sampling, during data assessment. All corrective actions of this type will be documented.

ATTACHMENT C-1

Users Guide for NITON XL-309 and 700 Series Instruments

Version 5.0.

NITON corporation

XL-309

&

700 Series

User's Guide

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- XL-309 and 700 Series User's Guide
- XL-309 Lead Detector
- 700 Series Multi-element Analyzer

Produced in the United States of America

Registration: NITON Corporation manufactures the XL-309 and 700 Series under the authority of the State of Rhode Island, *License #3A-105-01*. NITON XL-309 and 700 Series have been evaluated for safety in *Sealed Source and Device Evaluation Sheet RI-164-D-101-S*.

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Preface

This User's Guide is a detailed instruction and reference manual for NITON XL-309, 701, 701-A, 702, 702-A, 703 and 703-A owners and users. The operation and safety instructions in this Users Guide are complete. This User's Guide is intended to complement the instrument training that NITON provides free-of-charge.

Keep your NITON clean, particularly the beryllium window on the bottom of the instrument. If the beyllium window is dirty, the performance of your NITON will be affected. Clean the window gently with cotton swabs. Clean the instrument's metal case with a soft cloth. Never use water, detergents, or solvents. These may damage the instrument.

All Service except exterior cleaning must be performed by NITON Corporation. Do not attempt to make repairs yourself. Opening the case of your NITON will void the Instrument Warranty.

Never ship your NITON analyzer back to the factory for *any* reason without calling and obtaining a Return Authorization (RA) Number from NITON Corporation.

User's Guide conventions

Warnings: **Provide information on how to safely operate the NITON.**

Cautions: **Provide information on how to avoid damaging the NITON.**

Notes: **Highlight other important information.**

Warnings, cautions, and notes are printed in bold type.

Chapter summaries

Chapter 1, Unpacking your NITON

Supplies instructions for unpacking the shipping container.

Chapter 2, Operating your NITON

Includes basic operating instructions; an overview of NITON XRF test modes; and supplies instructions for instrument calibration, for taking a reading, for downloading data, and for charging and changing battery packs.

Chapter 3, Analyzing bulk samples

For users of 702, 702-A, 703 and 703-A model analyzers (for multiple elements).

For users of XL-309 with optional Lead in Soil Analysis Package (for lead only).

Supplies instructions for rapid, on-site, multi-element detection and analysis of a variety of bulk samples, including soils, house dust, sludges, and liquids.

Chapter 4, Analyzing thin samples

For users of 701, 701-A, 703 and 703-A model analyzers (for multiple elements).

For users of XL-309 with optional Dust Wipe Analysis Package (for lead only).

Supplies instructions for rapid, on-site, multi-element detection and analysis of a variety of thin samples, including filters, dust wipes and thin films.

Chapter 5, Analyzing lead paint

For users of 701-A, 702-A, 703-A and XL-309 model analyzers.

Supplies instructions for rapid, on-site detection and analysis of lead-based paint.

Chapter 6, Radiation safety

Includes an overview of radiation safety, instrument radiation profiles, and guidelines for safe operation of NITON XRF analyzers.

Chapter 7, Additional Information

Includes an overview of multi-element XRF analysis; tips to improve sampling and testing; a summary of safety warnings and equipment cautions; and NITON warranty information.

Chapter 8, Appendices

1: Unpacking your NITON

1. Inspect the shipping carton for signs of damage such as crushed or water damaged packaging. Immediately notify the shipper and NITON Corporation if any damage is noted.

Note: **The radioactive cadmium-109 source is completely sealed and extremely secure. It meets ANSI standard 33232.**

2. Open the packing carton. If your NITON Spectrum Analyzer is not packed in its carrying case, please call NITON Corporation immediately at (401) 294-1234

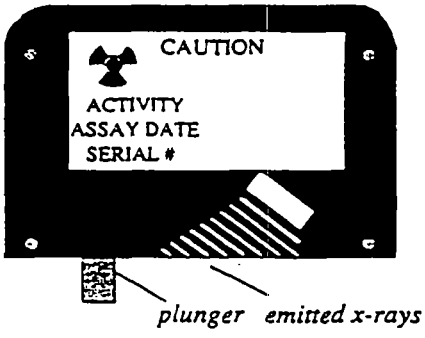
3. Verify the contents of the shipping container against the packing list. Please record any discrepancies and notify NITON Corporation.

4. Open the carrying case and visually inspect the instrument for damage before removing it from the case. Call the shipper and NITON Corporation if you find any damage to the case or its contents.

5. Save the shipping carton and all packing materials. Store them in a safe, dry area, Use when the spectrum analyzer is next shipped.

Fig. 2.02
Top view of the your NITON.

Diagram showing location of radioactive source and direction of the emitted x-rays.



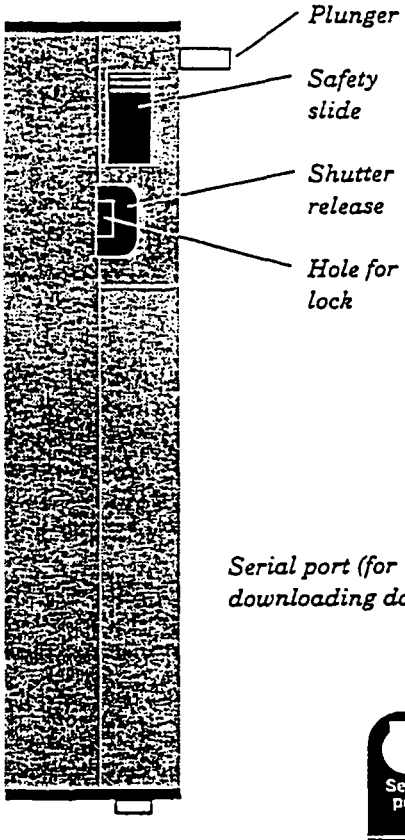


Fig. 2.03
Right side view of your NITON.

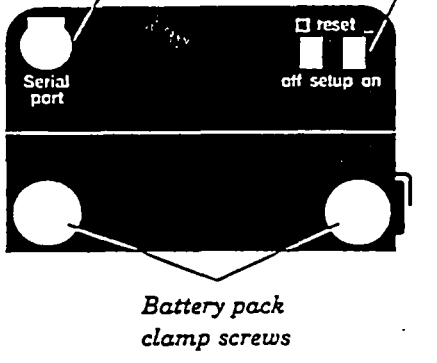


Fig. 2.04
Back view of your NITON

Modes of operation, by model

NITON Spectrum Analyzers operate in the following modes:

Model	Bulk Mode	Thin Sample Mode	Paint Modes
701	No	Yes	No
701-A	No	Yes	Yes
702	Yes	No	No
702-A	Yes	No	Yes
703	Yes	Yes	No
703-A	Yes	Yes	Yes
XL-309	Opt (lead only)	Opt (lead only)	Yes

Turning on your NITON

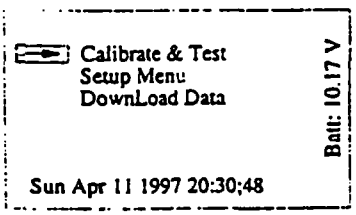


Fig. 2.05 Main Menu

Press Clear/enter to Calibrate. Test immediately in the mode when the XL was turned off.

1. Turn on the instrument. Depress and slide the **On/Off switch** on the bottom of the instrument to the **on** position (**Figure 2.04**). Sometimes the instrument's battery saving features momentarily delay start up. If your NITON does not turn on immediately, turn it off, wait a few seconds, and turn it on again. Each time the NITON is turned on, the **Main menu** appears (**Figure 2.05**).

2. The control panel consists of three buttons (**Figure 2.06**). These buttons allow you to navigate all of your NITON's screens and menus. Press the **Clear/Enter** button to *select* the function indicated by the screen arrow. When you turn on your NITON, the **Screen arrow** is on `Calibrate & test.`

Note: **You can begin to test immediately in whatever mode you *last* tested in by pressing the Clear/Enter button.**

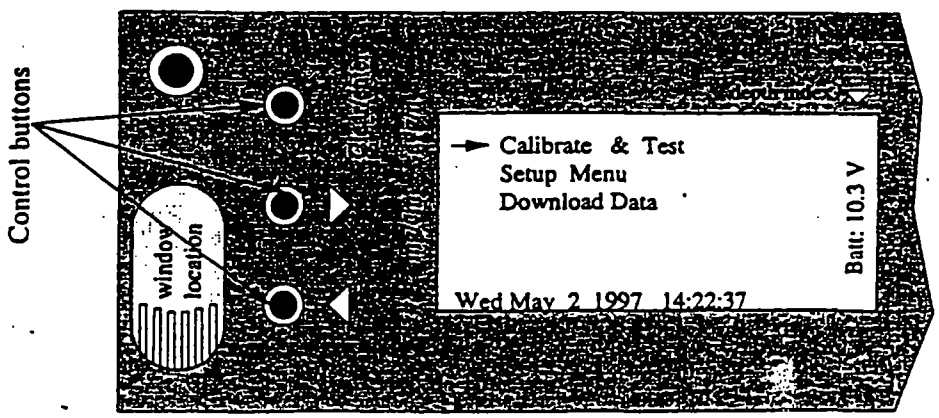


Fig. 2.06 Top View of XL showing the 3 control buttons.

Getting started

The XL-309 and 700 Series Instruments are highly sophisticated, electronic spectrum analyzers. The more familiar you are with your NITON's operation, the better your measurements and reports will be. Here, in brief, is an outline of how to do various kinds of testing using your NITON. More detailed information is offered in subsequent chapters.

1. Turn on the instrument. When testing in **Bulk Sample** or **Thin Sample modes**, leave your NITON on for fifteen minutes prior to testing. ***This is not necessary if you are going to test in any of the Paint Modes.*** Go to the **Setup Menu (Figure 2.07)** and set the mode you wish to test in.

2. Press **Clear/Enter** to begin self-calibration.

3. When the NITON beeps, calibration is complete. You are now ready to test. For instructions on how to take a measurement, depending on the nature of the media you will be measuring, turn to one of the following chapters: **Chapter 3: Analyzing Bulk Samples; Chapter 4: Analyzing Thin Samples**; or **Chapter 5: Analyzing Lead Paint.**

Note: **Check your instrument's calibration with testing standards before and after testing and at least once per hour during testing.**

Setup Menu
- Test Soil, Bulk Samples
- Setup thin Sample Mode
- → Setup Paint Mode
- Instrument Specification
- Set Time
- Illuminate Screen
- EXIT to Main Menu

Fig. 2.07 Setup Menu

The Setup Menu

Use the **Setup Menu** (Figure 2.08) to check your instrument specification; to set the date and time; to illuminate the screen continously; or to select a different testing mode. Select the **Setup Menu** from the **Main Menu** with the **Arrow buttons**; enter the **Setup Menu** by pressing **Clear/Enter**.

Setup Menu
- Test Soil, Bulk Samples
- Setup thin Sample Mode
- Setup Paint Mode
- Instrument Specification
- Set Time
- Illuminate Screen
- EXIT to Main Menu

Fig. 2.08 Setup Menu

Press Clear/enter to bring up the Instrument Specification screen.

Instrument Specification

To check the source strength of your instrument and other useful information, select the **Instrument Specification** screen (**Figure 2.09**) from the **Setup Menu** with the **Arrow buttons**. Press **Clear/Enter**. The screen displays the following information:

1. The **Day, Month, Date, Year** and **Time** (hours, minutes and seconds).
2. The **Instrument Serial Number**
3. The instrument **Model**; and the versions of **Firmware** and **DSP software** installed on the instrument.
4. The **Source Date**, the assay date of the cadmium-109 source.
5. The number of days since the last factory calibration of the instrument.
6. The **Hours used**, the number of hours the instrument has been used since the last factory calibration.
7. The **Source Strength**, the current strength of the instrument's cadmium-109 source, in millicuries (mCi).

To exit the **Instrument Specification** screen to the **Main Menu**, press the **Clear/Enter** button.

```
Sun Apr  4 1997  13:19:37
Serial  #  XL309-U833NS341
CZ 309 5.0B  DSP/12
Source date June  1  1997
Factory cal  8  days ago
Hours used:   0

Src Strength:  10 mCi
```

Fig. 2.09 Instrument Specifications

Setting the time and date on your NITON

NITON sets the date and time (EST) on each instrument before it is shipped. Reset as needed when changing time zones, daylight savings time begins and ends, or whenever the time or date is wrong.

Caution: **Check the `Time` and `Date` displayed on the Ready to Test screen. If they are not correct, reset them before taking any measurements. Your readings will not be accurate unless the date and time are correct.**

To reset the date and time from the **Setup Menu**, do the following steps:

1. Use the the **Arrow buttons** to scroll to `Set Time` **(Figure 2.10 a,b).**

Setup Menu
Test Soil, Bulk Samples
Setup thin Sample Mode
Setup Paint Mode
Instrument Specification
Set Time
Illuminate Screen
EXIT to Main Menu

Fig. 2.10a Setup Menu Set Time

Press Clear/enter to bring up the Set Time screen.

2. Press **Clear/Enter** to select it. The **Date** and **Time** appear as follows:

   `Month–Day–Year–Hour–Minute–Second`

The cursor starts at `Month` and moves to the right. To change the time and date, move from left to right on the screen. For example, To change the **hour** and **seconds**:

1. Press **Clear/Enter** three times to move the cursor to `Hour`.
2. Use the **Arrow buttons** to change the hour to the desired hour. Press **Clear/Enter.**
3. The cursor automatically moves to the next field: `Minute`. Use the **Arrow buttons** to change the minutes to the desired minutes. Press **Clear/Enter** again to move the cursor to `Second`.
4. Use the **Arrow buttons** to change the seconds to the desired seconds. Press **Clear/Enter.**
5. After selecting `Seconds`, the **Main Menu** screen is again displayed, set to `Calibrate & Test`.

Note: **If the year is incorrect, set it first. Use** Clear/Enter **to move to the year position and the** Arrow buttons **to set the year. Then press** Clear/Enter ***five*** **more times and set the remaining fields as described above.**

Sat Apr 3 1997 13:31:44

Fig. 2.10b Set Time screen

Lighting the LCD screen

In its default mode, your instrument's LCD screen remains back-lit for 15 seconds after any of the three buttons is pressed. You can light the screen any time the instrument is turned on by pressing any of the three buttons. When working in a dark place, you also have the option of lighting the screen continuously.

Take the following steps to either light the screen continuously, or turn off continuous screen lighting if it is currently activated:

1. Use the **Arrow buttons** to select **Illuminate Screen** from the **Setup Menu (Figure 2.11)**.
2. Press the **Clear/Enter button** to turn continous screen lighting on or off. The instrument will then return automatically to the **Main Menu**.

Setup Menu
Test Soil, Bulk Samples
Setup thin Sample Mode
Setup Paint Mode
Instrument Specification
Set Time
Illuminate Screen
EXIT to Main Menu

Fig. 2.11 Setup Menu Illuminate Screen

Overview of test modes

The **Setup Menu** allows you to choose the pre-programmed test mode best suited for the type of testing that you will be doing. A full chapter is devoted to each mode later in this User's Guide.

Note: **The Setup Menu shows all NITON analyzer modes for all instruments. If you select a test mode which is not available on your NITON instrument, a reminder message will be displayed on the sceen.**

Please contact NITON instrument sales at (800) 875-1578 or your local NITON sales representative to enquire about upgrading your NITON analyzer to add capabilities.

Use the **Arrow buttons** to select the mode you wish to test in. Press **Clear/Enter** to select the mode.

The Bulk Sample mode

Bulk Sample Mode can be used to measure concentrations of contaminants in any fairly homogeneous, fine-grained medium such as soil, ground-up paint chips, a liquid or many other kinds of bulk materials.

To test in Bulk Sample Mode:

1. Use the **Arrow buttons** to select `Test Soil, Bulk Samples` from the **Setup Menu** (**Figure 2.12**). Press the **Clear/Enter** button.
2. The instrument will return to the **Main Menu** ready to `Calibrate & Test` in Bulk Sample Mode. Press the **Clear/Enter** button.
3. The instrument will initiate self-calibration. This will take one to two minutes. When self-calibration is complete, the instrument will **beep** and display the **Ready to Test** screen for Bulk Sample Mode (**Figure 2.13**).
4. See **Chapter 3: Testing Bulk Samples** for details on how to test particular kinds of bulk samples.

```
Setup Menu
  Test Soil, Bulk Samples
  Setup thin Sample Mode
  Setup Paint Mode
  Instrument Specification
  Set Time
  Illuminate Screen
  EXIT to Main Menu
```

Fig. 2.12 Setup Menu Bulk Samples

```
Sun May 11 1997 20:39:22
  Serial # XL309-U833NS0341

      ·—► Ready to Test ◄—·

  Mode:   Bulk Mode

  Resolution: 0680 eV
  Src Strength: 10 mCi
```

Fig. 2.13 Ready to Test. Bulk Mode

The Thin Sample modes

Thin Sample Modes can be used to measure concentrations of contaminants in a variety of thin layers, including deposits on dust wipes, filters and many other substrates, including, for example, thin layers of uranium on concrete.

Caution: **The Standard Thin Sample Mode should not be used for quantitative lead-paint testing. Use only the three Paint Testing modes to test lead-based paint.**

There are five Thin Sample Testing modes, each designed for a different type of test media:

1. **37 mm CE Filters:** Used for 37 mm diameter filters (fiberglass or cellulose-ester) used in personal exposure monitoring. This mode can also be used for 37 mm filters used to analyze dust in Dust Vacuum Methods. In this Thin Sample Mode, three measurements are taken, weighted, and summed for each filter.

2. **TSP/PM Filters:** Used for the larger filters to monitor the concentration of metals in air. In this mode, the instrument averages the measurements you take on the filters.

3. **Dust Wipes:** Used for dust wipes to take samples by wiping surfaces following HUD guidelines for risk assessment and clearance testing for lead in dust.

4. **Standard Thin Sample:** Used for taking single measurements of samples or coatings. In this mode, results are displayed, in $\mu g/cm^2$.

5. **User-Definable Thin Samples:** User-definable testing gives you the flexibility to specify custom thin sample measurement protocols.

Testing in the Thin Sample Modes:

1. Use the **Arrow buttons** to select `Setup Thin Sample Mode` from the **Setup Menu**. Press **Clear/Enter**.

```
Setup Menu
    Test Soil, Bulk Samples
    Setup Thin Sample Mode
    Setup Paint Mode
    Instrument Specification
    Set Time
    Illuminate Screen
    EXIT to Main Menu
```

Fig. 2.14 Setup Menu Thin Sample Mode

2. The **Choose Operation Mode for Thin Samples** screen will appear (**Figure 2.14**)

3. Use the **Arrow buttons** to select the mode appropriate for the kind of thin samples you are going to test. Press **Clear/Enter**.

4. The **Choose Operation Mode for Thin Samples** screen will *highlight* the thin sample mode you have selected and the cursor will move to `Exit to Main Menu` (**Figure 2.15**). Press the **Clear/Enter** button to return to the **Main Menu**. Press the **Clear/Enter** button again to initiate `Calibration & Testing` in the thin sample mode you have selected.

5. The instrument will initiate self-calibration. This takes one to two minutes. When calibration is complete, the instrument will **beep** and display the **Ready to Test** screen for the thin sample mode you have selected (**Figure 2.16**).

6. See **Chapter 4: Testing Thin Samples**, for details on how to test thin samples.

```
Choose Operation Mode.
  37 mm CD Filters *
  TSP/PM
  Dust Wipes
  Standard Thin Sample
  User-Definable
→ E XIT TO Main Menu

Mon May 12 1997  20:33:51
                                Batt: 10.34 V
```

Fig. 2.15 Operation Mode Select 37 mm CD Filters

```
Mon May 12 1997  20:39:21
 Serial # XL309-U833NS0341
  → Ready to Test ←

Mode:          Thin Sample mode
               37 mm CE Filter

Resolution: 0662eV
Src Strength:  10 mCi
```

Fig. 2.16 Ready to Test 37 mm Filter Mode

The Paint modes

All three **Paint Modes** can be used interchangeably to measure lead concentrations in paint in mg/cm^2. In all paint modes, NITON analyzers *simultaneously measure and analyze both K-shell and L-shell lead x-rays* to determine (1) the numerical value of the lead in mg/cm^2 present in the sample; (2) the 95% confidence interval; and (3) whether the sample has a lead *concentration* that is ***greater-than-or-equal-to*** (**"Positive"**) *or* **less-than** (**"Negative"**) the lead **Action-level** (in mg/cm^2) that has been entered.

Standard Paint Mode

In **Standard Paint Mode**, the *instrument reads until a 95% confident* reading of **"Positive"** or **"Negative"** versus the **Action-level** is achieved. Then the instrument displays either `Positive` or `Negative`, the **Result** in mg/cm^2, and displays `Surface lead` for all **Positive** readings where the lead is not shielded by overlying layers of non-leaded paint.

In **Standard Paint Mode**, testing times will vary somewhat from sample to sample. The instrument will measure *only* until a 95% confident reading of **"Positive"** or **"Negative"** (versus the **Action-level** you have set) has been attained. Most readings take 10 seconds or less.

Standard Mode + Spectra

Standard Mode + Spectra is identical to **Standard Paint Mode** except that the x-ray spectrum is displayed with each reading.

K & L + Spectra Mode

In **K & L + Specra Mode**, the *instrument displays the complete test* information *continuously*, from the beginning of each reading, including the K-shell reading with 2-sigma confidence interval, the L-shell reading with 2-sigma confidence interval, the combined reading (Pb) with 2-sigma confidence interval, and the full x-ray spectrum. With each reading, a `Null` result is displayed until a `Positive` or `Negative` result is determined.

In **K & L Mode + Spectra**, you may continue readings indefinitely <u>after</u> a **"Positive"** or **"Negative"** *result is obtained, until you have attained a* desired measurement time or degree of precision.

Note: **In <u>all</u> paint testing modes, if a test is stopped *before* a "Positive" or "Negative" determination has been made, you will get a "Null" test result.**

Testing in the Paint Modes:

1. Use the **Arrow buttons** to select `Setup Paint Mode` from the **Setup Menu.** Press **Clear/Enter.** The **Setup Paint Mode** menu screen will appear (**Figure 2.17**)

2. Use the **Arrow buttons** to select `Set up Paint Protocol`. Press **Clear/Enter.** The **Paint Protocol** screen will appear (**Figure 2.18**)

3. Use the **Arrow buttons** to adjust the times for the `1st beep`, the `2nd beep` and the `3rd beep` signals for **K & L Mode + Spectra** and to set the `Action level`. Use the **Clear/Enter** button to enter each selection.

4. When the **Action-level** has been entered, the **Setup Paint Mode** screen will re-appear (**Figure 2.17**). Now use the **Arrow buttons** to select a Paint Testing Mode. Press **Clear/Enter.**

5. The **Main Menu** will appear, with the instrument ready to `Calibrate & Test` in the paint mode you have selected. Press**Clear/Enter.**

6. The instrument will self-calibrate in one to two minutes. When self-calibration is complete, the instrument will **beep** and display the **Ready to Test** screen for the paint mode you have selected (**Figure 2.19**).

7. See **Chapter 5: Testing Paint Samples**, for detailed descriptions of all three paint testing modes.

Standard Paint Mode
Standard Mode + Spectra
K & L Readings + Spectra
→ Setup Paint Protocol
Exit to Main Menu

Fig. 2.17 Setup Paint Mode Arrow on Paint Protocol

1st beep	3 sec
2nd beep	10 sec
3rd beep	30 sec
Action level	1.0

Figure 2.18: Paint ıtocol screen

Sun May 11 1997 20:39:22
Serial # XL309-U833NS0341

—► Ready to Test ◄—

Mode: Std Paint

Action Level 1.0
Resolution: 0680 eV
Src Strength: 10 mCi

Fig. 2.19 Ready to Test. Paint Mode

Calibrating your NITON

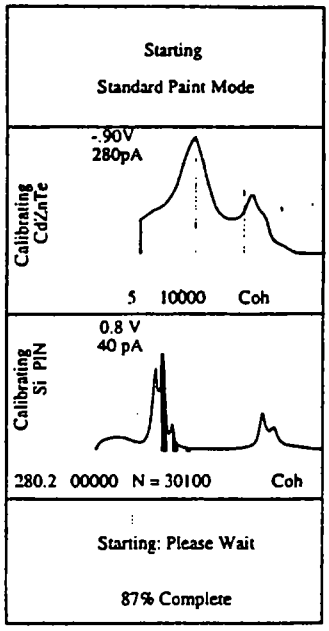


Fig. 2.20 Self Calibrating Process
4 screens during the self calibration

Your NITON has been thoroughly calibrated at the factory. To further assure the best Quality Assurance/Quality Control, your NITON performs a second self- calibration check every time you turn on or reset the instrument.

In addition, NITON has provided you with several standard samples so you may check both calibrations. These tests against known standards insure that the instrument is functioning properly and buttress your results with a permanent record of regular calibrations.

Instrument self-calibration

When the **screen arrow** (->) is on `Calibrate & test`, press **Clear/Enter** to start the self-calibration process (**Figure 2.20**). Self-calibration takes one to two minutes. When it is completed, the instrument will beep and the **Ready to Test screen** will appear.

The ready to test screen

The **Ready to Test screen** (**Figure 2.19**) displays the following fields:

1. The current **Date** and **Time**.

Caution: **Check the `Date` and `Time`. If they are not correct, reset them <u>before</u> taking any measurements** (see page 10). **Your readings will not be accurate unless the date and time are correct.**

2. The instrument **Serial Number**.
3. The indication that the instrument is `Ready to Test`
4. The testing mode the instrument is ready to test in.
5. The `Action-level` the instrument will use to make either a "Positive" or "Negative" determination of lead in paint testing. The **Action-level** is only used in paint testing modes.
6. The `Energy Resolution`. The lower the number (in eV), the better the instrument will perform.

Caution: **If you try to calibrate the instrument and it does not calibrate successfully, push the Reset Button on the bottom of the instrument and recalibrate. If your NITON does not calibrate successfully in <u>three</u> attempts, please call the NITON Service Department at (401) 294-1234.**

7. The **Source Strength** (`Src Strength`). The Source Strength indicates the current activity of the cadmium-109 source in your instrument, in millicuries. Your NITON compensates automatically for the decay of the source.

Re-calibrating your NITON during testing

To insure the accuracy and precision of your NITON, it is recommended that you re-calibrate hourly during testing. To recalibrate:

Press the **reset** button on the bottom of your NITON.

or turn the NITON off, then on, and press the **Clear/Enter** button.

Note: **Occasionally, your NITON may refuse to take further readings and the screen will display the following message: YOU MUST RECALIBRATE. Typically, this will occur when there is a sudden, very large change in the ambient temperature. When this occurs, recalibrate and continue testing.**

How to use your NITON standard samples

NITON provides sets of standard samples for each testing mode. These are used to check the calibration of the instrument:

1. For **Bulk Sample Mode**, there is a set of three NIST soil standards
2. For **Thin Sample Mode** there is a set of three thin film standards: lead, copper, and iron.
3. For **Lead Paint Mode**, there is a set of government-traceable lead paint films.

Note: **Although the standards do not contain every element our multi-element analyzers test for, when an instrument correctly measures the standards you have have received with your 700, your NITON will correctly measure the other elements.**

Test the standards regularly. First, immediately after the instrument finishes self-calibration. Then test the standard samples appropriate to the type of tests you are conducting, and once every 1–2 hours thereafter.

Warning: **Tampering with the 5,500 ppm lead-in-soil standard may cause exposure to lead dust. Keep all standards out of reach of children.**

Caution: **Never tamper with Test Standards. They cannot be used unless they are intact.**

Soil and Thin Film standards

To test soil or thin film standards, place the sample in the test platform receptacle and proceed to test as with any prepared sample. The NITON standard soil samples provided with your instrument contain known amounts of several elements. Do not contaminate the thin film samples with your fingerprints. Handle them by the edges with clean hands.

Lead paint standards

1. Place the NITON standard with the colored side face up. Choose the RED strip labelled 1.0 ± 0.1. Take a reading of that standard. Place the instrument on the standard so that the instrument window is fully on the standard. Your NITON should display a value between 0.9 and 1.1 mg/cm^2 and should indicate `Surface lead`.

2. Place the same standard with the colored side down. Take a reading of the standard (buried beneath the equivalent of 5–6 coats of non-lead paint). Your NITON should still display a value between 0.9 and 1.1 mg/cm^2 and should not display `Surface lead`.

Note: **If your instrument is testing high on Standard samples, check the surface the Standards are resting on. The surface may contain lead.**

When you test the Standard samples, your instrument should give readings which approximate the certified values. Your instrument should give consistent readings for each sample.

Downloading data

Your NITON stores up to 3,000 measurements plus their spectra. You can download this data to a computer for reporting or insertion in a database.

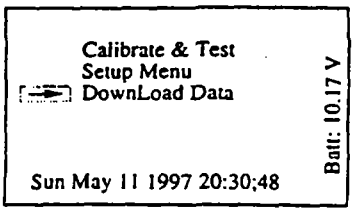


Fig. 2.21 Main Menu DownLoad Data

Downloading data does not erase readings. To make room for the next set of data, erase readings after verifying that the data was downloaded successfully (see next section).

The RS-232 port, on the back of your NITON, accommodates a 4-pin LIMO connector. A LIMO to 9-pin RS-232 connector cable is provided with your NITON. Your NITON can communicate with either a "dumb" or an "intelligent" terminal, such as a VT100 connected to a mainframe computer or a PC-compatible computer.

Fast data dump

You can download up to 3,000 measurements, their descriptions, and spectra (4–90 keV) in *minutes* using the high-speed compressed format, **NITON/Mid-Hudson Downloading Software**, provided with your instrument.

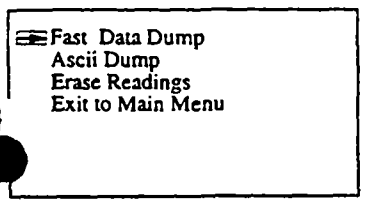


Fig. 2.22 Download Data Fast Data Dump

1. Connect your NITON to your computer with the RS-232 port cable that is provided.
2. Using the **Arrow buttons**, select `Download Data` from the **Main Menu** and press **Clear/Enter** (**Figure 2.21**).
3. Select `Fast Data Dump` from the **Download Data menu** (**Figure 2.22**)and press **Clear/Enter**. Select the first to the last readings you wish to download. The **default** setting will download all readings currently stored in memory.
4. When the instrument finishes downloading, it will return to the **Main Menu**.

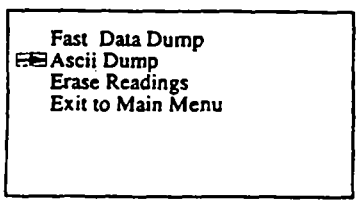


Fig. 2.23 Download Data Ascii Dump

ASCII data dump

For users who wish to download data in a format, the NITON can dump its data as an ASCII file to any terminal emulator program.

1. Connect the NITON to your computer with an RS-232 cable.
2. In the **Download Data screen**, press the **Arrow buttons** to scroll to `ASCII dump` (**Figure 2. 23**). Press **Clear/Enter**.
3. When the instrument finishes downloading, it will return to the **Main Menu**.

Erasing readings

If you do not erase your data, the NITON will continue to record data until the memory is completely full. Then the NITON will start to overwrite older data. Any data that is overwritten in this way will be lost.

Your NITON can store data on up to 3,000 measurements in all **Paint modes**, or 1,000 readings in **Bulk Sample** or **Thin Sample modes**.

Note: **Download your data before the memory is completely full. Clear the memory after downloading.**

The erase readings function is designed to protect you from accidentally erasing readings. To erase readings:

Fast Data Dump
Ascii Dump
Erase Readings
Exit to Main Menu

Fig. 2.24 Download Data Erase Readings

1. In the **Download Data** menu, use the **Arrow buttons** to scroll to `Erase Readings` (**Figure 2. 24**). Press **Clear/Enter**.

2. The **Erase Readings** screen (**Figure 2.25**) appears with the following choices:

```
    ERASE all readings
->  CANCEL do not erase
    EXIT to Main Menu
```

   The screen arrow defaults on `Cancel do not erase`, so that if you select it by mistake, you will not erase any readings.

3. To **Erase Readings**, use the **Up-Arrow button** to go to `ERASE all readings`. Then press **Clear/Enter**. When you enter either `ERASE all readings` or `CANCEL do not erase` your instrument will return to the **Main Menu**, ready to take and store more measurements.

Erase all 158 readings ?
ERASE all readings
CANCEL do not erase
EXIT to Main Menu

Fig. 2.25 Erase Readings Screen
Default is: CANCEL, do not erase

Battery packs and battery charger

Fully charged, each Nickel Metal Hydride battery pack gives eight or more hours of continuous use. It takes about 2½ hours to fully recharge a spent battery pack if the batteries have been recently used. If the NITON has not been used for several weeks, or if the batteries are completely discharged, they must be pre-charged before they can be recharged. See **Battery Charger**, below.

NITON Battery packs can be recharged at least 500 times. They are warranted to be free of defect when shipped. They are not further covered by manufacturers' warranty. When they need to be replaced, new battery packs may be purchased from NITON.

Note: **Before beginning a test, be certain the battery pack has sufficient charge. It is always a good idea to carry a spare battery pack.**

Caution: **NITON's Nickel Metal Hydride battery packs discharge at a rate of about 2% per day when not in use.**

Battery pack routine maintenance

Some guidelines:

- Don't leave battery packs on the charger *all* the time. Overnight recharging is recommended.
- For longest battery lifetimes, use a battery until completely discharged, and then recharge.
- Don't recharge a fully charged battery pack. If you want to charge a partially charged battery, run the Discharge cycle before recharging.
- Store the charger and battery packs in a cool, but not cold, place, away from direct sunlight.
- When a battery pack is not used for a long period of time, it will lose its charge completely. Fully recharge it before use.

Note: **The lithium battery inside your NITON will prevent any loss of data if you need to change the battery pack before downloading readings.**

Changing battery packs

Removing a battery pack

1. Avoid changing the battery pack outdoors. Moisture and dirt can damage a battery.
2. Rest the NITON on a clean surface.
3. Loosen the (2) clamp screws. They do not come off (**Figure 2.26**).
4. Pull the battery pack away from the instrument by grasping the knurled screws and gently rocking the battery pack from side to side while removing it.

Installing a battery pack

1. Rest the NITON on a clean surface, as before.
2. Slip the notch at the bottom of the battery pack into the wide slot.
3. Gently push the battery pack in, taking care that the battery pack connector is seated properly to the instrument.
4. Tighten the (2) knurled screw clamps that fit into holes on the NITON. If the screw clamps do not tighten, the connectors are not lined up properly. These screw clamps must be tight for a secure connection.

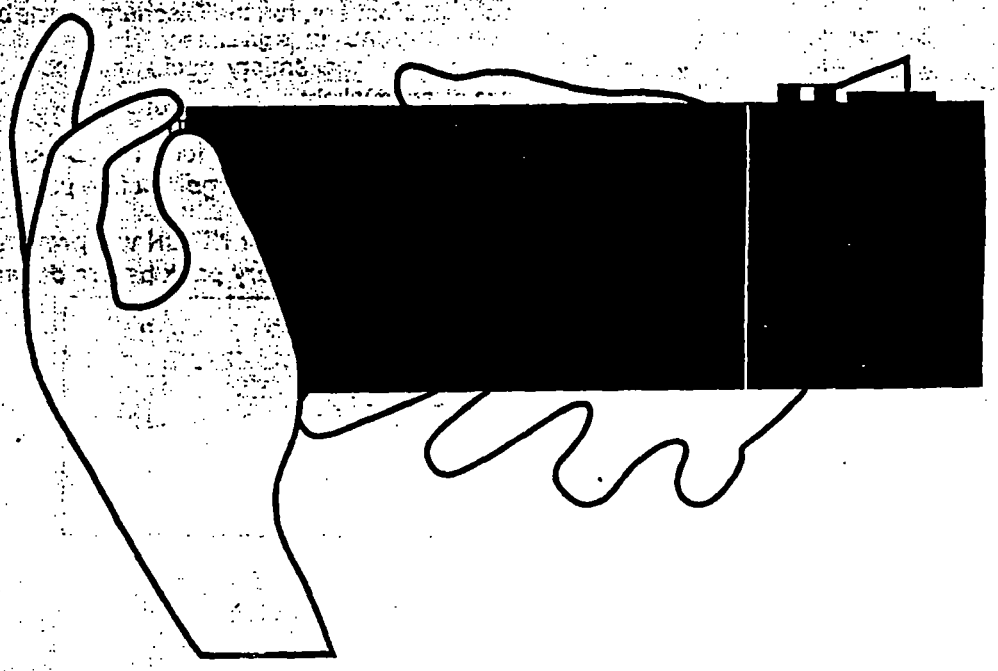


Fig. 2.26.
Loosen clamp screws to remove the battery pack. The clamp screws stay attached to the battery pack.

Recharging battery packs

Recharging with the AC adapter

1. Lay the battery pack on top of **Battery Charger**. Fit connectors together snugly (**Figure 2.27**).
2. Plug one end of the AC adapter into the power port on the bottom of the charger. Push the plug in, making sure it seats fully.
3. Power up the charger: Plug the other end of the AC adapter into a 110V outlet. The yellow ***Power*** light will come on and stay on throughout. The green ***Charge*** light will also come on. It will blink slowly at first, indicating that the battery is on **Pre-charge**, and then stay on with a steady light, indicating that the battery is on **Full Charge**.
4. In **Full Charge** mode, the green ***Charge*** light will stay on with a steady light while the battery is being charged. It is normal for the charger to make some noise in **Full Charge** mode.
5. In **Trickle Charge mode:** When the battery is fully charged, the charger will automatically switch to **Trickle Charge** mode and the green ***Charge*** light blinks rapidly.

Battery charger

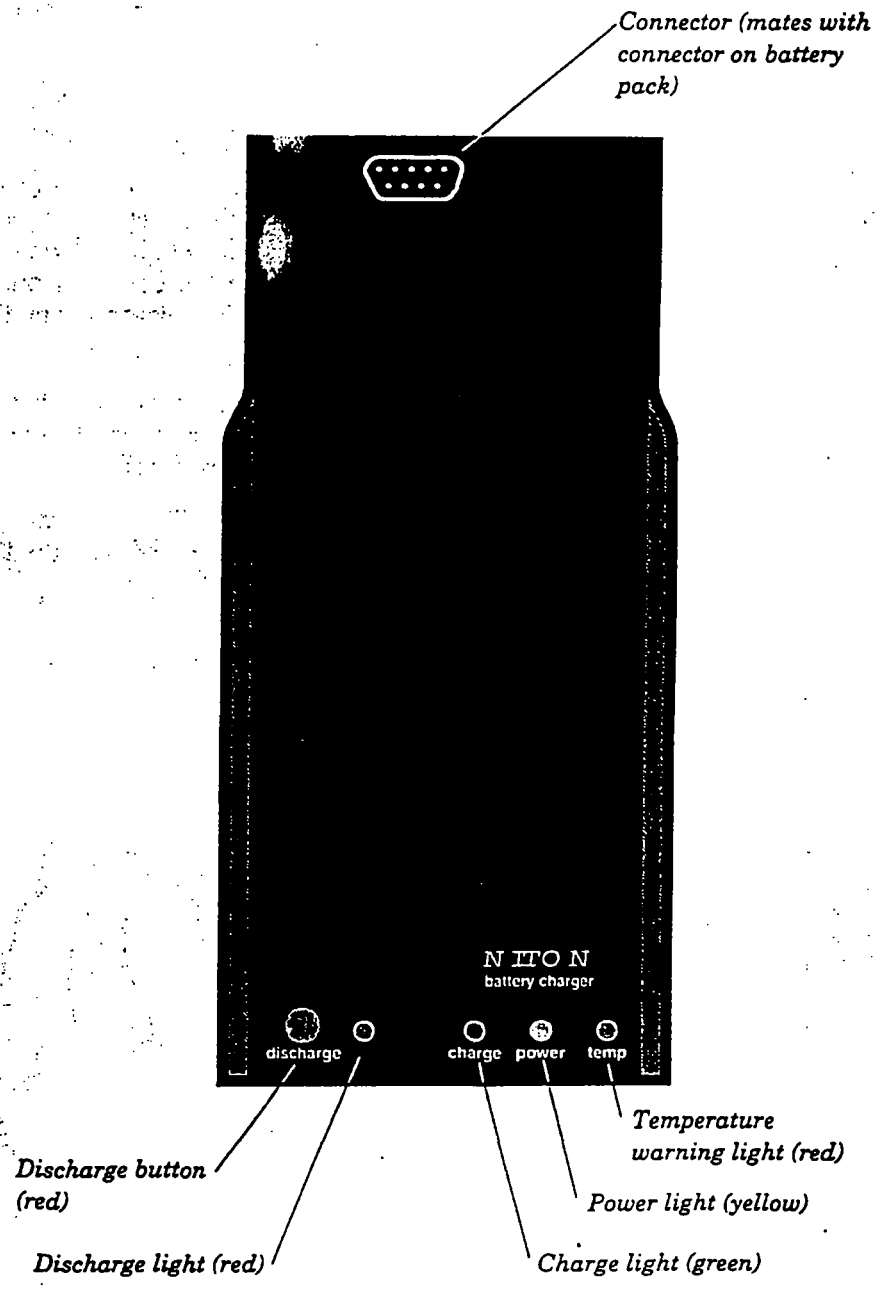


Fig. 2.27. Front view of the battery charger.

Caution: **Do not leave battery packs on the Battery Charger longer than necessary.**

Discharge cycle

Put battery packs on the **Discharge Cycle** only if they are not holding a charge; or, if they are partially charged, run the **Discharge Cycle** before recharging. It takes about eight hours to fully discharge a battery pack. To discharge a battery pack, place it on the charger and:

1. Press the red **Discharge** button. The red **Discharge light** goes on, and the green **Charge** light blinks slowly, showing charger is in **Discharge** mode.
2. After a full Discharge cycle, the charger automatically recharges the battery.
3. The red **Discharge** light goes out and the green **Charge** light will blink rapidly, showing it is in the **Trickle Mode**.

Pre-charge

If your NITON battery packs run all the way down, they must be pre-charged before they can be re-charged. The process can take up to 5 hours. A battery is pre-charging when the green **Charge** light on the battery charger is blinking slowly, and the **Discharge** and **Temperature** lights are off.

Overheating during charge

Caution: **If the red Temp light comes on repeatedly when a battery pack is on the battery charger in the Full Charge cycle, call NITON Customer Service at (401) 294-1234.**

Caution: **Do not store the battery packs or battery charger in direct sunlight.**

Using your vehicle's 12V DC outlet

- A 12V DC Adapter is provided with your NITON. Instructions are the same as for using the 110V AC Adapter. When you have seated all connections well, the yellow **Power** light will come on.
- Do not use the Discharge Cycle while on the DC outlet.
- Secure the charger so the power cord does not get pulled out while the vehicle is in motion.
- The plug of the DC Adapter has a 5A internal fuse. To check the fuse, unscrew the cap that retains the contact from the end of the plug. Replace this fuse only with a 5A fuse of the same size. If the fuse in the 12V Adapter burns out frequently, call NITON's Service Department at (401) 294-1234.

Note: **Please do not throw away spent battery packs. Return spent battery packs to NITON so we can dispose of them properly.**

Maintenance, cleaning and repairs

NITON Corporation welcomes any questions or comments you may have about your NITON analyzer. Please do not hesitate to call us at either our Main Office number: (617) 275-9275 or at our Rhode Island Service Facility number: (401) 294-1234.

Caution: **All Service except exterior cleaning must be performed by NITON Corporation. Do not attempt to make repairs yourself. Opening the case of your NITON will void the instrument Warranty.**

Keep your NITON clean, particularly the beryllium window on the bottom of the instrument. If the window is dirty, the performance of your NITON will be affected. Clean the window gently with cotton swabs. Clean the instrument's metal case with a soft cloth. Never use water, detergents, or solvents. These may damage the instrument.

Note: **Never ship your NITON analyzer back to the factory for *any* reason without calling and obtaining a Return Authorization (RA) Number from NITON Corporation.**

Storage, transport, and shipping

Storing and transporting your NITON

All NITON instruments come in waterproof, drop-proof carrying cases with padlocks. NITON instruments can be transported by car or plane or shipped as an ordinary package. There are no restrictions for tunnels or bridges. No notification is required for transportation except the following: There may be disclosure and/or licensing requirements if you take your NITON instrument across state or national boundaries. Please check with the appropriate agencies for details.

No special labelling is required on the outside of case or packaging. A compliance statement must be kept with the instrument case. *Always* transport the unit in its carrying case, and keep the NITON in its case whenever it is not being used. Store the instrument, in its case, in a secure area.

Shipping your NITON

All NITON instruments must be packed in their original padded carrying cases for shipment. Pack the NITON in its carrying case and ship in either the original carton and packing material or their equivalent.

Caution: **Do not ship your instrument back to NITON for any reason without first notifying NITON Corporation and receiving a Return Authorization Number.**

Caution: **If you return your NITON without the carrying case you will void the instrument warranty. You will also be billed for a replacement case plus any repairs resulting from improper shipping.**

Always enclose a copy of a current leak test certificate when you ship your instrument back to NITON.

Caution: **NITON's license prohibits repairing or upgrading any XRF instrument without a current leak test certificate. If you return an instrument without a current leak test certificate, NITON will perform a leak test and bill you for the leak test.**

Note: **Keep a copy of the following statement in the NITON case whenever the instrument is shipped:**

> THE NITON SPECTRUM ANALYZER CONFORMS TO THE CONDITIONS AND LIMITATIONS SPECIFIED IN 49 CFR 173.422 FOR EXCEPTED RADIOACTIVE MATERIAL, INSTRUMENTS AND ARTICLES, N.O.S. UN—2910. THIS PACKAGE CONTAINS NO MORE THAN 50 mCi CADMIUM-109 IN A PLATED, SOLID, SEALED SOURCE INSTALLED IN AN X-RAY FLUORESCENCE ANALYZER.

3: Analyzing bulk samples

Overview

The NITON XL-309 may be used to test lead in soil and ground-up paint chips if equipped with optional Lead In Soil Analysis software and hardware. 702, 702-A, 703 and 703-A Model Spectrum Analyzers are multi-element analyzers for bulk media, thick samples of materials such as soil, sludge, and various liquids. Applications include:

- in-situ soil testing,
- in-situ materials testing (e.g., contaminated concrete)
- bagged soil sample testing
- testing sludge, sediments, liquids, and dust in cups,
- testing prepared soil samples.

Choose the **Bulk Sample mode** from the **Setup screen (Figure 3.01)**.

Note: **Before testing in Bulk Sample mode, turn your NITON on at least 15 minutes prior to testing. This will give you more precise measurements.**

Setup Menu
Test Soil, Bulk Samples
Setup Thin Sample Mode
Setup Paint Mode
Instrument Specification
Set Time
Illuminate Screen
EXIT to Main Menu

Fig. 3.01 Setup Menu: Test Soil, Bulk Samples

In general, testing methods for bulk media are of two types: Field screening and testing prepared samples. Understanding the difference between these two types of analysis is crucial to getting good data.

Field screening should be used to profile an area, to locate sources of contamination, to determine the boundaries of contamination, or to gather data that will subsequently be used to design a sampling plan. Field screening is usually only approximate; field screening will correlate very well with lab analysis for a highly-homogeneous sample, but may correlate extremely poorly for a non-homogeneous sample.

Note: **For performance evaluation of field XRF results by comparing them to laboratory results (done to justify XRF usage), <u>never</u> use in-situ testing; always gather samples and prepare them before testing.**

When comparing field screening to laboratory analysis, try to compare the same samples. For best results, collect a large sample in a zipper locking storage bag. Shake the bag to mix the sample. Test the bagged sample several times using the NITON and average the readings. Then compare this average reading with lab results.

If you must test in-situ for performance evaluation, take several XRF readings bracketing a spot. Then take a sample for laboratory testing from that spot. For further discussion of field screening, see EPA Method 6200, "Field Screening Using a Field-Portable XRF." Contact NITON for a copy. The EPA accepts field screening using the NITON if the screening is performed using Method 6200. Most states accept EPA Method 6200.

The measurement screen

On NITON XL-309s with optional Lead in Soil Analysis, *only* lead is displayed in bulk sample testing. On 700 models, only the two highest-concentration elements are displayed (in ppm, with the two-sigma confidence intervals) on the first **Measurement screen (Figure 3.02a)**, with the x-ray spectrum. The black bars on the spectrum display highlight the presence or absence of lead or iron in the sample. The test time is also displayed in nominal, or source, seconds.

The summary screen

When you end a reading, the **Measurement Screen** is replaced by the **Summary Screen (Figure 3.02b)**. On 700 models, results are displayed for 14 elements. The elements are divided into two groups: elements that were detected in the sample, and elements that were not detected. Press the **Arrow buttons** to scroll through the elements.

Detection Limit: For an element to be detected by the NITON in a given sample, the measured concentration of the sample must be at least three times the standard deviation of the measurement. This detection limit will depend on the composition of the sample.

Precision: The measurement precision for each element displayed appears to the right of the measured concentration, under the heading "+-". The **precision** of each measurment is two times the standard deviation (sigma). An element is classified **detected** if the measured concentration (in ppm) is at least 1.5 times the precision.

Detected elements are displayed as in the Measurement screen. Non-detected elements are shown as < xx, where xx is the detection limit for that sample. The detection limit for each element is calculated from each sample.

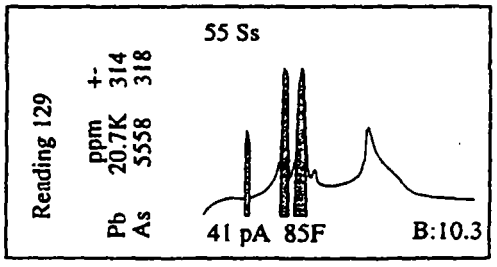


Fig. 3.02a Measurement Screen Bulk Mode. In-progress screen.

Reading 129

	ppm	+-
Pb	20.7	314
As	5558	318
Fe	2903	635
Cu	1191	257
Sr	793	303
Mo	373	105

Below Det.Lim
Zn < 147
Ni < 121

Fig. 3.02b Bulk Mode Summary Screen

In-situ surveys

Before you take your first measurement, you must decide whether to test the bulk material

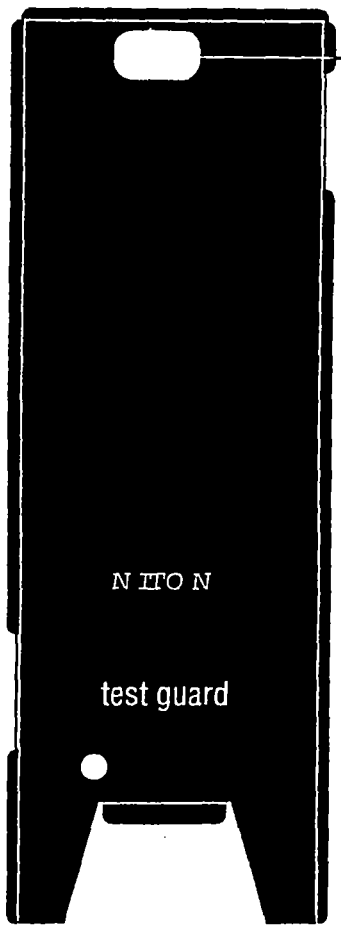
- in-situ (in-place),
- as bagged samples (or, for liquids and sludge, in cups) with a minimum of preparation, or
- in an XRF cup after careful preparation.

Note: **More sample preparation (drying, milling and sieving) will yield greater accuracy. The drier, finer, and more homogeneous the particles, the better the measurements.**

If you are primarily interested in determining whether an element is present (rather than in accurately measuring how much is present), direct measurement is the quickest, simplest way to proceed. Even if you intend to take samples, preliminary direct measurements will help you to survey the site. The analysis of bagged samples is another screening technique.

The NITON test guard

The NITON **Test Guard (Figure 3.03)** is a formed metal plate designed to be placed directly between the ground or other bulk media and the NITON. Use the **Test Guard** for surveys of bulk media *in-situ* or for testing bulk samples in bags. The **Test Guard** shields the unit from contamination and damage.



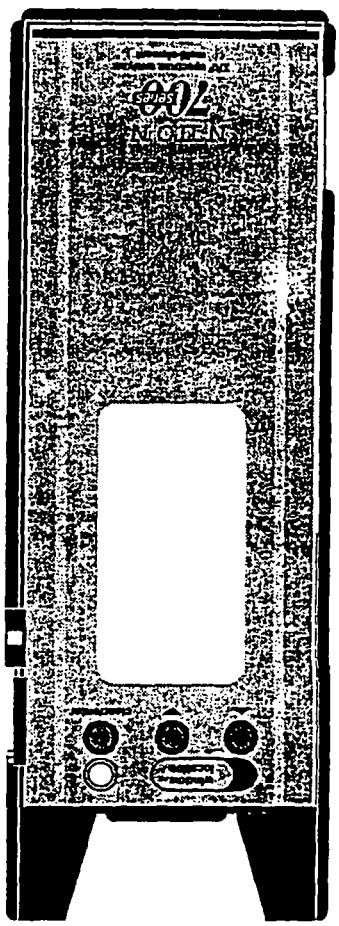


Fig. 3.03
The NITON
Test Guard

Testing *in-situ*

Warning: **When taking samples from a site where toxic chemicals may be present, always use gloves and respiration equipment for your own protection.**

1. Select a measurement site. Lead-in-soil from paint, for instance, will be concentrated within a few feet of the painted structure. Valid results will depend on a sufficient and appropriate selection of sites to sample.

2. Clear any surface debris or vegetation. Use a flat area so that the NITON will contact the test medium. The finer and more homogeneous the material, the more accurate the measurement. (You can increase your accuracy when testing soil by loosening the soil and letting it dry in the sun before testing.)

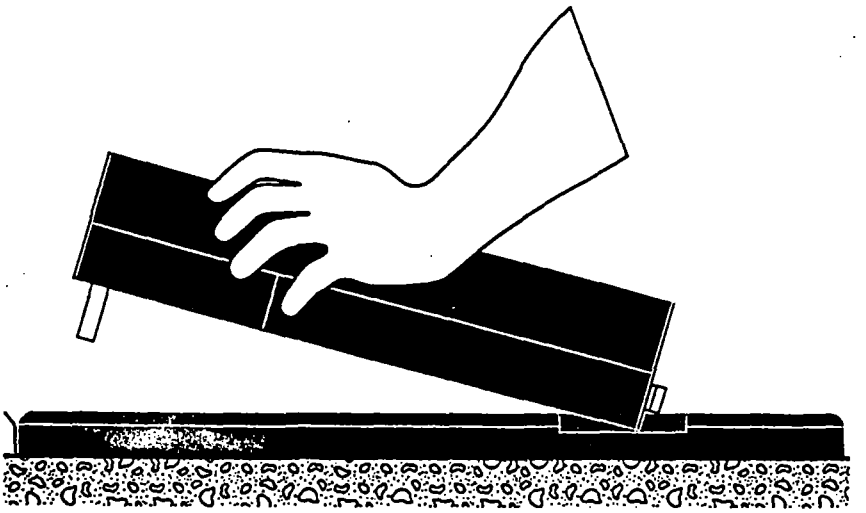


Fig. 3.04a
Place your NITON on the Test Guard.

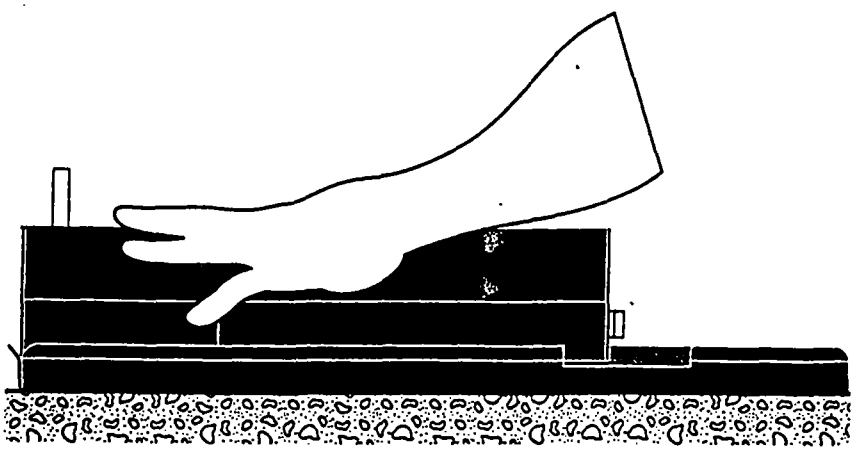


Fig. 3.04b
Firmly press your NITON flat against the surface.

3. Place the test guard on ground. Keep the top of the test guard clean.

4. Hold the NITON in one hand.

Warning: **Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.**

5. Push the safety slide (that locks the shutter release) out from under the shutter release. If the slide is still tucked in, you cannot press in the release nor will the instrument fit on the test guard correctly.

6. Place the NITON on the test guard so that the rectangular opening on the test guard is under the window of the NITON, squeeze the shutter release, and firmly press the instrument flat against the surface of the test guard (**Figure 3.04 a,b**). If you don't squeeze the shutter release, the plunger will not depress. If the plunger is not fully depressed, the window is not fully open and the NITON cannot measure accurately. The back of the unit must be flush with the test guard.

Note: **During the measurement, you do not need to squeeze the shutter release continuously. Hold the NITON firmly against the test guard surface and it will continue to read. Once you lift the instrument, the plunger will back out the bottom, the shutter will close, and the test will be finished.**

7. Watch for indications to decide when the test has reached the desired level of accuracy. A typical screening test will last 20-30 source seconds.

Warning: **In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.**

In-situ depth profiling

An XRF soil test examines only the top millimeter or so of soil. To do depth profiling, simply remove a vertical slice of soil and test several samples from different depths. Doing so rapidly yields information about the depth of contamination.

Analysis of bagged bulk samples

Sometimes it is convenient to collect samples in plastic bags. Without further preparation of the sample, you can screen the site by testing each bag. Because you are testing through a bag, test results will tend to be 5–10% lower than test results obtained from direct analysis.

Taking bagged samples

1. Before sampling a site, size it up for differences in soil characteristics. Valid results depend on a sufficient and appropriate selection of sites to sample. Consider the site's topography, texture, drainage, color of topsoil, and past use.

2. Take a composite sample from each predetermined area. Do not combine samples from areas with different compositions or history. **A composite sample made up of samplings from two distinctly different areas is not representative of either area.**

   Mix the sample. If it is too large, reduce the sample. Some techniques for reduction and homogenization are described in the section on analysis of prepared samples.

3. Fill a clean plastic bag with 50–100 grams of soil and close it securely (with a twist tie). The accuracy of your measurements will be limited by the thickness of the plastic in the bag you use. 1 mil-thick Polyethylene bags offer a reasonable compromise between accurate readings and bag durability. Be sure to label each bag with your name and the location of the sample site.

Testing samples in bags

Shape the bag of soil to form a continuous uniform layer of at least 1 cm. (0.4 inch) thickness. Place the NITON test guard on the bag (**Figure 3.05**). Then follow testing in-situ instructions.

Warning: **Do not hold bagged bulk samples in your hand during testing.**

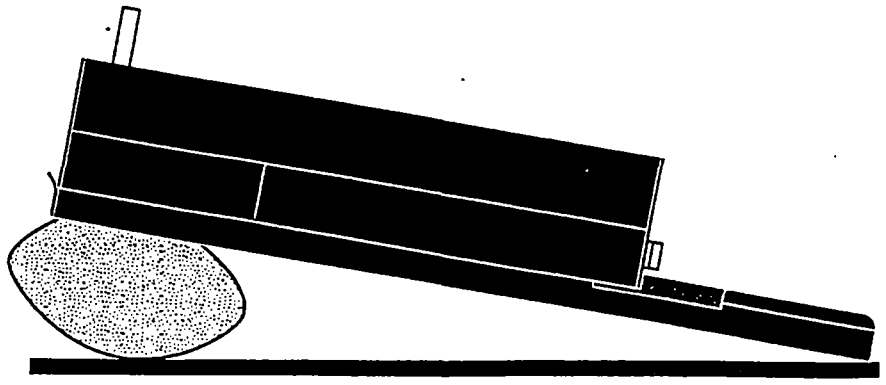


Fig. 3.05
To test a bag of soil, firmly press your NITON plus Test Guard flat against the surface of the bag (which should rest on a firm surface -- not on your hand).

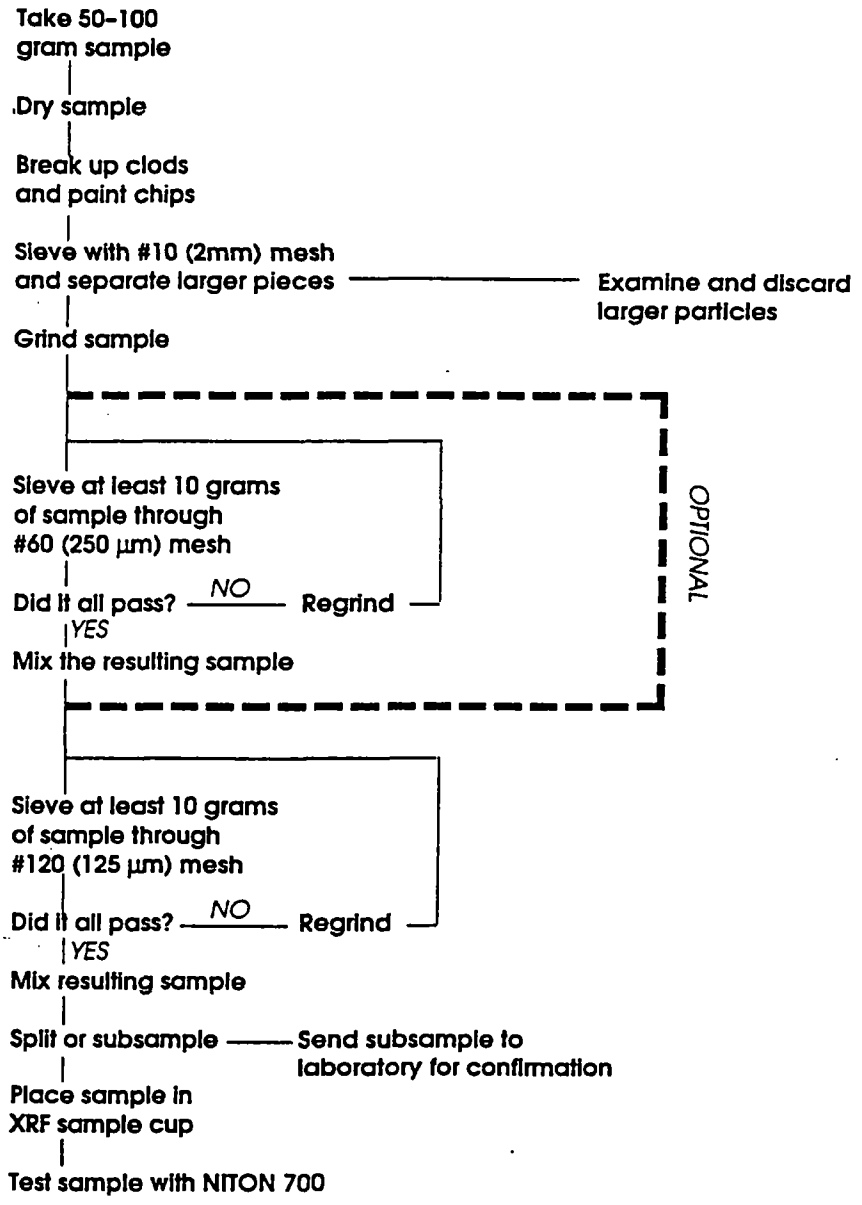
Analysis of prepared bulk samples

Prepared sample analysis is the most accurate method for determining the concentration of elements in a bulk medium using your NITON. Sample preparation will minimize the effects of moisture, large particle size and variations in particle size.

Warning: **For your protection, when taking samples from a site where toxic chemicals may be present, always use gloves and respiration equipment.**

NITON recommends a specific sample protocol. Following this protocol for preparing and testing samples is vital for achieving a level of accuracy comparable with laboratory results. See **Figure 3.06** for a flow chart of the protocol.

Fig. 3.06 Flow chart of sample preparation protocol recommended by NITON. Use of the #60 mesh sieve is optional.



Taking bulk samples

Note: **When testing for lead-in-soil in a residential setting, it is standard practice to sample the top 4 to 6 inches of soil.**

The soil probe or sampling tube is a very convenient sampling tool. It not only allows speed but it makes more accurate composite samples than any other tool as it may always be inserted to a marked depth and it removes the same amount of soil at each insertion. There are core sampling devices that remove an intact cylinder of undisturbed material.

A shovel, spade, dibble, narrow (1-1/2 inch) garden trowel, or other sampling tool can do the job. Take a half-inch soil slice. A satisfactory soil auger may be made by welding a 1-1/4 or 1-1/2 inch wood bit into a 1/2 inch pipe equipped with a T-handle.

Take 50–100 gram sample to insure that you have a sample large enough to be representative and unbiased after mixing, grinding, and straining it.

1. Before sampling a site, evaluate it for differences in soil characteristics. Valid results depend on a sufficient and appropriate selection of sites to sample. Test results may be worthless, even highly misleading, unless the samples tested actually represent the area.

   Consider topography, texture, drainage, color of topsoil, and past use. Lead, for instance, is usually concentrated near a building with lead paint (within 4–6 feet).

2. If the individual samplings are taken with a spade or trowel, (Fig. 3.07) reduce the samples by taking a vertical slice (so representative of the entire spadeful) about one inch wide.

   Place the reduced samples in a clean pail. Then mix the sample thoroughly by stirring and by rotating the pail at an angle of 45 degrees. Don't shake. (You do not want to stratify the sample by weight).

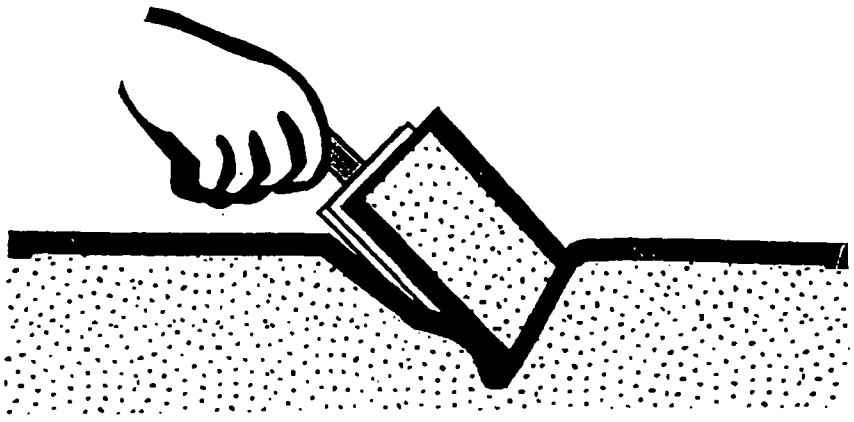


Fig. 3.07
Use a spade, trowel or garden dibble to take a half-inch thick slice of soil.

3. Take a composite sample from each predetermined area. Do not combine samples from areas with different compositions or history. A composite sample made up of samplings from two distinctly different areas is not representative of either area.

   From each predetermined area, prepare a composite sample by taking several samplings consisting of vertical columns of material approximately 1 inch in diameter. The length of each column should be about 6 inches. Lead from paint is usually concentrated within the top 1–4 inches. The elements you wish to measure and the local history will determine how deep you need to sample.

   Package samples from the following areas separately: samples close to painted structures, close to roads, samples close to where various types of waste have been stored, or near pressure-treated lumber.

4. Fill a clean plastic bag and close it securely (with a twist tie). Be sure to label it with the date, the site and the location where you took the sample

Preparing bulk samples

The equipment you need to prepare samples is included in your kit. Among these are a mortar and pestle (for the XL-309 with lead-in-soil-analysis), an electrically powered grinding mill (included with 700s), and several sized-sieves.

Caution: **Keep all test equipment clean to prevent contaminated samples.**

The mortar, pestle, and grinding mill may be cleaned with dry paper towels. Water will also clean the mortar, pestle, and the mill's container, but be sure each is absolutely dry before you use them on another sample. The mortar and pestle may be cleansed by grinding clean dry sand in the mortar. Use the short bristle brushes (included in your Bulk Testing Kit) to clean the sieves. When Soil Grinder blades wear out, unbolt the worn blades and replace.

Cone and quartering

At various times while preparing a sample you may need to divide it. Cone and quartering is a method for splitting the sample into homogenous quarters. Slowly and carefully pour the dry material onto a flat sheet or pan forming a symmetrical cone. Using a flat thin-bladed tool, such as a knife or ruler, divide the cone into equal piles. Divide these in half again. Now you have four samples, each one-quarter the size of the original and each more homogenous than the original.

1. If the sample is moist and cohesive, dry it. To best prepare a sample for presentation to the XRF, the material should be dry and well homogenized. Ideally, the entire sample should be dried to constant weight, sieved to remove gravel and debris, and ground or milled to a fine powder.

   The sample can be dried in any of several ways. Choose one of the following: Oven dry the sample for approximately 2 hours at 150° C., until the sample reaches a constant weight; air dry the sample overnight at room temperature in a shallow pan; gently stir and warm the sample in a pan over a hot plate or burner.

   Oven drying is inappropriate when volatile compounds may be present in the sample. For example, lead present as tetraethyl lead would be driven off by the heat of drying. Some forms of mercury and arsenic are volatile. Air drying will preserve more of these volatile substances.

2. Grind the sample to break up dirt clods and/or paint chips.

3. Sieve with the #10 (2mm) mesh and separate out the larger pieces (stones, organic matter, metallic objects, etc. Examine the larger particles by eye (look for paint chips), but do not include in the sample.

4. Grind the sample so its particles will be finer and more homogenous. Use mortar and pestle, or an electrically powered grinding mill.

Warning: **Grinding-and-sieving dried samples produces dust. Even clean soil contains silica, which may be hazardous when airborne. Prepare all samples in a ventilated area; wear a mask, gloves, and an apron; and spread a drop cloth.**

5. Sieve at least 10 grams of the sample through #60 (250 µm) and #120 (125 µm) mesh. Re-grind the unpassed material until the required fraction is able to pass.

6. Mix the resulting sample.

Putting the sample in an XRF sample cup

The container holding the sample affects the accuracy of the measurement. Use a container with as thin-walled a window as is convenient and use the same kind of container and window for each sample. Consistency and careful attention to detail are keys to accurate measurement.

Note: **The sample container should be a sample cup of a type that can be filled from the rear; that is, the side opposite the window (e.g. Chemplex #1330). NITON recommends using a 1/4 mil mylar film window** (Figure 3.08). **A supply of cups and windows are included.**

1. Place a circle of mylar film on top of an XRF sample cup. The window goes on the end of the cup with the indented ring. Note that the window may be prepared ahead of time.

2. Secure the film with the collar. The flange inside the collar faces down and snaps into the indented ring of the cup. Inspect the installed film window for continuity and smooth, taut appearance.

3. Set the cup, window-side down, on a flat surface. Fill it with at least three grams of the prepared sample (no more than half-full). Take care that there are no voids or layering.

4. Placing the cup film-side down on a flat surface, tamp the sample into the cup. The end of the pestle makes a convenient tamper. If you intend to re-use the sample, you can, alternatively, place a filter-paper disk on the sample before tamping it.

5. Fill the cup with polyester fiber stuffing to prevent sample movement. Use aquarium filter or pillow filling as stuffing. A small supply of stuffing comes with your bulk sample kit.

6. Fasten the cap on the cup (**Figure 3.09**). Using an indelible pen, write an identifying number on the cup. Keep a record of the sample number, the site and location, the date of the sample, and any other relevant comments.

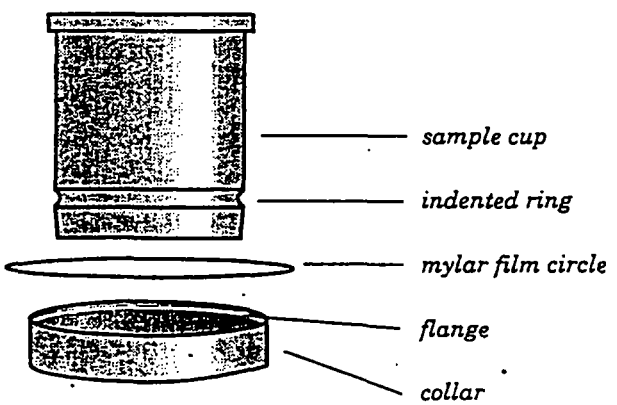


Fig. 3.08 Secure the film by snapping the collar on to the cup.

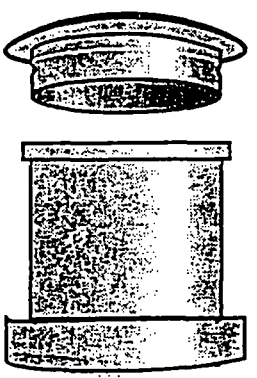


Fig. 3.09 Fasten the cap on the cup.

Preparing samples of liquids, sludges or dust

Liquids:

Fill an XRF sample cup with the liquid to be tested (Use no cotton). It is best if some overflows when the cap is put on, since the cup must be full.

Sludge:

Sludge can be placed directly in an XRF cup for screening. This is considered in-situ testing because no attempt has been made to prepare the sample. For more accuracy, the sludge can be dried, sieved, and ground.

Screening dust:

Use large dust samples taken from a home vacuum cleaner bag. Remove fibers, hairs, and debris. At least three grams of dust are needed to assure accurate analysis. Samples as small as one or two grams may be measured with less accuracy. Even smaller samples (0.3 to 1.0 grams) can be analyzed by applying a weight correction factor and by using a funnel to place the sample in the center of the sample cup.

Prepare in an XRF sample cup and test the same way you would with a soil sample. For risk analysis, it is advisable to use a 60-mesh sieve to isolate and test only fine particles.

The bulk testing platform

The test platform (**Figures 3.10a,b**) is an accessory fixture for holding bulk samples (such as soil or ground paint chips) in standard film-window XRF cups. This fixture snaps quickly and securely to your NITON instrument.

The platform latch screws underneath for storage. Before using the test platform, unscrew the latch and rescrew it on the end of the platform nearest the receptacle for the sample cup.

The test stand securely holds the XRF sample cup in place.

Testing the sample;

Set the NITON test platform on a flat, solid surface. Place the sample cup in the receptacle of the sampler. Included in your kit are some foam disks that you can put in the receptacle under the cup for firmer contact between the NITON and the sample cup window. Attach the NITON to the test stand and follow in-situ bulk sample instructions (**Figures 3.11 a,b**).

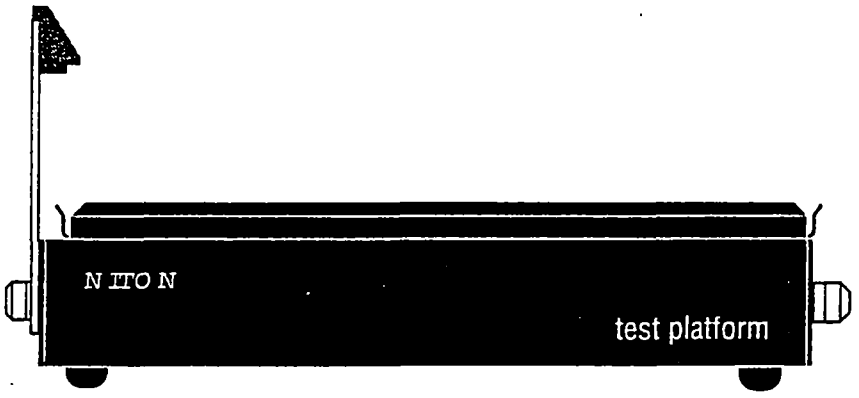


Fig. 3.10a
The Niton
Test Platform

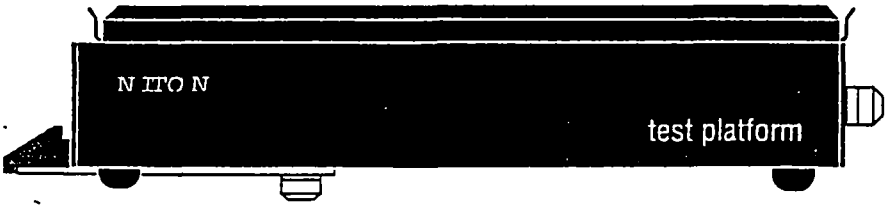


Fig. 3.10b
The Niton
Test Platform
with its latch in
the stored position.

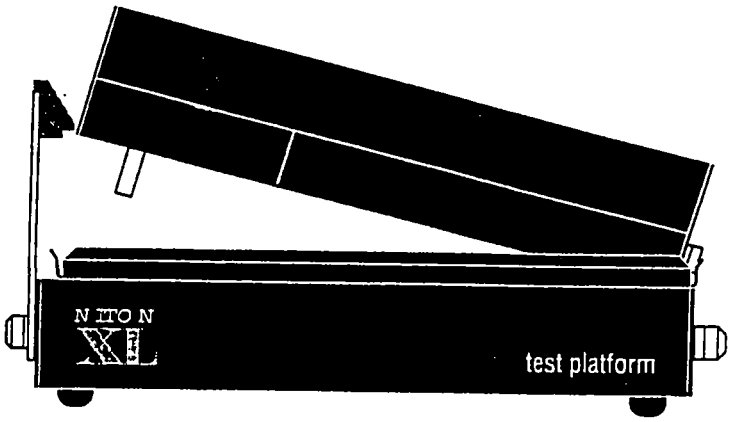


Fig. 311a. Place your NITON on the Test Platform.

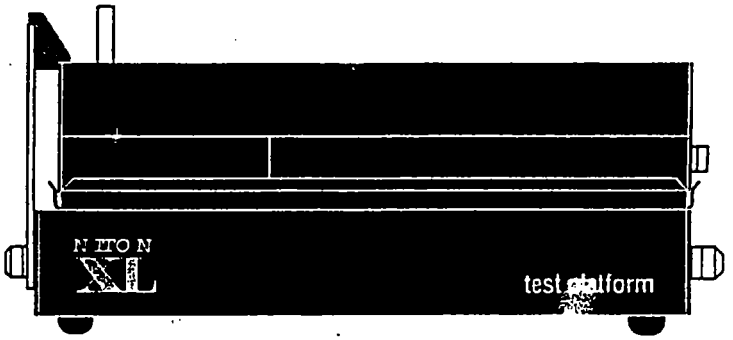


Fig. 311b. Firmly latch your NITON flat against the Test Platform surface.

4: Analyzing thin samples

Overview

The NITON XL can test dust wipes and other thin samples for lead if equipped with optional Dust Wipe Analysis Software and Hardware. The 701, 701A, 703 and 703A Model Analyzers are multi-element analyzers for a wide range of thin samples. Examples of thin samples include:

- 37 mm filters used for exposure monitoring filters, and filters used for Dust Vacuum methods
- Total Suspended Particulate (TSP) and Particulate Monitoring (PM) filters,
- dust wipes,
- filters used for measuring suspended and dissolved metal concentrations in liquids, and
- thin coatings deposited on substrates.

Contamination captured on filters or wipes is not usually deposited uniformly, and the filters and wipes are several times larger that the 1 cm x 2 cm scanning window of the instrument. To produce meaningful results, several readings must be taken for each thin sample measurement. Readings are then summed or averaged.

The number of readings, the weight given each reading, and whether the readings are summed or averaged depends on the application. For example, the procedure for testing dust wipes is different from the procedure for testing 37 mm personal exposure filters. The instrument follows a unique procedure for each application. Simply choose the appropriate Thin Sample Mode from the Thin Sample Setup Menu. (See **Figure 4.01**). See the section titled "Setup Thin Sample Mode".

Note: **Before testing in Thin Sample Mode, turn your NITON on at least 15 minutes prior to testing. This will give you more precise measurements.**

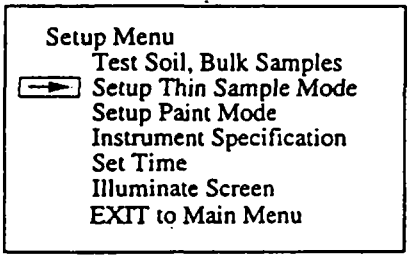


Fig. 4.01 Setup Menu. Thin Sample Mode.

The dust wipe and filter test platform

The Dust Wipe and Filter Test platform is an accessory fixture for hold 37 mm personal exposure filters, [illegible]er contamination monitoring filters, and dust wipes (**Figures 4.02, 4.0[illegible]**). The test platform snaps quickly and securely to your NITON—and detaches just as quickly. It also protects personnel from exposure to radiation.

The front end of the platform is designed to facilitate testing 37 mm personal exposure filters. The test stand securely holds the filter in place in each of the three test positions required for these filters. The clamp holds the instrument.

When testing larger TSP and PM filters, remove the front end. Use the plunger shield to protect the filter from being punctured by the NITON's plunger. The velcro strap on the filter test platform holds the instrument in place and loosens easily to permit you to reposition the filter between each reading.

37mm CE and fiberglass filters

```
Choose Operation Mode.
 37 mm CD Filters *
  TSP/PM
  Dust Wipes
  Standard Thin Sample
  User-Definable
 ►E XIT TO Main Menu
Mon May 12 1997 20:33:51
Batt:10.34 V
```

Fig. 4.04 Operation Mode Select 37 mm CD Filters

Before testing 37mm filters, access the **Setup Menu**, selecting `Setup Thin Sample mode`, and then select `37mm CE Filters` (**Figure 4.04**). See the following sections for details: "Setup" and "Setup Thin Sample mode".

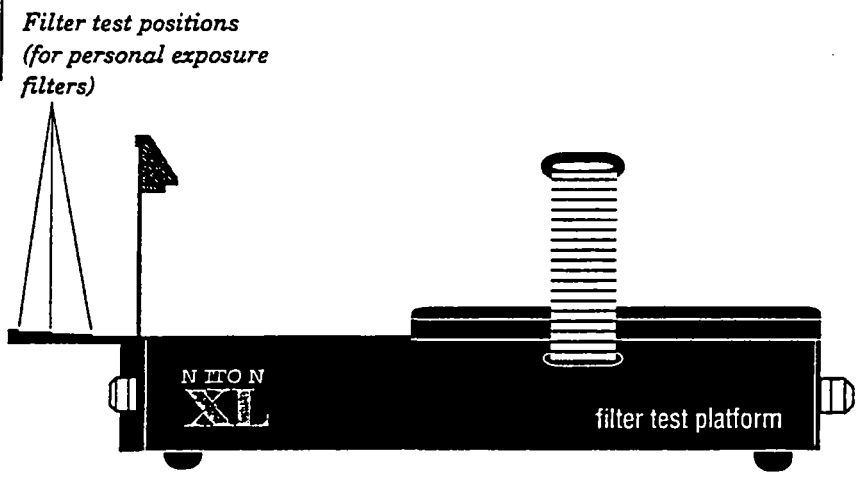


Figure 4.02
The NITON Thin Sample test platform.

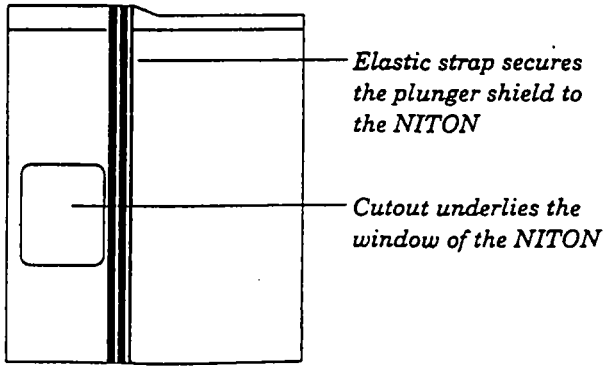


Figure 4.03
The NITON plunger shield protects PM and TSP filters from puncture.

Preparing a filter

37 mm filters are often used for monitoring personal exposure. Dust vacuum measures (DVM) use the same size filters and are tested in much the same way. To prepare the filter for testing, remove it from the air sampling cassette and load it in a filter sleeve.

The plastic air sampling cassette (**Figure 4.05**) is closed-face; an open-faced cassette would be missing the top section and plug. The filter sleeve is a piece of cardboard sandwiched between two layers of thin plastic film (**Figure 4.06**). The cardboard has a circular cutout of slightly larger cutout than the filter.

Note: **To avoid contaminating the test results, wear clean surgical gloves. Take a sleeve. Peel back the top layer of film. Set the sleeve down on a clean surface.**

Remove the bottom plug from the air sampling cassette. Separate the sections of the cassette so you can reach the filter. Using tongs, poke the filter and filter pad through the plug hole to release it from its seat in the cassette. Touching only the edges of the filter and pad, gently separate one from the other with your finger. Then, using the tongs, lift the filter from the cassette and place it on the sleeve in the cutout. Close the sleeve. It doesn't matter if the sleeve wrinkles some.

Note: **It is advisable to practice with several blank filter cassettes before using real samples.**

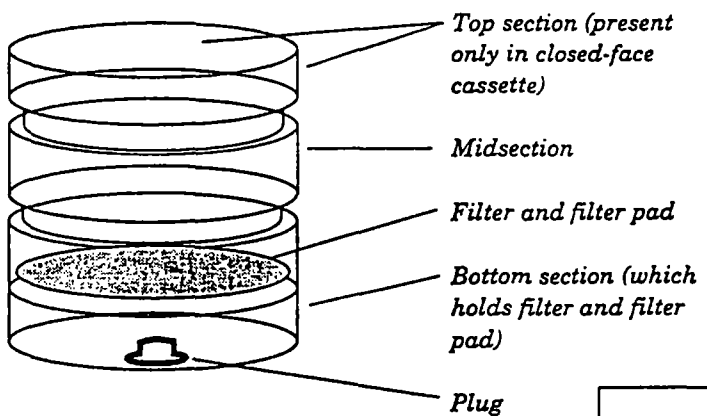


Figure 4.05 (right) An air sampling cassette.

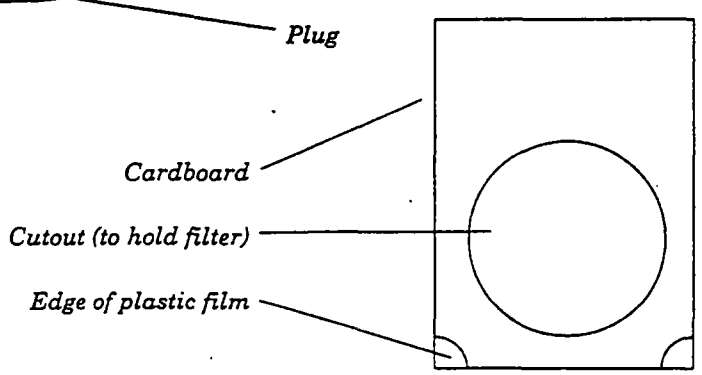


Figure 4.06 (far right) Place the filter in the cardboard filter-sleeve for testing.

Positioning a filter

Place the sleeve on the test platform. The test platform has a built-in filter holder, designed to hold 37 mm filters securely under the test window of the instrument.

To accurately determine the concentration of elements on the filter, you must take three readings, each from a different area of the filter (**Figure 4.07**). The XL or 700Series will automatically calculate the total loading, in µg, when you complete the three readings. The filter holder has ridges that hold the filter in position for each of the three required readings.

You must measure the center of the filter first (Figure 4.08). Place the filter against the middle ridge of the filter holder. This reading is multiplied by a different coefficient than either of the other reading, hence the order is important. Take the first measurement as described in the section *Taking One Reading.*

Note: **The order is important: The middle-of-the-filter reading must be done first.**

Next, slide the filter to the outermost ridge. Take the second measurement (the top of the filter). Finally, slide the filter to the innermost ridge. Take the third measurement. The order of these last two measurements is not important.

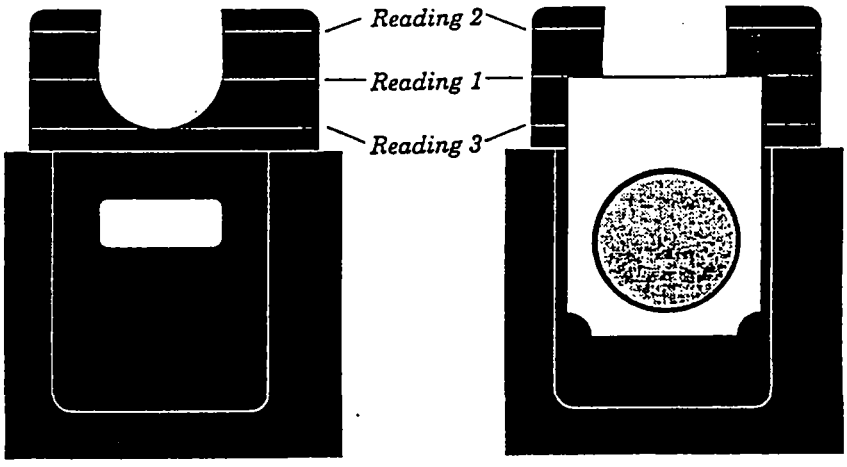


Figure 4.07 (left) Detailed diagram of filter test platform from above. Note three test positions.

Figure 4.08 (right) Filter-sleeve in the Middle position(the first reading) The filter is in the sleeve cutout.

Taking a reading

1. Set the test platform on a flat, solid surface.

2. Holding the NITON in your hand, place it on the test platform so that the filter is under the test window. Squeeze the shutter release, pull back the latch on the platform with your left hand, and firmly press the instrument flat against the platform surface. If you don't squeeze the shutter release, the plunger will not depress. If the plunger is not fully depressed, the window is not fully open and the NITON cannot measure accurately. The window opening must be flush with the test platform to get an accurate reading.

   The test platform latch will continue to hold the NITON flush against the sample until you lift it off.

Note: **During the measurement, you do not need to hold the NITON or squeeze the shutter release continuously. Your NITON will continue to test until you lift the instrument from the test platform.**

3. Watch for indications of lead on the screen to decide when the test has reached the desired level of accuracy. A typical test for the quantitative measurement of lead takes 60 nominal, or source seconds. The instrument will beep at 60 nominal seconds.

4. After the desired interval, pull back on the platform latch to release the NITON and lift from the test platform to end the test. The shutter will close automatically. The plunger should be fully extended.

Warning: **In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.**

Reading the display

The Measurement screen

The Measurement screen is displayed during each test and is accessible after the test is complete. For the XL, the screen shows each of the three measurements in µg/cm² of lead (Figures. 4.09 a-c).

Note:

On multi-element models, the initial Measurement Screen always shows lead because lead is the element most commonly measured in Thin Sample mode. The element with the next highest concentration, in µg/cm² is also shown. To see the other elements, press and hold Clear/Enter for two seconds (Figure 4.09 d). Use the Arrow buttons to scroll through the list of results for all elements.

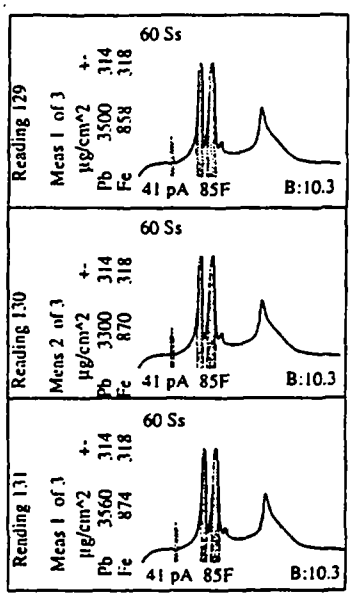


Fig. 4.09 a, b & c. Representative measurement screens for readings 1, 2 and 3

The Final Result screen

The **Final Result** screen (**Figure 4.10**) is displayed only after all three measurements are complete. Final results are in units of µg. On 700 Series instruments, the screen shows 14 elements, whether they were detected, and how much of each element that was detected on the filter (in µg). The **Final Result** screen is given the next reading number.

This screen is divided into three parts. The first shows the metals detected. For the XL, only lead is listed. For the 700 Series, all of the detected elements are listed, in order of decreasing amounts. Next is a list of elements where the result was less than the calculated detection limit. The XL (for lead) and the 700 Series calculates the detection limit for every sample. Each is shown as being less than a number representing the detection limit for that element, for that sample. The detection limit is calculated using EPA protocols, that the detection limit is three times the standard deviation. Finally, there is a list of these same undetected elements displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

These three lists will not fit on the screen at one time. Use the **Arrow buttons** to scroll up or down the screen.

Reading 132
Final Result

Elem		+-
Pb	6500	514
Fe	1300	450
Cr	1200	735
Cu	580	140
Sr	300	30

Below Det. Lim

Zr	< 34
Ni	< 50
As	< 62

Fig. 4.10
Final Result Screen

TSP and PM Filters

These filters are often used for air monitoring. They are about 8 x 10 inches in size. The samplers are designed for uniform filter deposition. The purpose of the XRF measurement is to determine total µg of lead and other metals on the filters. Because the samplers are designed for uniform deposition onto the filters, two measurements are taken on these filters. The choice of two measurements resulted from original testing conducted by NITON Corporation, Galson Corporation, and the New York State Department of Transportation (NYSDOT). Because deposition on the filter is presumed uniform, the NITON averages the two readings.

Preparing to take a measurement

1. Wear clean surgical gloves
2. Remove the front end of the filter test platform (**Figure 4.11**).
3. Place the plunger guard over the NITON. The elastic strap of the plunger guard should be between the buttons and screen of the instrument.
4. Place one corner of filter over the hole in filter test stand (which corresponds to the position of the test window on the NITON). Measure about two inches in from the edge of the contamination on the filter. Take the first measurement.
5. Take one reading from one quadrant of the filter (**Figure 4.12**). Wipe the bottom of the instrument and test guard after each filter.

Note: **Initial studies have shown that, after two readings, about 1 to 2% of the lead on a filter is removed from the filter and redeposited on the instrument. Hence, wipe the bottom of the instrument to avoid compromising future tests. You may want to have the wipes analyzed. Note that since the accuracy for this method (*and* for laboratory analysis) is 10–20%, the small error due to removing dust is negligible and can be ignored.**

Taking a Reading

See **Taking a Reading** for 37 mm filters (**Page 49**).

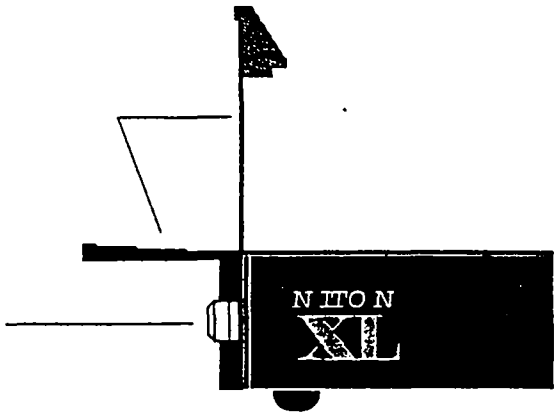


Figure 4.11
Before testing TSP or PM filters, take off the front part of the test platform by removing the two attachment screws.

Testing TSP and PM filters on the sampler

With your NITON, it is possible to test filters while they are still on the sampler (e.g., a Graseby Sampler). First, shut off the sampler. Then place the plunger guard over the NITON. The NITON (with plunger guard) will fit inside of the frame holding the filter.

Take two measurements, as described in the previous section. You will need to hold the NITON against the filter for the length of each test. The test will end when you lift the NITON from the filter. Wipe the instrument and guard after testing each filter.

The official protocol for this procedure is under evaluation by the NYSDOT.

Note: **Only test for lead, zinc, and arsenic when testing filters directly on a sampler. The steel grid supporting the filters makes it impossible to measure small concentrations of other elements.**

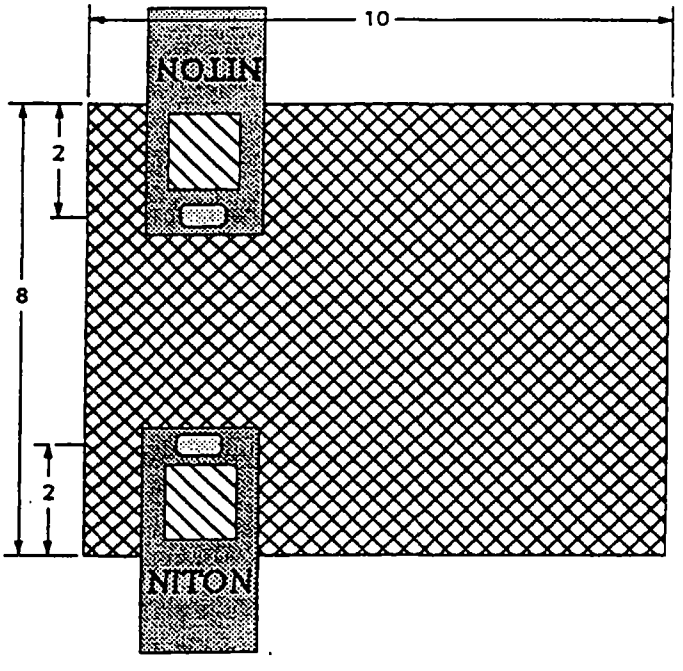


Fig. 4.12 Measurement Positions for TSP and PM Filters.

Reading the display

The Measurement screen

The Measurement screen is displayed during each test and is accessible after the test is complete. The screen shows each of the two measurements in µg/cm² of lead (**Figure 4.13 a,b**).

When the two measurements are complete, the XL or 700Series automatically averaged the results to yield the average loading in µg/cm². The average is multiplied by 404 cm² to yield the total lead and other metals, in µg. These results are displayed on the **Final Result** screen (**Figure 4.13c**).

Note: **Even on multi-element analyzers, lead is always displayed on the first screen. Lead is the element most commonly measured in Thin Sample mode. To display the next screen, which shows the results for other elements, press and hold** Clear/Enter **for two seconds. Use the** Arrow buttons **to scroll through the list of results for all elements.**

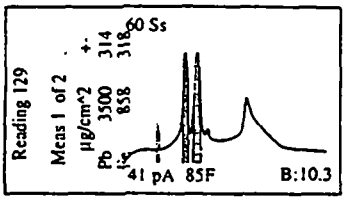


Fig. 4.13a Screen
End of 1st Measurement

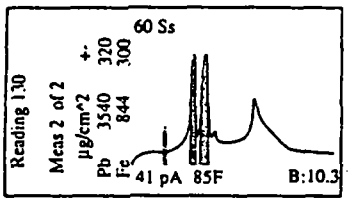


Fig. 4.13b Screen
End of 2nd Measurement

The Final Result screen

The Final Result screen (**Figure 4.13c**) is displayed only after both measurements are complete. Final results are in units of µg. On 700Series instruments, the screen shows 14 elements, whether they were detected, and how much of each element that was detected on the filter (in µg). The Final Result screen is given the next reading number.

This screen is divided into three parts. The first shows the metals detected. For the XL-309, only lead is listed. For the 700 Series, all of the detected elements are listed, in order of decreasing amounts. Next is a list of elements where the result was less than the calculated detection limit. The XL-309 (for lead) and the 700 Series calculate the detection limit for every sample. The detection limit is calculated using EPA protocols, that the detection limit is three times the standard deviation. Finally, there is a list of these same undetected elements displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

These three lists will not fit on the screen at one time. Use the **Arrow buttons** to scroll up or down the screen.

Reading 131
Final Result

Elem		+-
Pb	6500	514
Fe	1300	450
Cr	1200	735
Cu	580	140
Sr	300	30

Below Det. Lim

Zr	<	34
Ni	<	50
As	<	62

Fig. 4.13c
Final Result Screen

Other air-monitoring filters

Low-volume air-sampling techniques use 47 mm diameter filters. The NITON can test these as well. The filters are usually very uniform, so taking a single measurement of the center of the filter is a viable option. Use the **Standard Thin Sample mode** **(See Page 59)** for this. Results are given in µg/cm². The operator should multiply by the area of the filter to obtain results in µg. Sum or average several readings, or have the results automatically multiplied by using the **User-defineable Thin Sample mode** to specify a protocol that satisfies your requirements **(See Page 60)**.

Dust Wipes

This section describes the testing of dust wipes. The wipe, recommended by NITON and used in the ELPAT program, is the PaceWipe. It is available from:

Pace Environs
207 Rutherglen Drive
Cary, NC 27511
(800) 361-5323

NITON is developing a procedure for measuring dust wipes that will be reviewed for regulatory approval. What is presented here works in company tests, but is nonetheless tentative pending approval. The NITON displays levels of contamination in µg per wipe. The wipe reflects the contamination of the area wiped. Current regulations require lead contamination below 100 µg/ft^2 on floors, 500 µg/ft^2 on window sills, and 800 µg/ft^2 in window wells.

Note: **For the current software release (Version 5.0) the XL and 700Series provide quantitative results for lead only. You may use the 700 Series for screening of other metals on dust wipes, but element-specific correction factors must be implemented in the firmware to make non-lead measurements quantitative. Please contact NITON regarding timetables for new firmware releases that will offer this feature.**

NITON assumes that the operator follows the HUD guidelines for taking a dust wipe that are summarized here. To use the wipe, measure a known area of the surface, preferably one square foot. Wear clean surgical gloves. Wipe the measured square with parallel strokes. Fold the wipe in half. Wipe in strokes 90° to the original direction. Fold the wipe in half again. Thus far, you have followed one of the HUD procedures for taking a wipe test. For more information on taking dustwipes, please refer to "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing," Chapter 7.

Now, fold the wipe in half three more times (**Figure 4.14**). You now have a pad measuring about 1 x 1.5 inches (2.5 x 3.7 cm). It is important to fold the wipe neatly, so the final wipe is very nearly a neat square measuring about 1 x 1.5 inches.

Dust Wipes

This section describes the testing of dust wipes. The wipe, recommended by NITON and used in the ELPAT program, is the PaceWipe. This wipe is available from:

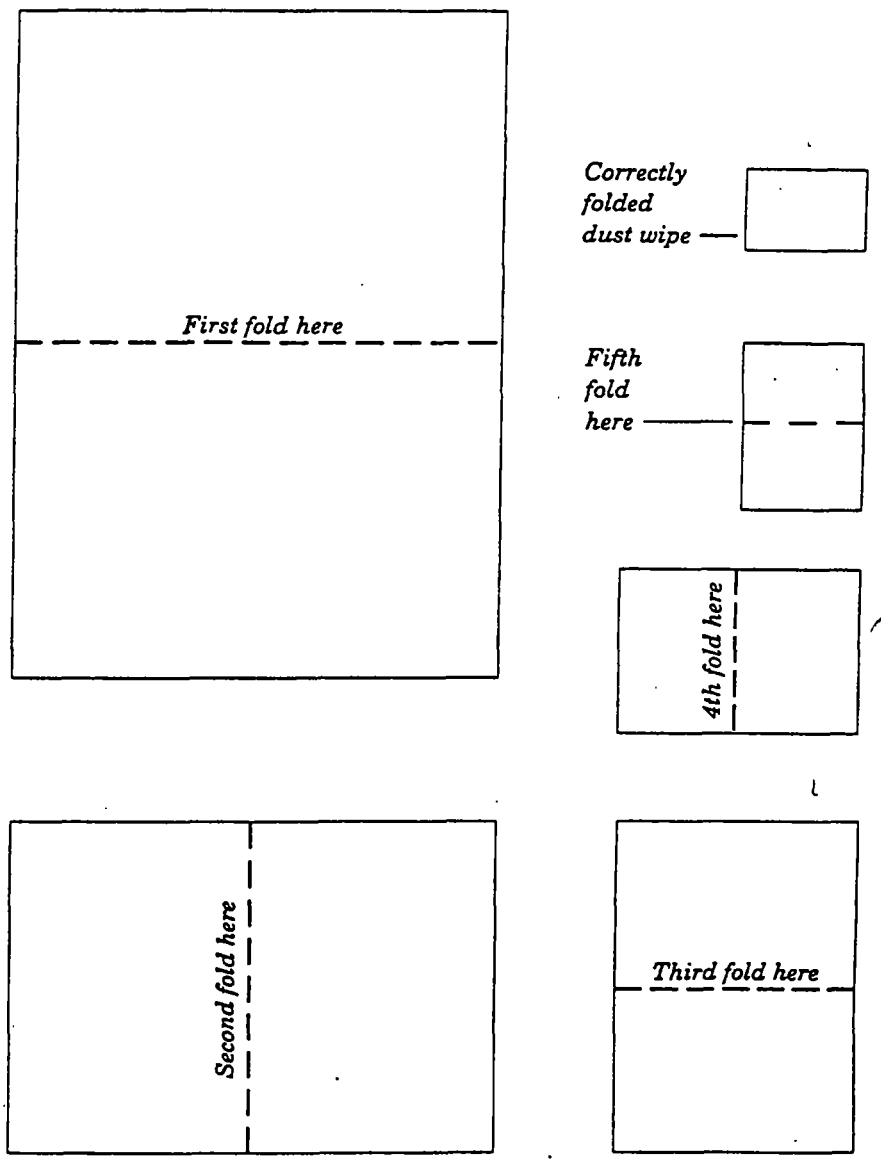


Fig 4.14

Folding the dust wipe. Start at the top left and proceed counterclockwise, making five folds.

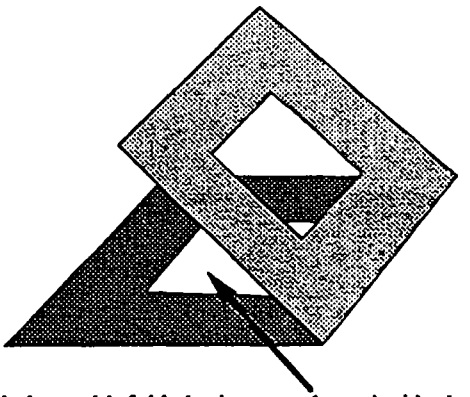
Then put the folded wipe in one of the plastic baggies provided, and place the wipe, in the baggie, in the metal dust wipe holder (**Figure 4.15**). The dust wipe is now ready to test. NITON recommends that the plastic bags NOT be re-used, to eliminate the chance of cross-contamination of subsequent wipes.

Taking dust wipe measurements

Take four measurements, positioning the metal dust wipe holder on the number one position of the test stand, then the number two position of the test stand; then rotate the dust wipe holder 180 degrees (without turning the holder over) and again test on the number one position followed by the number two position (**Figure 4.16**). This procedure assures that the entire area of the folded dust wipe is measured by the analyzer.

Taking a reading

See Taking a Reading for 37mm Filters (**See Page 49**).



Plastic bag with folded wipe goes here, inside the holder.

Fig. 4.15 Metal dust wipe holder

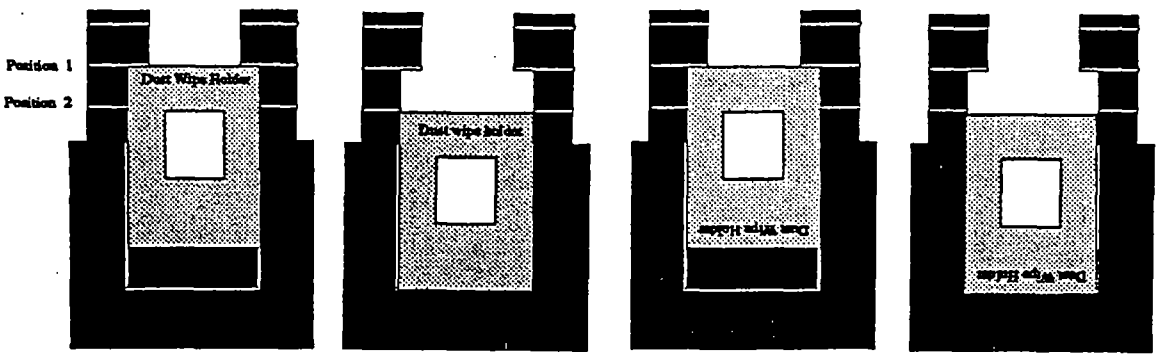


Fig. 4.16a Filter Test Platform Dust wipe in 1st position

Fig. 4.16b Filter Test Platform Dust wipe in 2nd position

Fig. 4.16c Filter Test Platform Dust wipe in 3rd position

Fig. 4.16d Filter Test Platform Dust wipe in 4th position

Reading the display

The Measurement screen

The Measurement screen is displayed during each test and is accessible after each test is complete. For the XL, the screen shows each of the four measurements in µg/cm² of lead (**Figure 4.17a-d**). When all four measurements are complete, the NITON automatically sums the four test results to achieve the correct reading. This result is given in the **Final Result** screen (**Figure 4.17e**).

Note: **Even on 700 Series instruments, only two elements are displayed on the first screen: lead and the element with the highest concentration (other than lead).**

To display the next screen, which shows the results for other elements, press and hold **Clear/Enter** for two seconds. Use the **Arrow buttons** to scroll through the list of results for all elements.

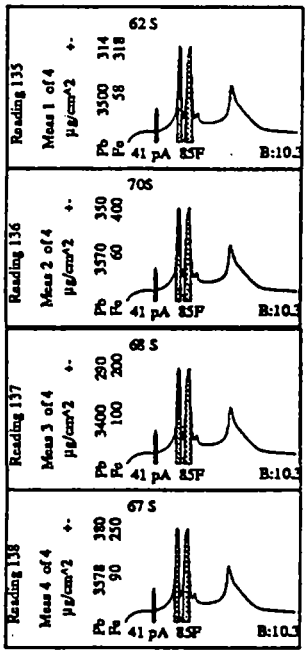


Fig. 4.17a-d
Measurement Screens
Dust Wipe Measurements

The Final Result screen

The Final Result screen (**Figure 4.17e**) is displayed only after all four measurements are complete. Final results are in units of µg. On 700 Series instruments, the screen shows 14 elements, whether they were detected, and how much of each element that was detected, on the filter (in µg). The Final Result screen is given the next reading number.

This screen is divided into three parts. The first shows the metals detected. For the XL, only lead is listed. For the 700 Series, all of the detected elements are listed, in order of decreasing amounts. Next is a list of elements where the result was less than the calculated detection limit. The XL (for lead) and the 700 Series calculates the detection limit for every sample. Each is shown as being less than a number, represneting the detection limit for that element, for that sample. The detection limit is calculated using EPA protocols, that the detection limit is three times the standard deviation. Finally, there is a list of these same undetected elements displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

These three lists will not fit on the screen at one time. Use the **Arrow buttons** to scroll up or down the screen.

Reading 139
Final Result

Elem		+-
Pb	12000	514
Fe	900	450
Cr	1200	735
Cu	580	140
Sr	300	30

Below Det. Lim

Zr	< 34
Ni	< 50
As	< 62

Fig. 4.17e Final Result Screen

Standard thin sample mode

The Standard Thin Sample mode should be used to test thin samples that have uniform contamination or deposition. These include many filters for liquids and gases, various types of coatings, and the leaves of plants. Operators who want to make a single measurement and obtain a result in units of µg/cm² should use Standard Thin Sample mode.

Caution: **The Standard Thin Sample Mode should not be used for quantitative lead-paint testing. Use only the three Paint Testing modes to test lead-based paint.**

In the Standard Thin Sample mode, each measurement is a separate test. For this reason, there is no **Final Result** screen in this mode. The results of each test are given in µg/cm² for lead only (XL) or for up to 14 elements (700Series).

Note: **Using Standard Thin Sample Mode to test any coating may yield lower-than-actual test results.**

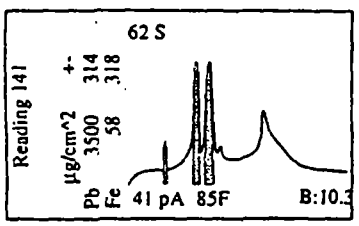


Fig. 4.18 Measurement Screen Standard Thin Sample Mode

Standard Thin Sample Mode does not correct for shielding caused by the presence of overlaying coatings. Thus, for coatings testing, the results should be viewed as the *minimum* amount of contaminants present. If an element is not detected, it may be that the element is present but entirely shielded by overlaying coatings. Beware. Do not rely on negative results when testing paints and other coatings in this mode.

The Measurement screen

The Measurement screen is displayed during each test and is accessible after each test is complete. For the XL, the screen shows the measurements in µg/cm² of lead (**Figure 4.18**). For the 700 Series the screen displays lead and the element with the highest concentration other than lead, in µg/cm². When the measurement is concluded, the display is changed to show all the elements, in µg/cm² (**Figure 4.19**). Use the **Arrow buttons** to scroll through the list of elements.

Reading 141
Meas 1 of 1

µg/cm^2		+-
Pb	12000	514
Fe	900	450
Cr	1200	735
Cu	580	140
Sr	300	30

Below Det. Lim
Zr < 34
Ni < 50
As < 62

Fig. 4.19 Final Result Screen Standard Thin Sample Mode

This screen is divided into three parts. The first shows the metals detected. For the XL, only lead is listed. For the 700 Series, all of the detected elements are listed, in order of decreasing amounts. Next is a list of elements where the result was less than the calculated detection limit. The XL (for lead) and the 700 Series calculates the detection limit for every sample. Each is shown as being less than a number, representing the detection limit for that element, for that sample. The detection limit is calculated using EPA protocols, that the detection limit is three times the standard deviation. Finally, there is a list of these same undetected elements displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

Note: **In Standard Thin Sample mode all results are in units of µg/cm².**

User-definable thin sample testing

User-definable Thin Sample mode allows you to set up your own protocol for testing thin samples. The user defines the number of measurements that constitute a set, the coefficient applied to each, and whether the measurements are to be summed or averaged.

Specifying a Protocol

You specify your own measurement protocol in this mode. When you select `User-Definable` from the **Setup Thin Sample Mode menu**, the screen (**Figure 4.20a**) is displayed. The menu allows you to customize an application. You can average or sum your choice of up to 9 of readings.

In most custom applications, where deposits on a thin sample are not uniformly spread across the sample, readings should be averaged or summed. Using this screen's menu, you can customize how readings are summed or averaged for a particular application.

Note: **Whatever configuration you enter will be saved in the instrument's memory. When you select the User-Definable mode, the last configuration entered will be recalled.**

To Define a Protocol:

- **Avg or Sum:** Use the **Arrow buttons** to select either `Avg` or `Sum`. Press **Clear/Enter**. Your choice will be shaded. If `Avg` is chosen, your NITON will average the number of readings you have specified. If `Sum` is chosen, readings will be summed instead of averaged. (Refer to **Figure 4.20a.**)
- **# readings:** To tell the instrument how many readings to use when calculating an average or sum: Use the **Arrow buttons** to increase or decrease the number of readings you wish to average or sum. Press **Clear/Enter**. The number must be between 1 and 9. (Refer to **Figure 4.20b.**)
- **Range:** This allows the operator to set the numeric range of the coefficents, from 0.0001 to 9999. The same range must be used for all coefficients. First, set the decimal place by using the **Arrow buttons**. The decimal place determines the range of possible values for the coefficients. When the decimal place is set press **Clear/Enter.** (Refer to **Figure 4.20c.**)

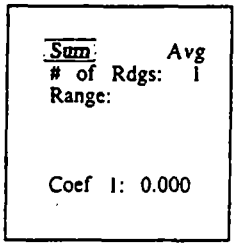


Fig. 4.20a Thin Sample User Defined Screen

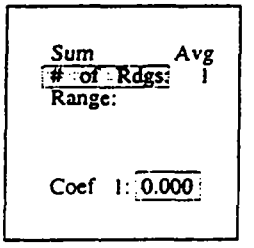


Fig. 4.20b Thin Sample Set # of Readings

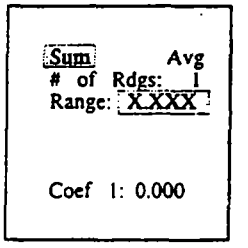


Fig. 4.20c Thin Sample Setting Range

```
Sum          Avg
# of Rdgs:   3
Range:  X.XXX


Coef 1: 2.800
Coef 2: 4.500
Coef 3: 1.200
Coef 4: 0.000
Coef 5: 0.000
Coef 6: 0.000
Coef 7: 0.000
Coef 8: 1.000
Coef 9: 0.000
```

Fig. 4.20d Thin Sample User Defined

- **Coefficients:** (Refer to **Figure 4.20d**). Enter each coefficient. Moving from left to right, set the value of each digit that constitutes the coefficient. First use the **Arrow buttons** to set the value, then press **Clear/Enter** to move to the next digit to the right. To move to the next digit without changing the current digit, press **Clear/Enter**. Repeat this process until every digit of the coefficient has been set. After every digit has been set, press **Clear/Enter** to move to the next coefficient. When finished with the last coefficient, press **Clear/Enter** to return to the **Main Menu**. By setting coefficients, you can calculate a *weighted sum*, in which the result of each reading is multiplied by the coefficient entered for that reading. For a simple (un-weighted) sum, set each coefficient to 1.0. All unused coefficients should be set to 0.0 (0.0 is the **default** setting).

From the **Main Menu**, enter `Calibrate and Test`. When the NITON is finished self-calibrating, you may begin testing.

Example:

Suppose you would like to perform a weighted sum of three consecutive measurements, using the formula:
(2.800 x Measurement 1) + (4.5 x Measurement 2) + (1.2 x Measurement 3)

The screen for setting up the protocol should appear as follows:

```
Sum
# of Rdgs = 3
Range: X.XXX
Coef 1: 2.800
Coef 2: 4.500
Coef 3: 1.200
```

Note: **In User-Definable Thin Sample mode, you must take exactly the number of readings that you have specified for each test in this mode before proceeding to the next test.**

When you conclude each measurement within the protocol, the analyzer will display the results, in µg/cm² (**Figure 4.09a**). When the protocol is complete, the analyzer will display a **Final Result** screen (**Figure 4.09d**).

Note: **The units of measurement will be determined by the coefficients you have chosen. In "User-Definable" Mode, the units are not necessarily µg.**

5: Analyzing lead paint

Overview

Lead paint mode is standard on NITON XL-309, 701-A, 702-A and 703-A Spectrum Analyzers. In addition to the silicon PIN-diode detector standard in all NITON analyzers, all NITON analyzers equipped to test lead in paint have a second detector: a cadmium-zinc-teluride (CdZnTe) detector optimized to measure lead K-shell x-ray fluorescence.

Caution: **The Standard Thin Sample Mode (on 701, 701-A, 703 and 703-A analyzers, and available as an option on XL-309s) should not be used for quantitative lead-paint testing. Use only the three Paint Testing Modes (on 701-A, 702-A, 703-A, and XL-309 analyzers) to test lead-based paint.**

Getting started

1. Turn on your NITON Analyzer

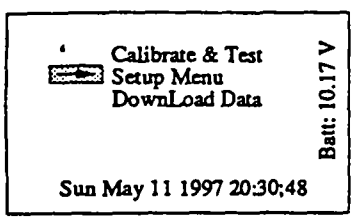


Fig. 5.01 Main Menu

2. Use the **Arrow buttons** to select `Setup` menu from the **Main menu**. Press **Clear/Enter** (**Figure 5.01**).
3. Use the **Arrow buttons** to select `Setup Paint` mode from the **Setup menu**. Press **Clear/Enter** (**Figure 5.02**).
4. Go to *step* 5 unless you want to change the **Action-level** or ***beep* time** settings. If they are not changed, the NITON will default to the last settings entered. To change settings, enter `Setup Paint Protocol` from the **Setup Paint screen**. The **Setup Paint Protocol screen** allows you to set the **Action-level** and ***beep* times** (**Figure 5.03**). When you have set the paint protocol, the instrument will return automatically to the **Setup Paint** screen.

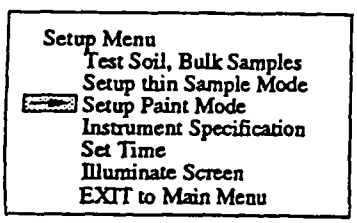


Fig. 5.02 Setup Menu
Setup Paint Mode

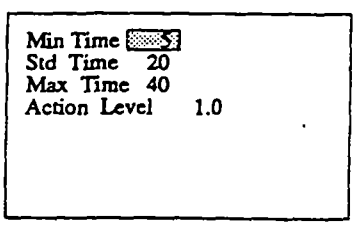


Fig. 5.03 Paint Protocol Screen

5. From the **Setup Paint** screen (**Figure 5.04**), select one of the three paint testing modes: **Standard Paint Mode**, **Standard Mode + Spectra** or **K & L Readings + Spectra**. When you have selected a paint testing mode, the instrument will return automatically to the **Main Menu**.

6. Select `Calibrate and Test`. The instrument will then initiate its auto-calibration sequence. This will take one to two minutes. When calibration is complete, the instrument will beep and display the **Ready to Test** screen for whichever of the three paint modes you selected in *Step 5* (**Figure 5.05**). The **Ready to Test** screen displays the paint testing mode you have selected, the date and time, the instrument serial number, the action-level, the instrument energy resolution and the current source strength.

Caution: **Check the `Date` and `Time` displayed on the Ready to Test screen. If they are not correct, reset them <u>before</u> taking any measurements. Your readings will not be accurate unless the date and time are correct.**

```
Standard Paint Mode
Standard Mode + Spectra
K & L Readings + Spectra
Setup Paint Protocol
Exit to Main Menu
```

Fig. 5.04 Setup Paint screen

```
Mon May 12 1997 20:39:21
Serial # XL309-U833N50341
→ Ready to Test ←

Mode:          Standard Paint

Action Level:     1.0
Resolution: 0662eV
Src Strength: 10 mCi
```

Fig. 5.05 Ready to Test
Standard Paint Mode

Taking a measurement

Warning: **Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.**

Caution: **When testing the *exterior* of the window sash from the inside of a room, avoid standing in the path of the NITON's radiation beam. The direction of the beam is drawn on the cover of the instrument (Figure 5.06 a,b). It is easier to avoid the radiation beam if you hold the instrument in your right-hand.**

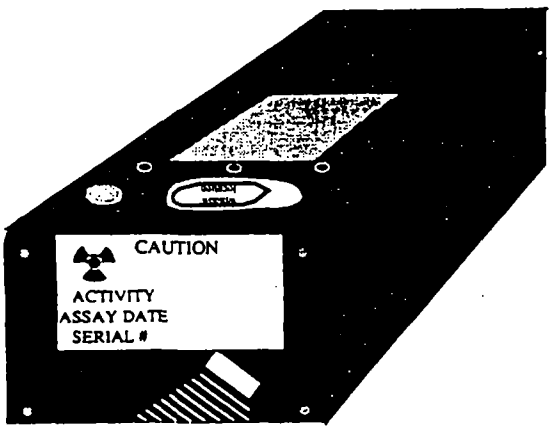


Fig. 5.06a Front/top view of XL showing the position of the inspection window and the source.

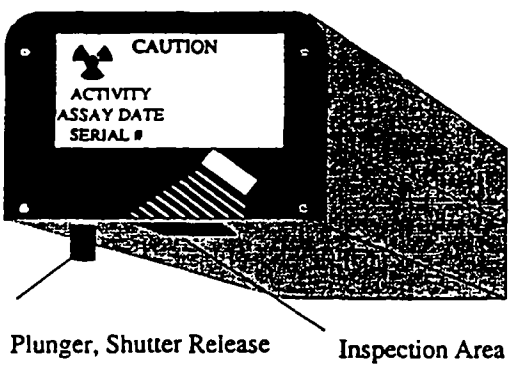


Fig. 5.06b. Front/bottom view of XL showing the position of the inspection window and the source.

How to take a measurement

1. Push the safety slide (that locks the shutter release) out from under the shutter release. When the slide is in place, you cannot press in the release (**Figure 5.07**).

2. **When you are using the Barcode Data Entry System:** Attach the light pen bar-code reader and wrist-mounted bar codes. Flick the **Barcode Reader** across one of the bar codes to display the **Data Entry screen** (**Figure 5.08**). Enter the test location and other test information with the **Barcode Reader**.

3. Place the NITON on the painted surface, squeeze the shutter release, and press the NITON against the surface.

Note: **The shutter-release trigger must be activated and the window at the back of the instrument must be flush against the surface for instrument to take reliable readings. The instrument must be held against the surface throughout each measurement. You do not need to hold the shutter release continuously.**

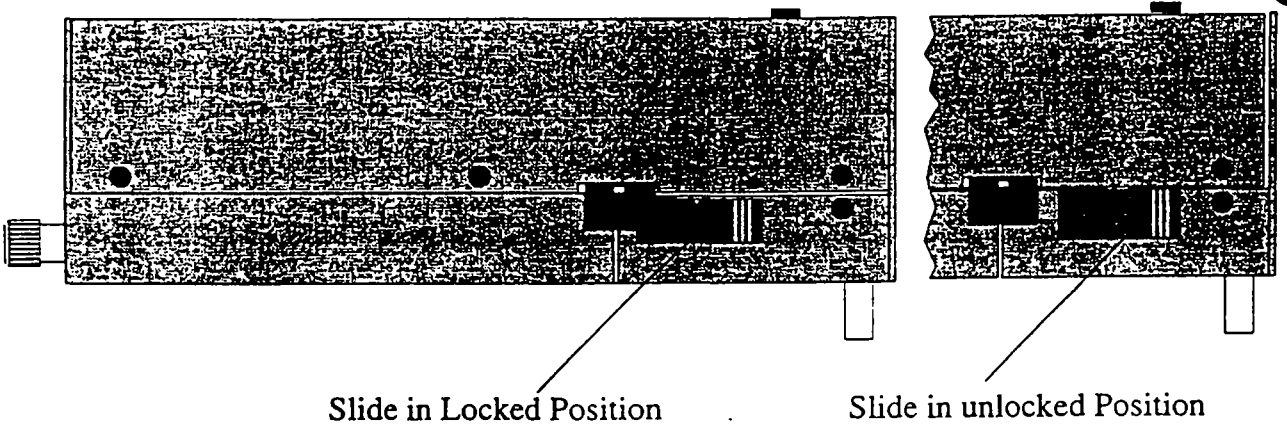


Fig. 5.07 Slide lock shown in locked position (left) and unlocked position (right).

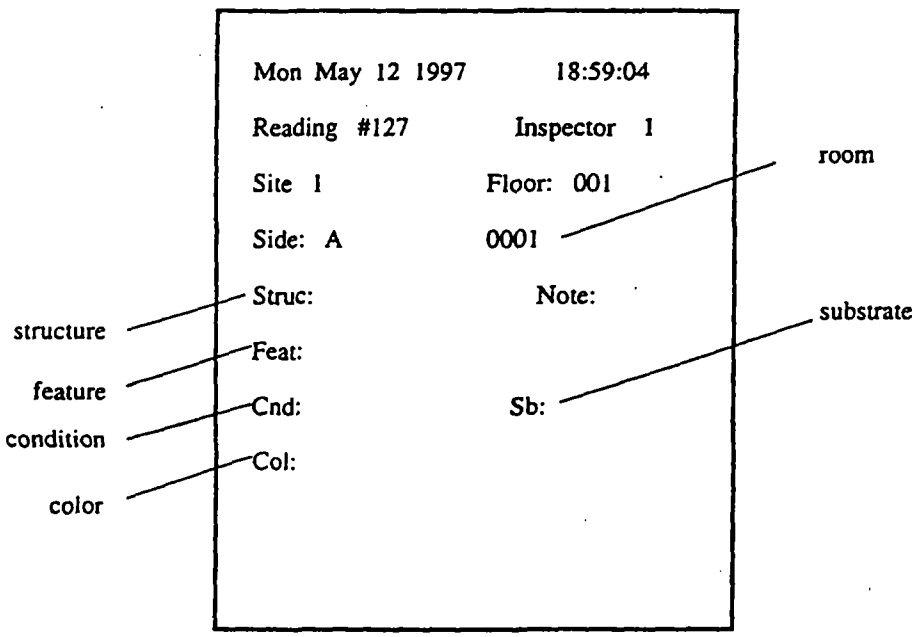


Fig. 5.08 Barcode Data Entry Screen

4. Please refer to **Reading the display (see Page 69)** for screen descriptions in each paint mode.

5. When the test is finished, lift the NITON from the surface. The shutter will close automatically.

Warning: **In the unlikely event that the plunger gets stuck in that open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.**

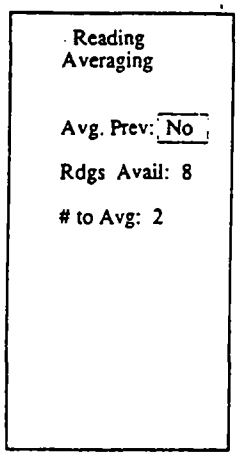


Fig. 5.09
Reading Averaging Screen

6. Your NITON Analyzer can average up to 100 readings at a time. To set up the **Averaging Screen**, hold down the **Clear/Enter** button to toggle through the testing and data entry screens to the **Reading Averaging** screen (**Figure 5.09**). If you select Yes to average readings, you will be prompted to select the number of readings you wish to average. To take additional readings, simply repeat steps 3 through 5. Your NITON will display both the average of the current and previous readings and the number of readings being averaged.

Using the NITON on flat and curved surfaces

Using your NITON, you can take measurements of any surface a child can mouth; only 5/8 inch (1.6 cm) is required.

1. A sketch of the window is printed on the front of the NITON's case so you can position the instrument properly (**Figure 5.10**) The window of the instrument must be flat against the paint surface or it cannot read properly.

3. Your NITON Analyzer can measure accurately many curved surfaces. Position the instrument so that its window is flat on the surface. The rest of the instrument doesn't have to lie flat. E.g., on slightly rounded clam shell trim, turn the NITON at right angles to the trim so that its window runs parallel with the length of the trim (**Figure 5.11**). On a cast iron radiator, find a spot againt which the NITON's window can lie flat.

Note: **On *very* highly curved surfaces (such as quarter-round moldings or balusters) the NITON will tend to underestimate the amount of lead present. On very highly curved surfaces, your NITON can only be used to positively identify high concentrations of lead.**

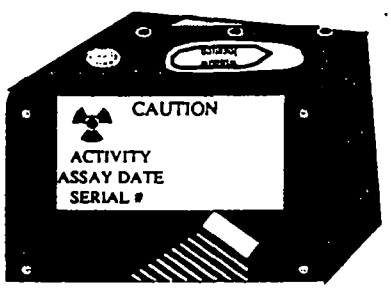


Fig. 5.10 (Right) Sketch of the front of your NITON

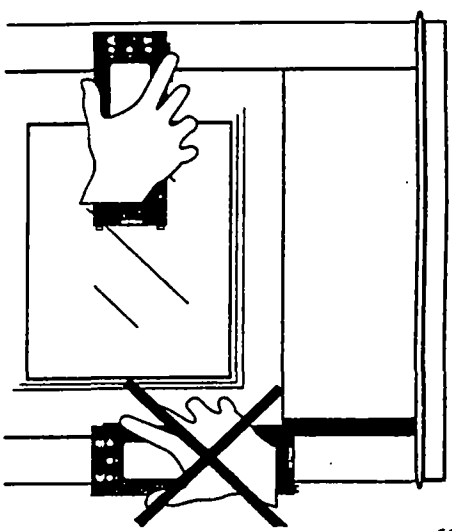


Fig. 5.11 (Far Right) How to position your NITON to measure a clam shell trim.

How long is a Test

In any of the three paint testing modes, your NITON can measure paint samples in as little as one second; most readings take less than ten seconds. The testing time will depend primarily on the amount of lead in the sample that you are testing compared to the action level you have set. The closer the actual lead concentration in the sample is to the action level, the longer it will take the NITON do make a 95% confident "Positive" or "Negative" determination.

In **Standard Paint Mode** and **Standard Paint Mode + Spectra**, the instrument will measure the paint sample only until a 95% confident reading of "Positive" (greater-than-or-equal-to) or "Negative" (less-than) versus the action-level you have set has been attained. In **K & L Mode + Spectra**, the instrument will also display a "Positive" or "Negative" result and will beep as soon as a 95% confident reading is attained. You then have the option to continue readings until you have achieved a given reading time or degree of precision.

Note: **For all paint testing modes, if you terminate a test *before* a "Positive" or "Negative" determination is attained by the instrument, it will display a "Null" test result.**

Reading the display

In **Standard Paint mode**, the instrument displays `Please Wait` until a 95% confident reading is achieved. If there is lead in the sample, the instrument will indicate `Lead present` on the **Please Wait** screen.

When a 95% confident reading is achieved, the instrument will display the reading number; either a "Positive" or "Negative" reading; the result in mg/cm^2; the reading time in nominal (source) seconds; and will display `Surface lead` for all positive readings where the lead is not shielded by layers of non-leaded paint (**Figures 5.12 a,b**).

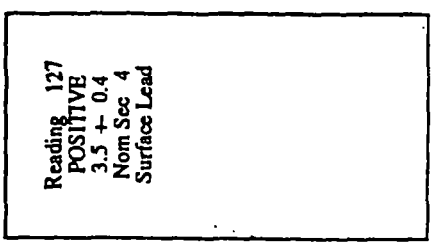


Fig. 5.12a Instrument Reading Standard Paint Mode

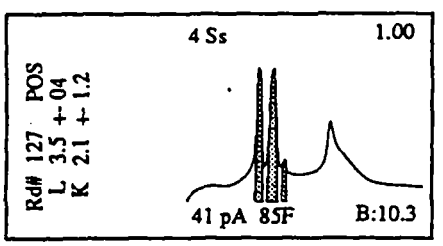


Fig. 5.12b Instrument Reading With Spectrum Displayed

Standard Mode + Spectra is identical to Standard Mode except that the x-ray spectra is displayed with each reading.

In **K & L Mode + Spectra**, the instrument displays the following information, updated continously during each reading: the **reading number**, the **nominal seconds**, the **L-shell reading** (displayed as `L`) with the two-sigma confidence interval, the **K-shell reading** (displayed as `K`) with the two-sigma confidence interval, the **combined reading** (displayed as `Pb`) with the two-sigma confidence interval, the **full x-ray spectrum**, and the **Depth Index (Figure 5.13)**.

Note: **During each reading in K & L + Spectra mode, *before* a 95% confident Positive or Negative determination has been made, the instrument displays a "Null" test result** (Figure 5.14). **When a 95% confident determination has been made, the instrument beeps, and the reading classification switches from** `Null` **to either** `Positive` **or** `Negative`.

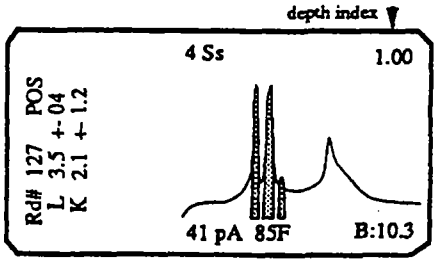


Fig. 5.13 Instrument Reading With Spectrum Displayed

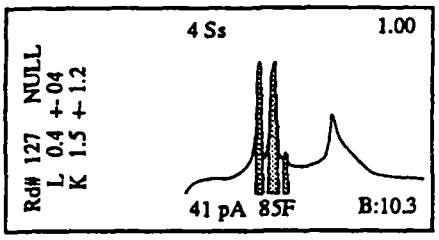


Fig. 5.14 Instrument Reading NULL Reading in Progress

The Depth Index (K & L + Spectra mode)

The **Depth Index** (DI) is a numerical indication of the amount of non-leaded paint covering the lead detected by the instrument. The position of the DI on the screen is indicated by an arrow painted on the front of the NITON (**Figure 5.13**). A DI less than 1.5 indicates lead very near the surface layer of paint. A DI between 1.5 and 4.0 indicates moderately covered lead. A DI greater than 4 indicates deeply buried lead.

Averaging readings

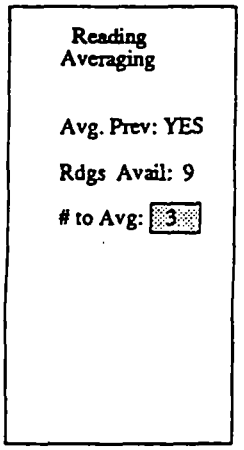


Fig. 5.15
Reading Averaging Screen

Two or more readings may be averaged by specifying the parameters in the **Averaging Screen** (**Figure 5.15**). To start or stop averaging, go to the **Averaging Screen** by holding down the **Clear/Enter** button until the screen appears. You may enter the **Averaging Screen** whenever the instrument in one of the paint testing modes. Once in the **Averaging Screen**, press **Clear/Enter** *briefly* to move the cursor between lines on the screen. Press the **Arrow buttons** to change averaging parameters. If, for example, you set the # to avg at two, subsequent tests will be grouped in twos and averaged.

To add the next measurement to the current average, enter Avg YES; if you enter Avg NO the next reading will not be averaged. Use the **Arrow buttons** to toggle between Avg YES and Avg NO.

Toggling between paint modes

At any time when a reading is displayed, you may toggle from the paint mode you are in to one of the other paint modes by pressing **Clear/Enter** until that paint reading is displayed in the desired paint mode.

Note: **Your NITON will continue to take readings in the most recently displayed paint mode until another paint mode is selected. If you scroll to previous readings using the** Arrow **buttons, the instrument will also display the readings in the *current* paint mode being being displayed, regardless of the paint mode that was used when the readings were taken. You toggle between paint modes after any reading simply by pressing and holding the** Clear/Enter **button until the paint mode you want to see appears on the screen.**

SpectraView

SpectraView is standard on all 700 models. **SpectraView** comes with XL-309s equipped with either the optional **Lead-in-Soil Analysis** package or the **Dust Wipe Analysis** package. **SpectraView** is also available on XL-309s as a separate option. With **SpectraView**, you can quickly scan the entire x-ray spectrum for a non-quantitative assessment of dozens of elements.

How to use SpectraView:

After taking a paint measurement in any mode, you can toggle to the **SpectraView** screen (**Figure 5.16**) with the **Clear/Enter** button. Once in the **SpectraView** screen, use the **Arrow buttons** to scroll through the spectrum. The vertical curser-line indicates the current position along the spectrum.

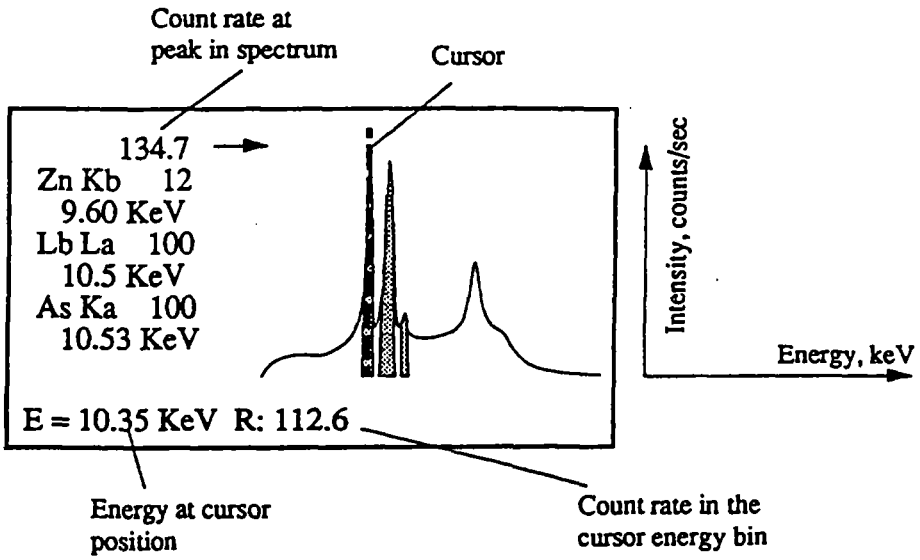


Fig. 5.16 SpectraView Screen
Cursor (dashed line) is at 10.35 KeV

In **SpectraView mode**, the spectrum is displayed in a linear scale, auto-scaled so that the highest peak on the screen reaches the top of the scale. To the *left* of the spectrum is a list of the elements with XRF energies close to where you are currently looking on the spectrum. (**Figure 5.17**). To determine if a given element is present, look at the bottom of the screen. Next to the number indicating the **position** of the **Spectraview cursor** on the energy-level scale (from 4 to 100 keV) is a number representing the **x-ray count rate** (in counts per second) at that energy-level.

Note: **SpectraView cannot be used to determine exact element concentrations in a sample.**

SpectraView zoom

To look at a part of the spectrum in greater detail, use the SpectraView zoom feature.

1. Use the **Arrow buttons** to move the cursor to the *center* of a spectral peak.
2. Push **Clear/Enter** four times in rapid succession.
3. The part of the spectrum you were looking at will appear in expanded form so you can look at it in detail (**Figure 5.18**).

To exit SpectraView

To exit **SpectraView** and continue testing, simply start another measurement. The measurement will be taken in the last paint testing mode you used.

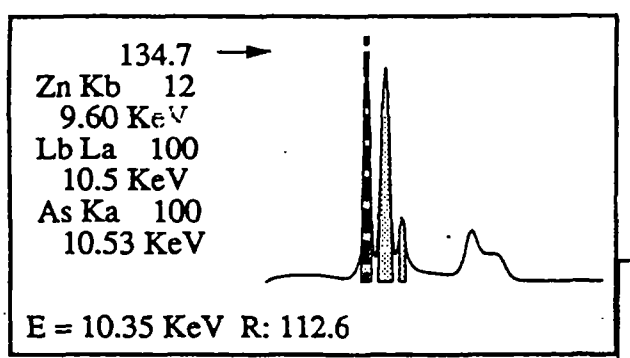
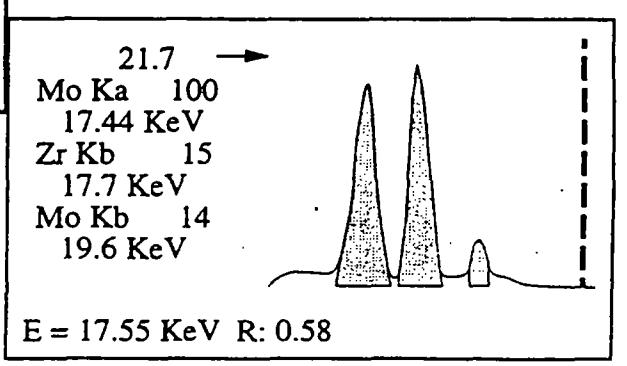


Fig. 5.17 SpectraView 300 eV per channel



5.18 SpectraView Expanded spectrum, 100 eV per channel

6: Radiation Safety

NITON has designed its XRF analyzers so that there is virtually no measurable radiation external to any part of the instrument when the shutter is closed. When our instruments are used according to instructions, there is minimal radiation exposure even with the shutter open. NITON XRFs contain sealed cadmium-109 radioactive sources. The source is designed to remain secure even under extreme conditions, so that even if the instrument is broken, crushed or burned, there will be no leakage of radioactive material.

During manufacturing, each sealed source is placed in a solid metal source holder. A plug is screwed into the access hole and secured with a set screw and Locktite. The source is completely secure in its housing beacause the aperture at the other end of the housing is smaller than the source. The small aperture is sealed with a beryllium metal window that is transparent to the cadmium x-rays and gamma-rays. The source assembly is secured in the NITON's aluminum case. The case has tamper proof screws.

The following table lists typical radiation doses encountered in everyday living and lists the annual occupational radiation dosage limits for adults set forth in NITON's Materials license from the Rhode Island Radiation Control Agency, Section A.2.3.

Typical Radiation Doses in mR (NCRP, 1987)	
Average total dose in US. (annual)	360 mR
Average worker exposure (annual)	210 mR
Average exposure for underground miner (annual)	400 mR
Exposure for airline crew (1,000 hours at 35,000 ft)	500 mR
Additional from living in Denver at 5300' (annual)	25 mR
Additional from 4 pCi/l radon in home (annual)	1,000 mR
Typical chest x-ray	6 mR
Typical head or neck x-ray	20 mR
Typical pelvis/hip x-ray	65 mR
Typical lumbar spine x-ray	130 mR
Typical upper G.I. x-ray	245 mR
Typical barium enema x-ray	405 mR
Typical CAT scan	110 mR
Minimum detectable dose on a standard film badge	5 mR
<u>Annual occupational dosage limits:</u>	
Maximum allowable for the general public (annual)	500 mR
Annual Occupational Dose Limits for Adults:	
The lesser of (1) total effective radiation dose	5 ,000 mR
or the (2) <u>sum</u> of the deep dose equivalent plus the committed dose equivalent to any individual organ or tissue *other* than the lens of the eye	50,000 mR.
For a pregnant worker or a minor	500 mR.
Eye dose equivalent	15,000 mR.

Shallow dose equivalent to the skin or any extremity	50,000 mR.

How to use your NITON safely

Each NITON is designed to be safe as possible. However, we strongly recommend that you follow these precautions to insure your safety and the safety of those around you:

- Always be aware of the location of your instrument's radioactive source and the direction of its beam of x-rays. The location of the source and the direction of its beam are both clearly marked on the front (**Figure 6.01**) and top side (**Figure 6.02**) of your NITON.
- Open the shutter *only* to do a test.

During testing, a strong beam of radiation (gamma-rays and x-rays) is continuously emitted through the beryllium window at the bottom of the NITON. There will be some radiation at the front and top-front of the instrument. There is negligible radiation where your hand should be holding the instrument.

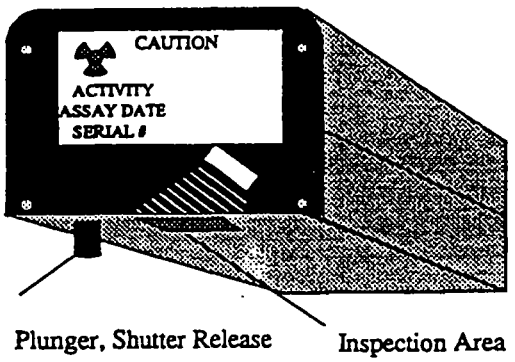


Fig. 6.01 Front/bottom view of XL showing the position of the inspection window and the source.

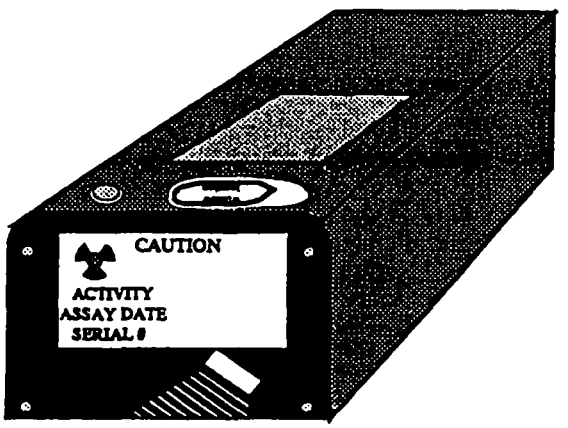
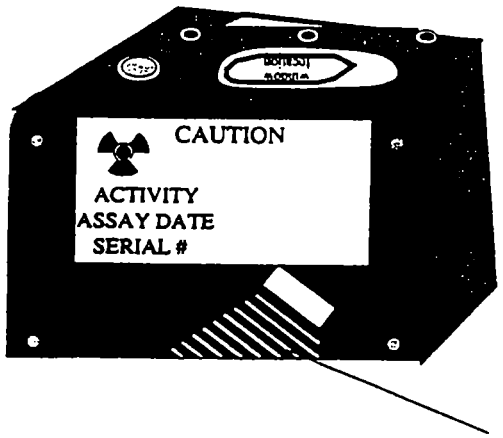


Fig. 6.02 Front/top view of XL showing the postion of the inspection window and the source.

Warning: **Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring (Figure 6.03). Never point the NITON at yourself or anyone else when the shutter is open.**

Caution: **When testing the *exterior* of the window from the inside of a room, avoid standing in the path of the NITON's radiation beam. The direction of the beam is drawn on the cover of the instrument (Figure 6.03). It is easier to avoid the radiation beam if you hold the instrument in your right hand.**



Direction of the beam of x-rays from the source.

Fig. 6.03 End plate. Do not put your hand on this plate during a test. The radiation levels are very low but much higher than at the recommended hand position.

Shutter safety

Your NITON is designed so you cannot accidently open the shutter or leave it open accidentally when you lift the instrument from a surface.

To open the NITON's shutter and to keep it open, the instrument must be held against a surface. The shutter will close as soon as you cease to hold your NITON against a surface.

1. The shutter should be open only during a test.
2. Under no circumstances should the shutter be open when the instrument is not in use.
3. Your NITON clearly indicates any time the shutter is open (**Figure 6.04**). The plunger will stick up through the instrument case whenever the shutter is open.

Warning: **In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.**

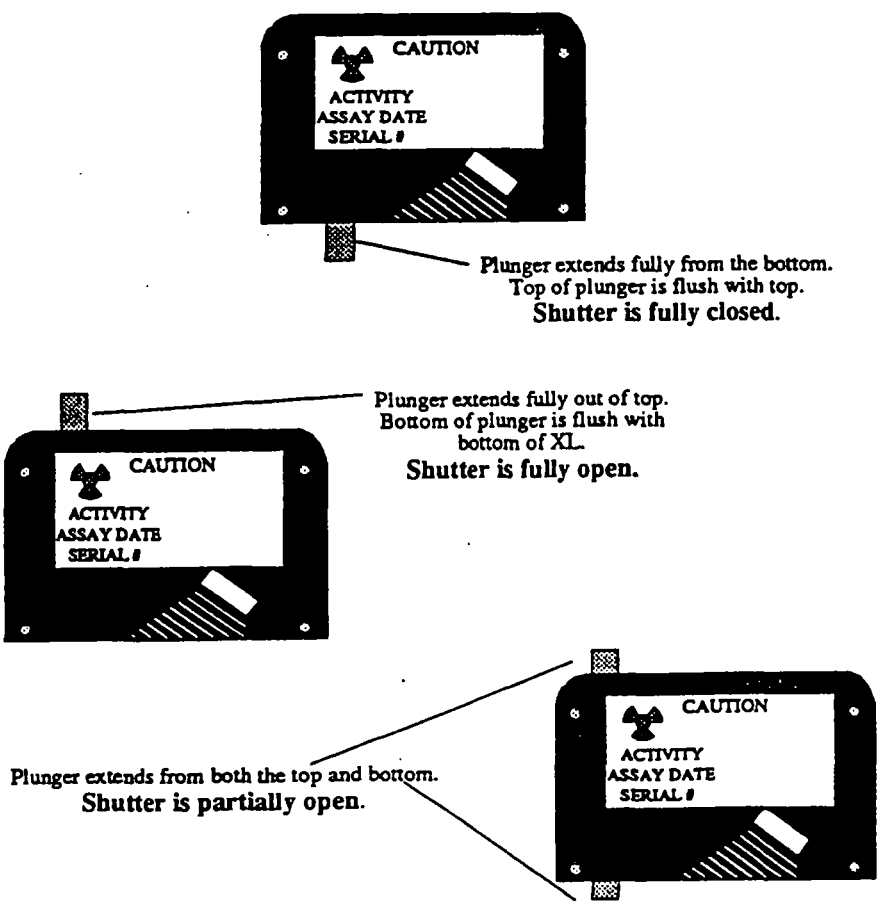


Fig. 6.04 Plunger positions indicate status of shutter.

Monitoring your radiation exposure

There is virtually no measurable radiation from a NITON when its shutter is closed. The maximum dosage to which you are exposed when properly operating your NITON is 0.1 mR/hr on the fingers of the hand holding the instrument with the shutter open.

As an additional precaution to insure that your radiation exposure is always minimal, NITON strongly recommends that you wear a dosimeter at all times when using the instrument.

Note: **Your state may have regulations concerning radiation monitoring.**

A dosimeter badge is usually worn close to the parts of your body that are most sensitive to radiation, including your reproductive organs and your eyes. These badges are available from many companies. One company selling dosimeters is:

Landauer, Inc.

2 Science Road

Glenwood, IL 60425-9979.

Each month, your radiation badge company will send you a new badge.

Warning: **Wearing a dosimeter badge does not protect you against current exposure. A dosimeter badge measures your exposure after the fact. If, at any time, you find measurable exposure, call NITON immediately at (401) 294-1234.**

The principles of radiation safety

Your exposure to radiation is related to three factors: time, distance, and shielding. Human exposure to radiation is typically measured in rems, or in one-thousandths of a rem, called millirems (mR).

As noted previously in this chapter, the allowable limit in the US. for occupational exposure is 5,000 mR/year for a whole-body and 50,000 mR for shallow penetration of extremities. Exposure from a properly-used NITON will be less than 50 mR per year, even if the instrument is used 2,000 hours per year.

Warning: **Pregnant female workers may want to take special precautions to reduce their exposure to radiation. Qualified scientists have recommended that the radiation dose to pregant women should not exceed 500 mR/year because of possible risk to the fetus.**

For a given source of radiation three factors will determine the radiation dosage you receive from the source:

Duration of Exposure

The longer you are exposed to a source of radiation the more radiation strikes your body and the greater the dose you receive. Dosage increases in direct proportion to the length of exposure.

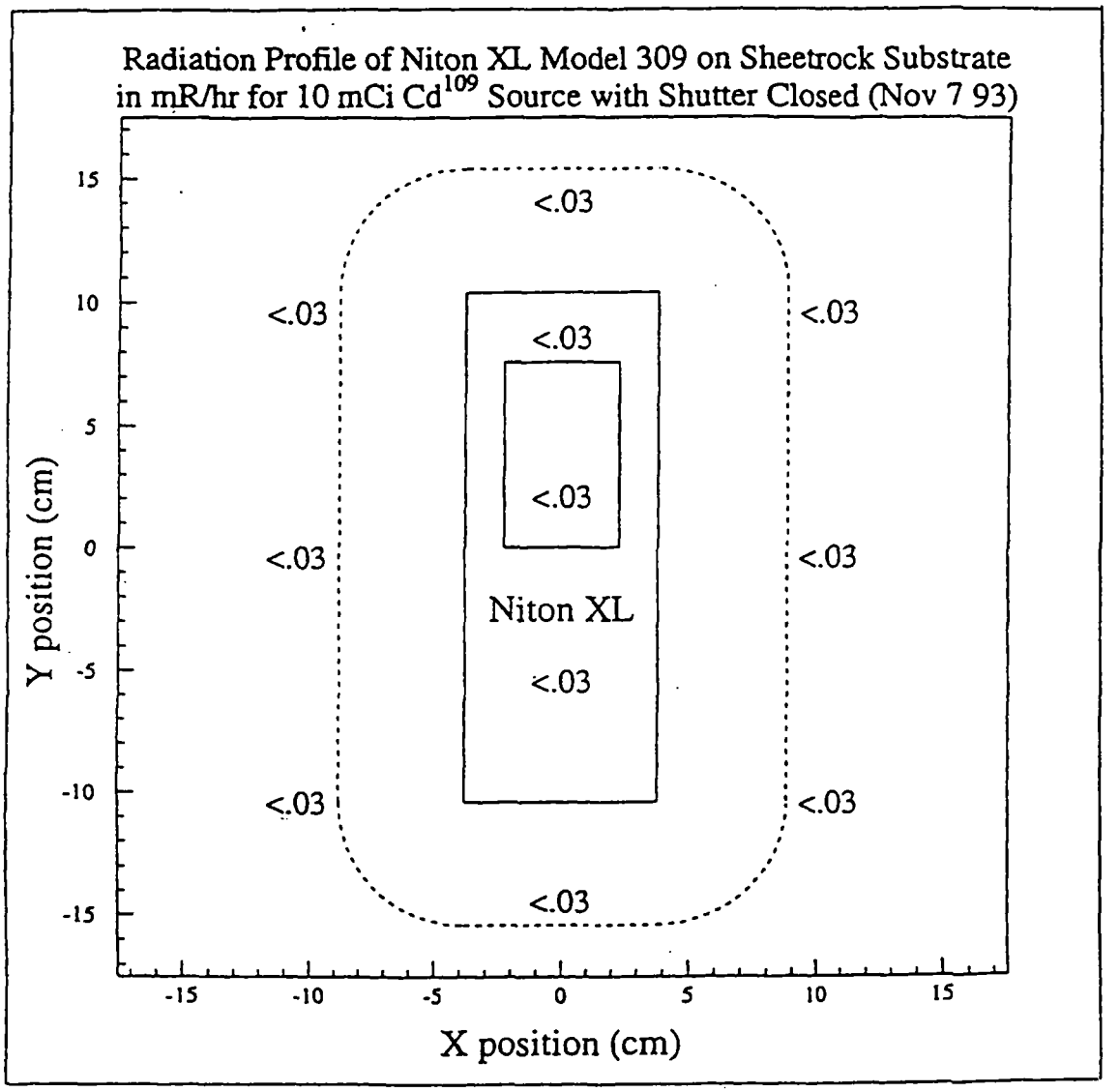
Distance from the source

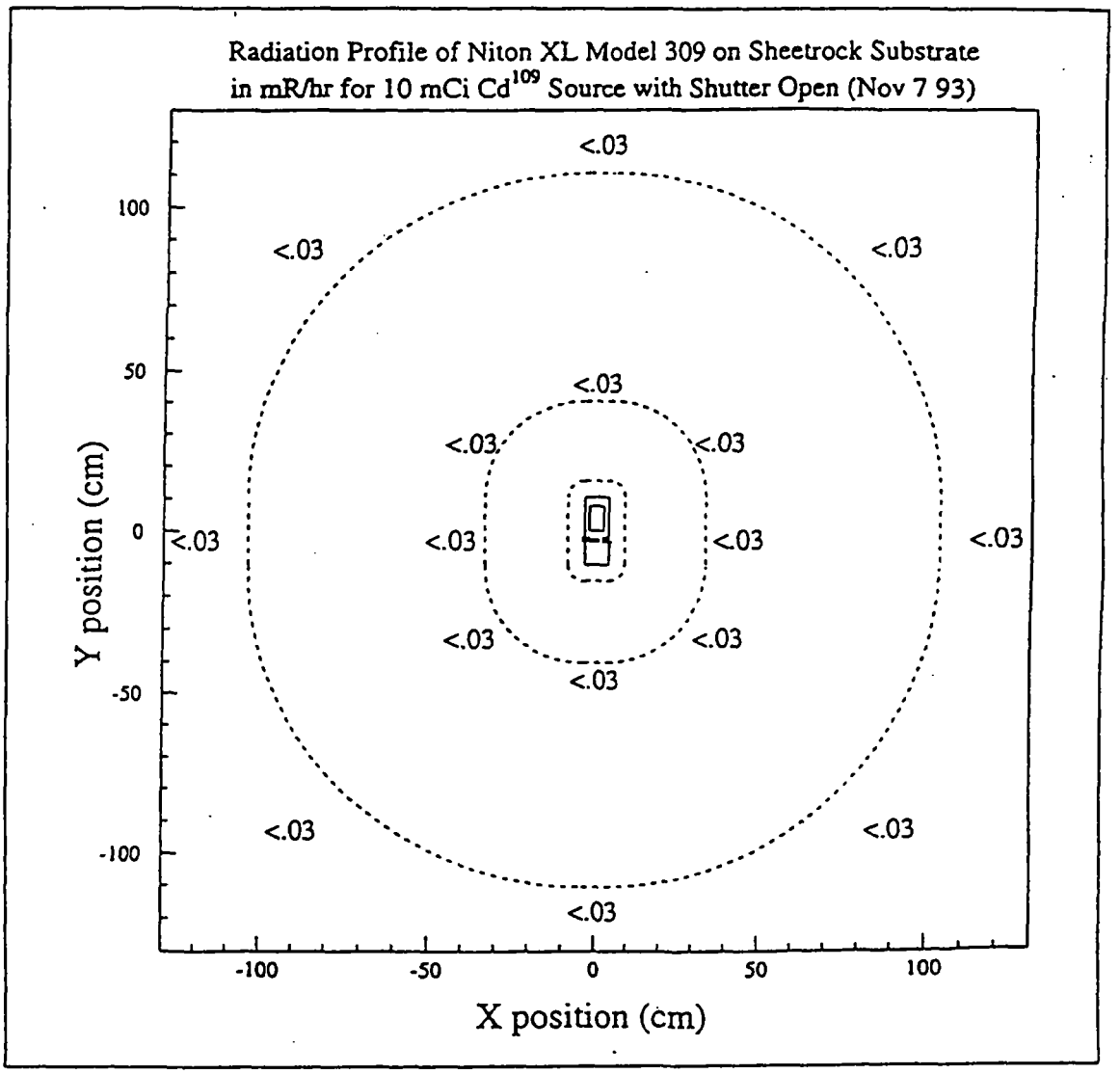
The closer you are to a source of radiation, the more radiation strikes you. The dosage increases in inverse-squared relation to the distance from the source. For example, the radiation dose one inch from a source is *nine* times greater than the dose three inches from the source, and *144* times greater than the dose one foot from the source. Keep your hand away from the source-end of your NITON when the shutter is open to minimize your exposure.

Shielding

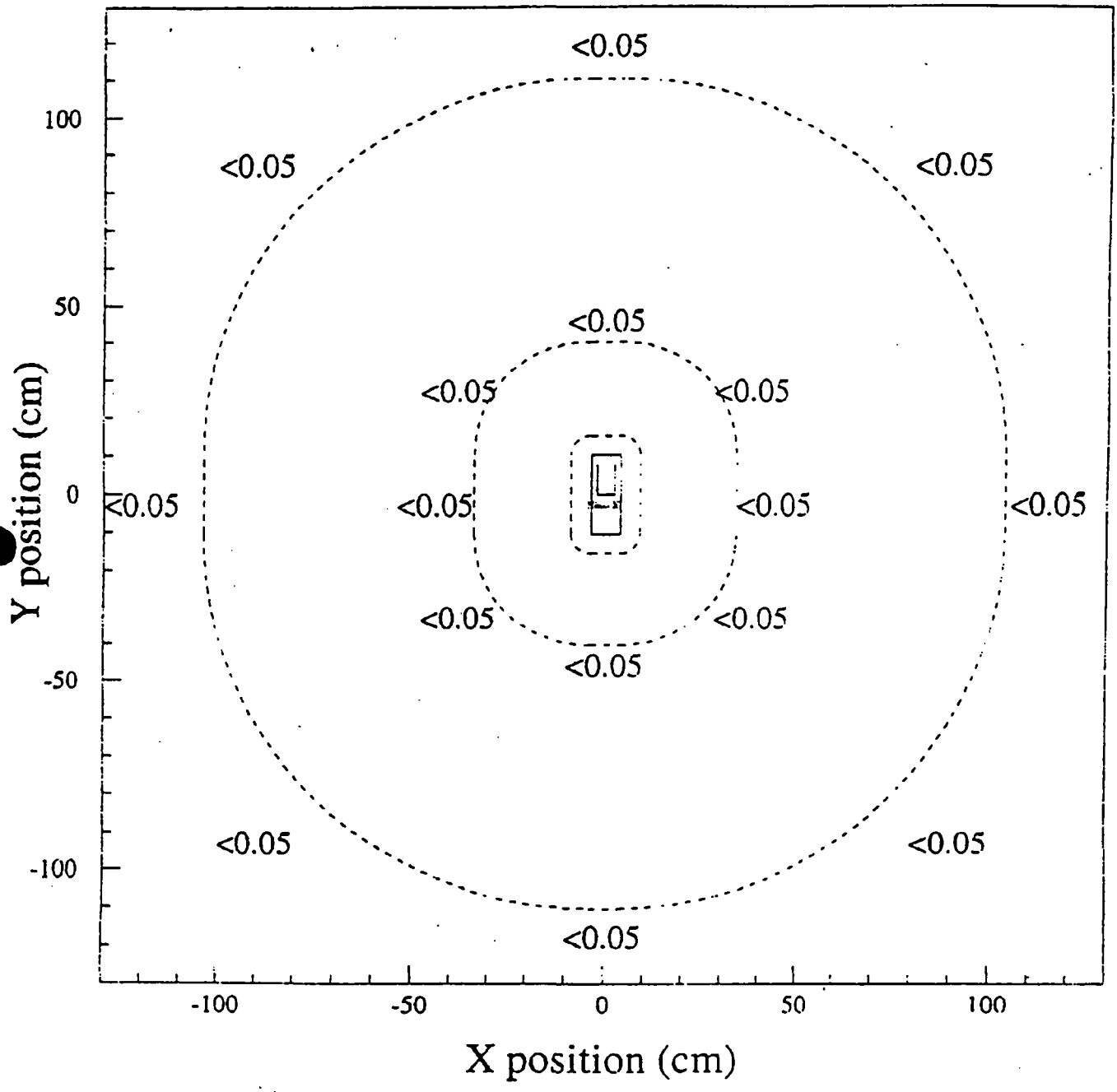
Every NITON XRF emits virtually no radiation with the shutter closed because the cadmium-109 source is thoroughly shielded in every direction. This shielding absorbs nearly all of the radiation produced by the source — except when the shutter is open during testing. With the shutter open, the instrument emits a directed radiation beam of about one mR/hr intensity; the direction is clearly indicated by the diagram on the front of the NITON. Always hold your NITON so as to avoid the radiation beam.

Instrument radiation profiles




Radiation Profile of Niton XL Model 309 on Sheetrock Substrate
in mR/hr for 10 mCi Cd109 Source with Shutter Open (Nov 7 93)
<.03
100
50
0
-50
-100
Y position (cm)
-100
-50
0
50
100
X position (cm)

Radiation Profile of Niton XL Model 309 on Wood Substrate
in mR/hr for 50 mCi Cd^{109} Source with Shutter Closed (Sept 14 94)



Wipe testing

The shielding on your NITON is designed to hold up even under extreme conditions, including the instrument's being crushed or burned. The continued effectiveness of the instrument's radiation shielding should be tested every six months with a thorough leak test of the instrument **(Figure 6.05)**.

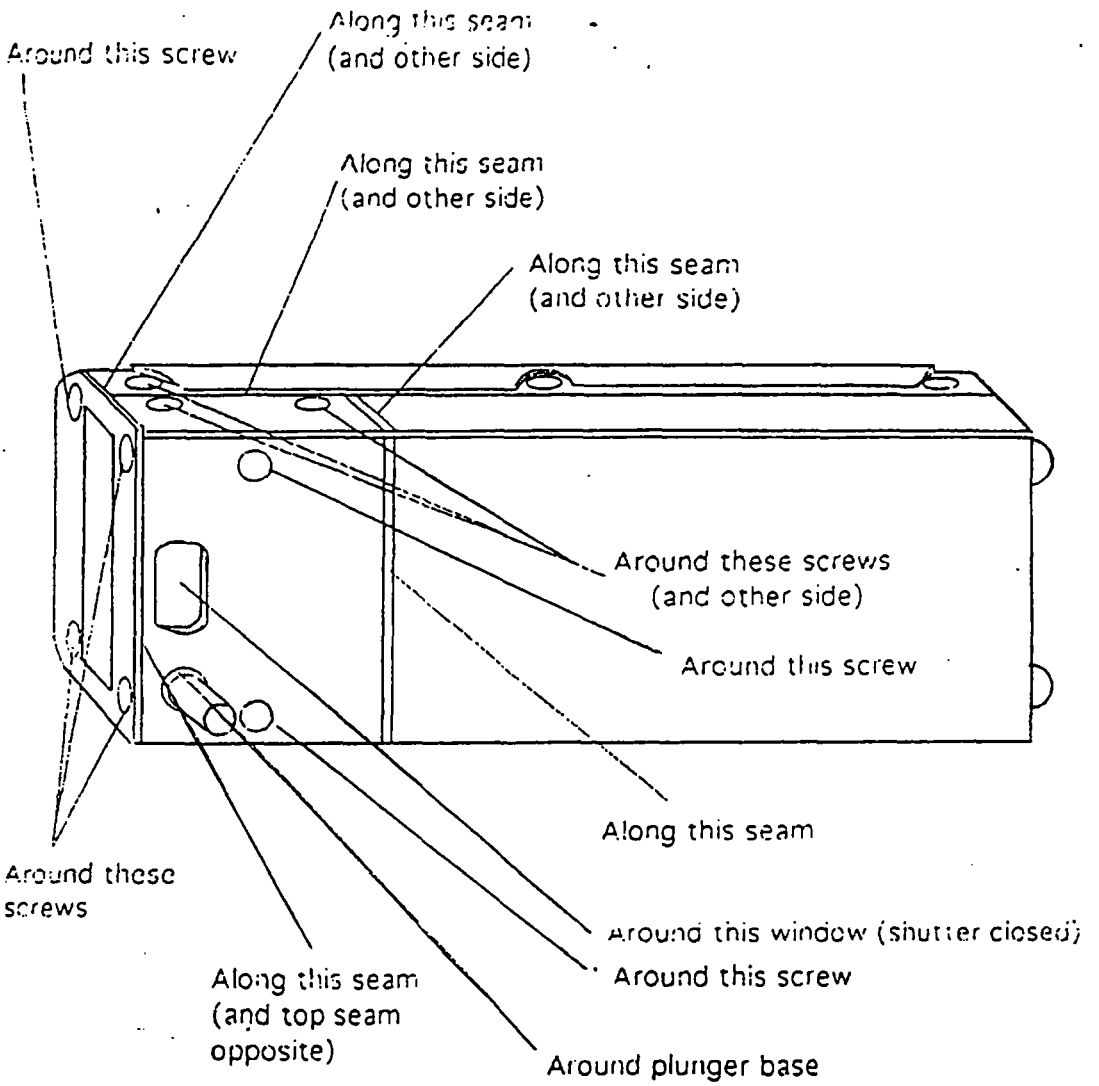
NITON's license requires that leak tests be done every 6 months. Leak test kits, with full instructions, are available from several vendors. These vendors will remind you when it's time to do another semi-annual leak test on your NITON. Please follow the accompanying instructions and promptly mail the test sample to the laboratory. The following are just a few of the labs that offer leak tests:

Applied Health Physics
2986 Industrial Blvd.
Bethel Park, PA 15102
Tel: (412) 835-9555

Stan A. Huber Consultants
200 N. Cedar Road
New Lennox, IL 60451
Tel: (800) 383-0468

Valley Safety Services
330 Old Enfield Road
Belchertown, MA 01007
Tel: (413) 323-9571

Location of Wipe Test wipes



Note: Must be done with shutter closed

If your NITON is damaged, destroyed, lost or stolen:

Immediately

- **Notify the Office of Radiological Safety** in your state Dept. of Health.

  Telephone: _____

- **Notify NITON Corp's Radiation Safety Officer, Dr. Don Sackett.**

  During regular business hours: (800) 875-1578

  Evenings and weekends: (617) 275-1424

- **If your NITON is lost or stolen, or damaged in a car accident:**
  Also immediately notify your state police.

  Telephone: _____

- **If your NITON is damaged in a fire or an explosion:**
  Also immediately notify your local fire department.

  Telephone: _____

Please fill in the phone numbers on this page today. Keep copies where you can find them in case of an emergency.

7: Additional Information

Multi-element analysis (700 Series only)

Overview

700 Series analyzers can quantify concentrations of many elements. The normally displayed elements are: arsenic, barium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, rubidium, strontium, zinc and zirconium. The best detection limits are for molybdenum, rubidium, strontium and zirconium, as well as niobium and yttrium, which are not ordinarily displayed. 700's also have excellent detection limits for lead and mercury, as well as for gold, tungsten and uranium, which are not ordinarily displayed. 700's detect barium, chromium, cobalt, iron, manganese, and nickel with somewhat less sensitivity; the same applies to calcium, scandium, titanium, and vanadium, which are not ordinarily displayed. Finally, 700's detect arsenic, copper and zinc, but there are sometimes problems associated with the measurement of these elements due to cross-element interference. In particular, when zinc and copper are both present in a sample, the element with the higher concentration of the two can be measured more accurately.

Cross-Element Interference

700 Series users should be aware that interference between elements can reduce the sensitivity of the 700 to certain elements in certain situations. Interference occurs when the spectra of two or more elements partially or totally overlap (that is, the elements have nearly identical x-ray flourescent energies).

Note: **All NITON analyzers correct automatically for cross-element interference in all modes. These corrections are performed automatically and continuously, throughout each test.**

NITON instruments correct for these cross-element interferences in all modes. In some instances, however, these corrections will worsen the detection limits and precision of the instrument in **Bulk Sample** and **Thin Sample** modes. For example, in the presence of high concentrations of zinc (>10,000 ppm), the 700 Series analyzer will be unable to detect slight trace concentrations of copper that would be detected if a large amount of zinc was not present. Another example: Very high concentrations of iron (>30,000 ppm) may produce false-positive readings for very small concentrations of manganese and/or cobalt.

Tips for better testing

Define Data Quality Objectives (DQOs)

Before implementing a sampling and analysis program, consider the data quality objectives (DQOs) for the particular site and job. For what purpose is the data being collected? What types of decisions will be made as a result of the data? What are the action-levels for the analytes you are testing at the site? What is known about the extent and distribution of the contaminant? What are the implications of possible mis-classification of samples?

The answers will help to determine the precision and accuracy you need to attain for different phases of the program. These in turn will help you to determine sample-collection procedures, sample preparation methods, sample measurement times, and your requirements for quality assurance and laboratory support.

Standard Operating Procedures

To obtain good test data in your study, it is essential to develop a written Standard Operating Procedure for sampling, measuring, and reporting data. A systematic procedure will help you to produce data of uniform quality. Typically, the Standard Operating Procedure is a written document that details the steps to be taken in handling the samples, standards, equipment, and data, including quality assurance measures, such as calibration checks and laboratory confirmation.

Warm up and calibration checks

All Niton analyzers should be turned on at least 15 minutes prior to testing in **Thin Sample** or **Bulk Sample** modes. This procedure is not necessary in any of the paint testing modes.

Note: **Your instrument should be calibrated before and after testing and at least once per hour during testing.**

Check your instrument by testing **Standard Samples** of known concentration every time you calibrate. Check both a low-level standard (or "blank"),and a high-level standard, (or "spike") of known concentration. Tests of **Standard Samples** should be recorded and kept with the sample test data.

Compare samples *with* and *without* preparation

Set aside part of a sample and prepare the rest. Measure both the prepared and the unprepared portions. Small differences (±30%) are to be expected.

Send samples to a lab for confirmation

Have some samples measured by atomic absorption spectrophotometry by a certified laboratory. This will verify the correctness of your technique and alert you to any site-specific biases.

Split some samples and analyze each sample with both the XRF and with atomic absorption spectrophotometry in a lab. Your Standard Operating Procedure should specify the number of confirmatory samples (perhaps 10 percent of all samples), what actions will be taken in response to the results, and what records will be kept.

Range, precision and limits

Range of accurate measurement

NITON XRFs are calibrated to give accurate values for most elements in concentrations of 10,000 ppm or less. This is because the linear range of the Compton Normalization Method is from 0 ppm to approximately 10,000 ppm (1%). For actual concentrations of 10,000 ppm to 20,000 ppm (1% to 2%), NITON's may overstate the elemental concentration. For content above 20,000 ppm (2%), readings may exhibit even greater deviation.

This deviation results from the extreme x-ray absorption of lead relative to the typical matrix. In terms of x-ray properties, the sample with greater than 20,000 ppm (2%) lead behaves more like lead than the matrix. It may be possible to develop a calibration curve for a specific soil matrix with a very high concentration of lead. If you wish to measure lead in such matrices, please contact Dr. Don Sackett at NITON Corporation for further information at (617) 275-9275.

95% confidence intervals

The precision of a measurement is expressed as the uncertainty or error of the measured result. For every measurement, the NITON gives an uncertainty range that represents a 95% (or "2-sigma") confidence interval. The 95% confidence interval is the interval between the measured-result-minus-the-uncertainty-range to the measured-result-plus-the uncertainty-range. For example, if you took 100 measurements of a sample, you would expect 95 of the measurements to fall within the 95% confidence interval.

Detection limits (DLs)

The detection limit (DL) is the lowest concentration of analyte in a sample that can reliably be distinguished from zero concentration in a sample. In XRF, the DL is usually defined as three times the standard deviation (sigma) of fluctuation in the background.

A estimate of the DL can be obtained by measuring a blank standard. Use a standard measurement time (e.g. 60 source seconds). The estimated DL is 1.5 times the two-sigma precision of the measurement.

The method detection limit (MDL) may be a more realistic measure of sensitivity in actual field conditions. The MDL can be determined by replicate analysis of a blank or low level soil standard. This procedure may be carried out in the laboratory or field. The number of replicate blank measurements should be at least 7. If the replicate blanks are interspersed with the regular measurements as part of the continuing calibration verification (CCV), then the MDL will include the error resulting from instrument drift. Calculate the mean and standard deviation of the replicate measurement series. The bias is the mean minus the standard's known concentration. The MDL is 3 times the standard deviation. The MDL should be reasonably close to the estimated DL. Conservatively, one should report the DL to be the largest value among the estimated DL, MDL, and bias.

In actual usage, a measurement result that exceeds the DL is considered strong evidence of the analyte's presence in the sample. A measurement result that does not exceed the DL for an analyte is reported as "not detected."

Quantitation limit (QLs)

The quantitation limit (QL) is the lowest concentration of analyte that can be reliably measured at high enough precision to allow comparisons among measurements. The XRF industry usually defines QL as 10 times the standard deviation (or "10-sigma") or fluctuation in the background level. QL is therefore 3.33 times the DL. Similarly, the method quantitation limit (MQL) is simply 3.33 times the MDL.

Regulatory bodies often require analytical methods used to establish compliance with a standard or action level to achieve a quantitation limit (QL) equal to or below the standard or action level.

Summary of warnings

Warning: Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

Warning: Wearing a dosimeter badge does not protect you against current exposure. A dosimeter measures your exposure after the fact. If, at any time, you find measurable exposure, call NITON immediately at (401) 294-1234.

Warning: Pregnant female workers may want to take special precautions to reduce their exposure to radiation. Qualified scientists have recommended that the radiation dose to pregnant women should not exceed 500 mR/year because of possible increased risk to the fetus.

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

Warning: Tampering with the 5,500 ppm lead-in-soil standard may cause exposure to lead dust. Keep all standards out of reach of children.

Warning: Always use gloves and respiration equipment for your protection when taking samples from a site where toxic chemicals may be present.

Warning: Grinding and sieving dried samples produces dust. Even clean soil contains silica, which may be hazardous when airborne. Prepare all samples in a ventilated area; wear a mask, gloves, and an apron; and spread a drop cloth.

Warning: Do not hold bagged bulk samples in your hand during testing.

Summary of cautions

Caution: Do not attempt to make repairs yourself. All Service except exterior cleaning must be performed by NITON Corporation. Any attempt to open your NITON instrument will void the instrument warranty.

Caution: Do not return your NITON without the carrying case. You will void the instrument warranty. You will also be billed for a replacement case plus any repairs resulting from improper shipping.

Caution:	Do not return your instrument to NITON without a current leak test. NITON's license prohibits us from repairing or upgrading our instruments without a current leak test certificate. If you return an instrument without a current leak test certificate, NITON will perform a leak test and bill you for the leak test..
Caution:	Do not ship your instrument back to NITON for any reason without first notifying NITON Corporation and receiving a Return Authorization Number.
Caution:	Do not store the battery packs or battery charger in direct sunlight.
Caution:	Do not leave battery packs on the battery charger longer than necessary.
Caution:	If the red Temp light comes on repeatedly when a battery pack is on the Battery Charger in the Full Charge cycle, call NITON Customer Service at (401) 294-1234.
Caution:	NITON's Nickel Metal Hydride battery packs discharge at a rate of about 2% per day when not in use.
Caution:	If you try to calibrate the instrument and it does not calibrate successfully, push the Reset Button on the bottom of the instrument and recalibrate. If your NITON does not calibrate successfully in three attempts, please call the NITON Service Department at (401) 294-1234.
Caution:	Check the `Date` and `Time` displayed on the Ready to Test screen. If they are not correct, reset them before taking any measurements. Your readings will not be accurate unless the date and time are correct.
Caution:	Never tamper with Test Standards. They cannot be used unless they are intact.
Caution:	The Standard Thin Sample Mode should not be used for quantitative lead-paint testing. Use only the three Paint Testing modes to test lead-based paint.
Caution:	When testing the *exterior* of the window sash from the inside of a room, avoid standing in the path of the NITON's radiation beam. The direction of the beam is drawn on the cover of the instrument. It is easier to avoid the radiation beam if you hold the instrument in your right-hand.
Caution:	Keep all test equipment clean to prevent contaminated samples.

Warranty

NITON will warranty parts and labor for any manufacturer's defects for 15 months. No precision instrument is warranted if crushed, dropped on the floor or in a bucket of water. All service, including repair, maintenance and source replacements, must be performed by NITON Corporation. Any attempt to open the metal case of your NITON instrument will nullify this warranty.

Limited Warranty Provision for Use with Purchase and License Agreement for NITON Corporation XRF Detection instruments:

(a) Except as otherwise agreed in writing, NITON Corporation warrants, under normal conditions of operation, each product sold (except for components not of its manufacture) against defects of material and workmanship, provided that such product has been properly utilized. This warranty applies to the original purchaser only and shall commence to run from the date of shipment and shall continue for a period of fifteen (15) months. In any event, NITON Corporation's liability for any such defects of material and workmanship shall not exceed the cost of replacement of defective parts upon timely notification of such defect in writing delivered to NITON Corporation's home office. NITON Corporation shall not be liable for damage or destruction caused during delivery or caused other than by employees of NITON Corporation.

(b) Material, accessories, parts, or items of equipment furnished by suppliers to NITON Corporation and used in the manufacture of NITON Corporation products are guaranteed by NITON Corporation only to the extent of the original manufacturer's express warranty to NITON Corporation for a period not to exceed the warranty period described in paragraph (a) above and provided that the purchaser shall have notified NITON Corporation so as to enable NITON Corporation to avail itself of its rights under such original manufacturer's express warranty.

(c) NITON Corporation shall, at its option, repair such defects or replace the parts or products found defective. All defective parts are to be returned, freight prepaid, immediately to NITON Corporation for inspection and credit. NITON Corporation will make no allowance for repairs or alterations made by the purchaser unless made with the advance written consent of NITON Corporation. NITON Corporation assumes no liability for costs of disassembly of defective parts and equipment. Shipment by purchaser of all repairs and replacements under this warranty are F.O.B. NITON Corporation's factory or authorized service representative and method of shipment will be determined by NITON Corporation. The purchaser will pay shipping costs and insurance in both directions of products, parts, or components shipped for warranty service hereunder. The purchaser will be responsible for risk of loss in both direction. Replaced parts or components will become the property of NITON Corporation. Replacement parts or components may contain recycled, refurbished, or remanufactured parts equivalent to new parts and shall be warranted for the remainder of the original warranty period for the products.

(d) NITON Corporation shall not be liable for delays, deprivation of use, or any other damages, direct or indirect, which may result to the purchaser because of defects in the product or because of the purchaser's inability to operate it or use it to his satisfaction. NITON Corporation will not be liable to anyone for special or consequential damages of any kind. NITON Corporation neither assumes nor authorizes any person to assume for it, any other obligation or liability with respect to NITON Corporation products.

EXCEPT FOR THE FOREGOING EXPRESS WARRANTY, THERE ARE NO WARRANTIES, REPRESENTATIONS, OR GUARANTEES, EXPRESS OR IMPLIED, EXCEPT AS ARE EXPRESSLY SET FORTH HEREIN. THE FOREGOING WARRANTY IS THE ONLY WARRANTY MADE BY NITON CORPORATION. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON THIS PRODUCT IS LIMITED IN DURATION TO THE TWO YEAR DURATION OF THIS WRITTEN WARRANTY. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OF LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

8: Appendix A

x-ray emission energies by atomic number

Element		Atomic No.	Atomic Weight	Average Energy of X-ray Fluorescence (keV) Kα	Kβ	Lα	Lβ	Lγ
titanium	Ti	22	47.90	4.5	4.9			
vanadium	V	23	50.94	4.9	5.4			
chromium	Cr	24	52.00	5.4	5.9			
manganese	Mn	25	54.94	5.9	6.5			
iron	Fe	26	55.85	6.4	7.1			
cobalt	Co	27	58.93	6.9	7.6			
nickel	Ni	28	58.70	7.5	8.3			
copper	Cu	29	63.55	8.0	8.9			
zinc	Zn	30	65.38	8.6	9.6			
gallium	Ga	31	69.72	9.2	10.3			
germanium	Ge	32	72.59	9.9	11.0			
arsenic	As	33	74.92	10.5	11.7			
selenium	Se	34	78.96	11.2	12.5			
bromine	Br	35	79.90	11.9	13.3			
krypton	Kr	36	83.80	12.6	14.1			
rubidium	Rb	37	85.47	13.4	15.0			
strontium	Sr	38	87.62	14.1	15.8			
yttrium	Y	39	88.91	14.9	16.8			
zirconium	Zr	40	91.22	15.7	17.7			
niobium	Nb	41	92.91	16.6	18.6			
molybdenum	Mo	42	95.94	17.4	19.6			
tellurium	Te	52	127.60	27.4	31.1	3.8	4.0	4.6
iodine	I	53	126.90	28.5	32.4	3.9	4.2	4.8
xenon	Xe	54	131.30	29.7	33.8	4.1	4.4	5.0
cesium	Cs	55	132.91	30.9	35.1	4.3	4.6	5.3
barium	Ba	56	137.33	32.1	36.6	4.5	4.8	5.5
lanthanum	La	57	138.91	33.3	38.0	4.7	5.0	5.8
cerium	Ce	58	140.12	34.6	39.5	4.8	5.3	6.0
praseodymium	Pr	59	140.91	35.9	41.0	5.0	5.5	6.3
neodymium	Nd	60	144.24	37.2	42.5	5.2	5.7	6.6

Element		Atomic No.	Atomic Weight	Average Energy of X-ray Fluorescence (keV) Kα	Kβ	Lα	Lβ	Lγ
promethium	Pm	61	(145)	38.5	44.0	5.4	6.0	6.9
samarium	Sm	62	150.35	39.9	45.6	5.6	6.2	7.2
europium	Eu	63	151.96	41.3	47.3	5.8	6.5	7.5
gadolinium	Gd	64	157.25	42.8	48.9	6.1	6.7	7.8
terbium	Tb	65	158.92	44.2	50.7	6.3	7.0	8.1
dysprosium	Dy	66	162.50	45.7	52.4	6.5	7.2	8.4
holmium	Ho	67	164.93	47.3	54.2	6.7	7.5	8.7
erbium	Er	68	167.26	48.8	56.0	6.9	7.8	9.1
thulium	Tm	69	168.93	50.4	57.8	7.2	8.1	9.4
ytterbium	Yb	70	173.04	52.0	59.7	7.4	8.4	9.8
lutecium	Lu	71	174.97	53.7	61.6	7.7	8.7	10.1
hafnium	Hf	72	178.49	55.4	63.6	7.9	9.0	10.5
tantalum	Ta	73	180.95	57.1	65.6	8.1	9.3	10.9
tungsten	W	74	183.85	58.9	67.6	8.4	9.7	[illegible]
rhenium	Re	75	186.2	60.7	69.7	8.7	10.0	[illegible]
osmium	Os	76	190.2	62.5	71.8	8.9	10.4	[illegible].1
iridium	Ir	77	192.2	64.3	73.9	9.2	10.7	12.5
platinum	Pt	78	195.09	66.2	76.1	9.4	11.1	12.9
gold	Au	79	196.97	68.2	78.4	9.7	11.4	13.4
mercury	Hg	80	200.59	70.2	80.7	10.0	11.8	13.8
thallium	Tl	81	204.37	72.2	83.0	10.3	12.2	14.3
lead	Pb	82	207.19	74.2	85.4	10.5	12.6	14.8
bismuth	Bi	83	208.98			10.8	13.0	15.2
polonium	Po	84	(210)			11.1	13.4	15.7
astatine	At	85	(210)			11.4	13.9	16.2
radon	Rn	86	(222)			11.7	14.3	16.8
francium	Fr	87	(223)			12.0	14.8	17.3
radium	Ra	88	(226)			12.3	15.2	17.8
actinium	Ac	89	(227)			12.7	15.7	18.4
thorium	Th	90	232.04			13.0	16.2	19.0
protactinium	Pa	91	(231)			13.3	16.7	19.6
uranium	U	92	238.03			13.6	17.2	20.2

8: Appendix B

X-ray emission energies by element

Element		Atomic No.	Atomic Weight	Average Energy of X-ray Fluorescence (keV) Kα	Kβ	Lα	Lβ	Lγ
actinium	Ac	89	(227)			12.7	15.7	18.4
arsenic	As	33	74.92	10.5	11.7			
astatine	At	85	(210)			11.4	13.9	16.2
barium	Ba	56	137.33	32.1	36.6	4.5	4.8	5.5
bismuth	Bi	83	208.98			10.8	13.0	15.2
bromine	Br	35	79.90	11.9	13.3			
cerium	Ce	58	140.12	34.6	39.5	4.8	5.3	6.0
cesium	Cs	55	132.91	30.9	35.1	4.3	4.6	5.3
chromium	Cr	24	52.00	5.4	5.9			
cobalt	Co	27	58.93	6.9	7.6			
copper	Cu	29	63.55	8.0	8.9			
dysprosium	Dy	66	162.50	45.7	52.4	6.5	7.2	8.4
erbium	Er	68	167.26	48.8	56.0	6.9	7.8	9.1
europium	Eu	63	151.96	41.3	47.3	5.8	6.5	7.5
francium	Fr	87	(223)			12.0	14.8	17.3
gadolinium	Gd	64	157.25	42.8	48.9	6.1	6.7	7.8
gallium	Ga	31	69.72	9.2	10.3			
germanium	Ge	32	72.59	9.9	11.0			
gold	Au	79	196.97	68.2	78.4	9.7	11.4	13.4
hafnium	Hf	72	178.49	55.4	63.6	7.9	9.0	10.5
holmium	Ho	67	164.93	47.3	54.2	6.7	7.5	8.7
iodine	I	53	126.90	28.5	32.4	3.9	4.2	4.8
iridium	Ir	77	192.2	64.3	73.9	9.2	10.7	12.5
iron	Fe	26	55.85	6.4	7.1			
krypton	Kr	36	83.80	12.6	14.1			
lanthanum	La	57	138.91	33.3	38.0	4.7	5.0	5.8
lead	Pb	82	207.19	74.2	85.4	10.5	12.6	14.8
lutecium	Lu	71	174.97	53.7	61.6	7.7	8.7	10.1
manganese	Mn	25	54.94	5.9	6.5			
mercury	Hg	80	200.59	70.2	80.7	10.0	11.8	13.8
molybdenum	Mo	42	95.94	17.4	19.6			
neodymium	Nd	60	144.24	37.2	42.5	5.2	5.7	6.6
nickel	Ni	28	58.70	7.5	8.3			
niobium	Nb	41	92.91	16.6	18.6			
osmium	Os	76	190.2	62.5	71.8	8.9	10.4	12.1
platinum	Pt	78	195.09	66.2	76.1	9.4	11.1	12.9

Element		Atomic No.	Atomic Weight	Average Energy of X-ray Fluorescence (keV) Kα	Kβ	Lα	Lβ	Lγ
polonium	Po	84	(210)			11.1	13.4	15.7
praseodymium	Pr	59	140.91	35.9	41.0	5.0	5.5	6.3
promethium	Pm	61	(145)	38.5	44.0	5.4	6.0	6.9
protactinium	Pa	91	(231)			13.3	16.7	19.6
radium	Ra	88	(226)			12.3	15.2	17.8
radon	Rn	86	(222)			11.7	14.3	16.8
rhenium	Re	75	186.2	60.7	69.7	8.7	10.0	11.7
rubidium	Rb	37	85.47	13.4	15.0			
samarium	Sm	62	150.35	39.9	45.6	5.6	6.2	7.2
selenium	Se	34	78.96	11.2	12.5			
strontium	Sr	38	87.62	14.1	15.8			
tantalum	Ta	73	180.95	57.1	65.6	8.1	9.3	10.9
tellurium	Te	52	127.60	27.4	31.1	3.8	4.0	4.6
terbium	Tb	65	158.92	44.2	50.7	6.3	7.0	8.1
thallium	Tl	81	204.37	72.2	83.0	10.3	12.2	14.3
thorium	Th	90	232.04			13.0	16.2	19.0
thulium	Tm	69	168.93	50.4	57.8	7.2	8.1	9.[illegible]
titanium	Ti	22	47.90	4.5	4.9			
tungsten	W	74	183.85	58.9	67.6	8.4	9.7	11.3
uranium	U	92	238.03			13.6	17.2	20.2
vanadium	V	23	50.94	4.9	5.4			
xenon	Xe	54	131.30	29.7	33.8	4.1	4.4	5.0
ytterbium	Yb	70	173.04	52.0	59.7	7.4	8.4	9.8
yttrium	Y	39	88.91	14.9	16.8			
zinc	Zn	30	65.38	8.6	9.6			
zirconium	Zr	40	91.22	15.7	17.7			

8: Appendix C

x-ray emission energies by energy (keV)

3.8	tellurium	Te	6.7	gadolinium	Gd	10.1	lutecium	Lu
3.9	iodine	I	6.9	cobalt	Co	10.3	gallium	Ga
4.0	tellurium	Te	6.9	erbium	Er	10.3	thallium	Tl
4.1	xenon	Xe	6.9	promethium	Pm	10.4	osmium	Os
4.2	iodine	I	7.0	terbium	Tb	10.5	arsenic	As
4.3	cesium	Cs	7.1	iron	Fe	10.5	lead	Pb
4.4	xenon	Xe	7.2	thulium	Tm	10.5	hafnium	Hf
4.5	titanium	Ti	7.2	dysprosium	Dy	10.7	iridium	Ir
4.5	barium	Ba	7.2	samarium	Sm	10.8	bismuth	Bi
4.6	cesium	Cs	7.4	ytterbium	Yb	10.9	tantalum	Ta
4.6	tellurium	Te	7.5	nickel	Ni	11.0	germanium	Ge
4.7	lanthanum	La	7.5	holmium	Ho	11.1	polonium	Po
4.8	cerium	Ce	7.5	europium	Eu	11.1	platinum	Pt
4.8	barium	Ba	7.6	cobalt	Co	11.2	selenium	Se
4.8	iodine	I	7.7	lutecium	Lu	11.3	tungsten	W
4.9	vanadium	V	7.8	erbium	Er	11.4	astatine	At
4.9	titanium	Ti	7.8	gadolinium	Gd	11.4	gold	Au
5.0	praseodymium	Pr	7.9	hafnium	Hf	11.7	arsenic	As
5.0	lanthanum	La	8.0	copper	Cu	11.7	radon	Rn
5.0	xenon	Xe	8.1	tantalum	Ta	11.7	rhenium	Re
5.2	neodymium	Nd	8.1	thulium	Tm	11.8	mercury	Hg
5.3	cerium	Ce	8.1	terbium	Tb	11.9	bromine	Br
5.3	cesium	Cs	8.3	nickel	Ni	12.0	francium	Fr
5.4	chromium	Cr	8.4	tungsten	W	12.1	osmium	Os
5.4	vanadium	V	8.4	ytterbium	Yb	12.2	thallium	Tl
5.4	promethium	Pm	8.4	dysprosium	Dy	12.3	radium	Ra
5.5	praseodymium	Pr	8.6	zinc	Zn	12.5	selenium	Se
5.5	barium	Ba	8.7	rhenium	Re	12.5	iridium	Ir
5.6	samarium	Sm	8.7	lutecium	Lu	12.6	krypton	Kr
5.7	neodymium	Nd	8.7	holmium	Ho	12.6	lead	Pb
5.8	europium	Eu	8.9	copper	Cu	12.7	actinium	Ac
5.8	lanthanum	La	8.9	osmium	Os	12.9	platinum	Pt
5.9	manganese	Mn	9.0	hafnium	Hf	13.0	thorium	Th
5.9	chromium	Cr	9.1	erbium	Er	13.0	bismuth	Bi
6.0	promethium	Pm	9.2	gallium	Ga	13.3	bromine	Br
6.0	cerium	Ce	9.2	iridium	Ir	13.3	protactinium	Pa
6.1	gadolinium	Gd	9.3	tantalum	Ta	13.4	rubidium	Rb
6.2	samarium	Sm	9.4	platinum	Pt	13.4	polonium	Po
6.3	terbium	Tb	9.4	thulium	Tm	13.4	gold	Au
6.3	praseodymium	Pr	9.6	zinc	Zn	13.6	uranium	U
6.4	iron	Fe	9.7	gold	Au	13.8	mercury	Hg
6.5	manganese	Mn	9.7	tungsten	W	13.9	astatine	At
6.5	dysprosium	Dy	9.8	ytterbium	Yb	14.1	strontium	Sr
6.5	europium	Eu	9.9	germanium	Ge	14.1	krypton	Kr
6.6	neodymium	Nd	10.0	mercury	Hg	14.3	radon	Rn
6.7	holmium	Ho	10.0	rhenium	Re	14.3	thallium	Tl

14.8	francium	Fr
14.8	lead	Pb
14.9	yttrium	Y
15.0	rubidium	Rb
15.2	radium	Ra
15.2	bismuth	Bi
15.7	zirconium	Zr
15.7	actinium	Ac
15.7	polonium	Po
15.8	strontium	Sr
16.2	thorium	Th
16.2	astatine	At
16.6	niobium	Nb
16.7	protactinium	Pa
16.8	yttrium	Y
16.8	radon	Rn
17.2	uranium	U
17.3	francium	Fr
17.4	molybdenum	Mo
17.7	zirconium	Zr
17.8	radium	Ra
18.4	actinium	Ac
18.6	niobium	Nb
19.0	thorium	Th
19.6	molybdenum	Mo
19.6	protactinium	Pa
20.2	uranium	U
27.4	tellurium	Te
28.5	iodine	I
29.7	xenon	Xe
30.9	cesium	Cs
31.1	tellurium	Te
32.1	barium	Ba
32.4	iodine	I
33.3	lanthanum	La
33.8	xenon	Xe
34.6	cerium	Ce
35.1	cesium	Cs
35.9	praseodymium	Pr
36.6	barium	Ba
37.2	neodymium	Nd
38.0	lanthanum	La
38.5	promethium	Pm
39.5	cerium	Ce
39.9	samarium	Sm
41.0	praseodymium	Pr
41.3	europium	Eu
42.5	neodymium	Nd
42.8	gadolinium	Gd
44.0	promethium	Pm
44.2	terbium	Tb
45.6	samarium	Sm
45.7	dysprosium	Dy
47.3	holmium	Ho
47.3	europium	Eu
48.8	erbium	Er
48.9	gadolinium	Gd
50.4	thulium	Tm
50.7	terbium	Tb
52.0	ytterbium	Yb
52.4	dysprosium	Dy
53.7	lutecium	Lu
54.2	holmium	Ho
55.4	hafnium	Hf
56.0	erbium	Er
57.1	tantalum	Ta
57.8	thulium	Tm
58.9	tungsten	W
59.7	ytterbium	Yb
60.7	rhenium	Re
61.6	lutecium	Lu
62.5	osmium	Os
63.6	hafnium	Hf
64.3	iridium	Ir
65.6	tantalum	Ta
66.2	platinum	Pt
67.6	tungsten	W
68.2	gold	Au
69.7	rhenium	Re
70.2	mercury	Hg
71.8	osmium	Os
72.2	thallium	Tl
73.9	iridium	Ir
74.2	lead	Pb
76.1	platinum	Pt
78.4	gold	Au
80.7	mercury	Hg
83.0	thallium	Tl
85.4	lead	Pb

8: Appendix D

Chemical composition of NIST samples

Non-certified value standards

Non-certified values are provided for information only. All non-certified values are listed in parentheses. Standards for many elements do not have certified values. This occurs because (1) some bias is suspected in one or more of the methods used for certification, or (2) two independent methods of certification are not available. As more data becomes available, certified-value standards will likely become available for some of these elements.

Table D-1. High standard certified values

Element	wt. %	Element	µg/g
Aluminum	6.44 ± 0.08	Antimony	38.4 ± 3.0
Calcium	1.25 ± 0.03	Arsenic	626 ± 38
Iron	3.38 ± 0.10	Barium	707 ± 51
Magnesium	0.853 ± 0.042	Cadmium	21.8 ± 0.2
Manganese	1.01 ± 0.04	Copper	2,950 ± 130
Phosphorus	0.106 ± 0.015	Lead	5,532 ± 80
Potassium	2.11 ± 0.11	Mercury	32.6 ± 1.8
Silicon	28.97 ± 0.18	Nickel	14.3 ± 1.0
Sodium	1.14 ± 0.06	Silver	35.3 ± 1.5
Sulfur	0.240 ± 0.006	Vanadium	76.6 ± 2.3
Titanium	0.283 ± 0.010	Zinc	6952 ± 91

Table D-2. High standard non-certified values

Element	wt. %	Element	µg/g
Carbon	(3)	Bromine	(6)
		Cerium	(57)
		Cesium	(107)
		Chromium	(39)
		Cobalt	(10)
		Dysprosium	(5.4)
		Europium	(1)
		Gallium	(34)
		Gold	(0.6)
		Hafnium	(3.2)
		Holmium	(0.6)
		Indium	(5.1)
		Lanthanum	(34
		Molybdenum	(19)
		Neodymium	(23)
		Rubidium	(2)
		Samarium	(7.8)
		Scandium	(8.7)
		Strontium	(240)
		Thallium	(1.3)
		Thorium	(13)
		Tungsten	(93)
		Uranium	(25)
		Ytterbium	(1.3)
		Yttrium	(23)

Table D-3. Low standard certified values

Element	wt. %			Element	µg/g		
Aluminum	7.50	±	0.06	Antimony	7.9	±	0.6
Calcium	1.89	±	0.05	Arsenic	17.7	±	0.8
Iron	3.50	±	0.11	Barium	968	±	40
Magnesium	1.51	±	0.05	Cadmium	0.38	±	0.01
Phosphorus	0.062	±	0.005	Chromium	130	±	4
Potassium	2.03	±	0.06	Cobalt	13.4	±	0.7
Silicon	29.66	±	0.23	Copper	34.6	±	0.7
Sodium	1.16	±	0.03	Lead	18.9	±	0.5
Sulfur	0.089	±	0.002	Manganese	538	±	17
Titanium	0.342	±	0.024	Mercury	1.40	±	0.08
				Nickel	88	±	5
				Selenium	1.57	±	0.08
				Silver	0.41	±	0.03
				Strontium	231	±	2
				Thallium	0.74	±	0.05
				Vanadium	112	±	5
				Zinc	106	±	3

Table D-4. Low standard non-certified values

Element	wt. %	Element	µg/g
Carbon	(1.2)	Cerium	(42)
		Cesium	(5.3)
		Dysprosium	(3.5)
		Europium	(0.9)
		Gallium	(14)
		Gold	(0.3)
		Hafnium	(3.7)
		Holmium	(0.54)
		Iodine	(5)
		Lanthanum	(23)
		Molybdenum	(2.0)
		Neodymium	(19)
		Rubidium	(96)
		Samarium	(3.8)
		Scandium	(12)
		Thorium	(11)
		Tungsten	(2)
		Uranium	(3)
		Ytterbium	(1.6)
		Yttrium	(18)
		Zirconium	(160)

Table D-5. Medium standard certified values

Element	wt. %	Element	µg/g
Aluminum	6.53 ± 0.09	Antimony	19.4± 1.8
Calcium	2.88 ± 0.08	Arsenic	105 ± 8
Iron	2.89 ± 0.06	Barium	726± 38
Magnesium	1.05 ± 0.03	Cadmium	41.70± 0.25
Phosphorus	0.086± 0.007	Copper	114 ± 2
Potassium	2.45 ± 0.08	Lead	1162 ± 31
Silicon	30.44± 0.19	Manganese	638± 28
Sodium	1.14 ± 0.03	Mercury	6.25 ± 0.19
Sulfur	0.042± 0.001	Nickel	20.6 ± 1.1
Titanium	0.306± 0.023	Selenium	1.52 ± 0.14
		Silver	4.63 ± 0.39
		Strontium	245.3 ± 0.7
		Thallium	2.47 ± 0.15
		Vanadium	81.6 ± 2.9
		Zinc	350.4 ± 4.8

Table D-6. Medium standard non-certified values

Element	wt. %	Element	µg/g
Carbon	(2)	Bromine	(5)
		Cerium	(69)
		Cesium	(6.1)
		Chromium	(47)
		Cobalt	(10)
		Dysprosium	(5.6)
		Europium	(1.1)
		Gallium	(15)
		Gold	(.03)
		Hafnium	(7.3)
		Holmium	(1)
		Indium	(1.1)
		Iodine	(3)
		Lanthanum	(40)
		Molybdenum	(1.6)
		Neodymium	(31)
		Rubidium	(110)
		Samarium	(5.9)
		Scandium	(9)
		Thorium	(14)
		Tungsten	(3)
		Uranium	(2.6)
		Ytterbium	(2.7)
		Yttrium	(25)
		Zirconium	(230)

8: Appendix E
Detection limits

Soil Measurement
Detection limits (in ppm)

60 Src Seconds	Low NIST (2709)	Silicon Dioxide
molybdenum	25	20
zirconium	35	20
strontium	60	25
rubidium	70	30
lead	80	45
arsenic	275	220
zinc	130	90
copper	230	150
nickel	630	285
cobalt	1,500	390
iron	1,000	840
manganese	4,600	1,000
chromium	5,400	1,400

Filter Measurements
Detection limits (in µg/filter)

60 Src Seconds	37 mm CE	25 mm CE	Glass Fiber
molybdenum	<6	3	—
zirconium	<6	3	—
strontium	<7	3	—
rubidium	<7	3	—
lead	7	4	15
arsenic	28	14	—
zinc	6	3	—
copper	7	4	—
nickel	10	5	—
cobalt	<20	8	—
iron	25	13	—
manganese	<50	20	—
chromium	40	20	—

Appendix D

APPENDIX D

FENCED AREA 2003 SAMPLING RESULTS

Data

July 2003 Sampling Event

ASARCO

August 20, 2003

Mr. Dave Nation
Tacoma Plant

PROJECT # A4TF CT940I0107002

Attached are the analytical results and quality control data for (34), thirty four soil samples collected between July 22, and July 23, 2003, in association with the Tacoma Everett Source Material Verification Plan and received by the laboratory on July 27, 2003.

The samples were digested on August 14, 2003, in accordance with EPA method 3050 and analyzed by ICP spectroscopy. Results are reported on a dry weight basis.

The analytical results meet the requirements of the National Environmental Laboratory Accreditation Conference, in accordance with Chapter 5 of the 1999 NELAC Standard.

If you need further information, please call at (801) 262-2459 Ext. 24.

Sincerely,

Adil Harami
Senior Chemist

c.c: Gstanga (w/attach.)
c.c: Linda Tangen (w/attach.)

ASARCO Incorporated 3422 South 700 West, Salt Lake City, Utah 84119-4191 (801) 262-2459 FAX (801) 261-2194

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: L030373

LAB NO	DATE/TIME COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030373-001	22-JUL-03 NP	PTB-0	AS	26.	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	<10.0	ppm	AKH	18-AUG-03	6010B
L030373-002	22-JUL-03 NP	PTB-10	AS	880.	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	18.	ppm	AKH	18-AUG-03	6010B
L030373-003	22-JUL-03 NP	PTB-20	AS	2362.	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	41.	ppm	AKH	18-AUG-03	6010B
L030373-004	22-JUL-03 NP	PTB-30	AS	7507.	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	<10.0	ppm	AKH	18-AUG-03	6010B
L030373-005	22-JUL-03 NP	PTB-40	AS	6471.	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	14.	ppm	AKH	18-AUG-03	6010B
L030373-006	22-JUL-03 NP	PTB-50	AS	12360.	ppm	AKH	19-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	43.	ppm	AKH	18-AUG-03	6010B
L030373-007	22-JUL-03 NP	PTB-70	AS	10300.	ppm	AKH	19-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	17.	ppm	AKH	18-AUG-03	6010B
L030373-008	22-JUL-03 NP	PTB-80	AS	4285.	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	78.	ppm	AKH	18-AUG-03	6010B
L030373-009	22-JUL-03 NP	PTB-90	AS	2947.	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	<10.0	ppm	AKH	18-AUG-03	6010B
L030373-010	22-JUL-03 NP	PTB-100	AS	4918.	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	15.	ppm	AKH	18-AUG-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: L030373

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030373-011	22-JUL-03	NP	PTB-110	AS	4099.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	88.	ppm	AKH	18-AUG-03	6010B
L030373-012	22-JUL-03	NP	PTB-120	AS	3749.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	50.	ppm	AKH	18-AUG-03	6010B
L030373-013	22-JUL-03	NP	PP+10-BRICK	AS	2060.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	69.	ppm	AKH	18-AUG-03	6010B
L030373-014	22-JUL-03	NP	PP+13-BRICK	AS	2423.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	93.	ppm	AKH	18-AUG-03	6010B
L030373-015	22-JUL-03	NP	PP+28-CONCRETE	AS	411.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	45.	ppm	AKH	18-AUG-03	6010B
L030373-016	22-JUL-03	NP	PP+32-BRICK	AS	1457.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	<10.0	ppm	AKH	18-AUG-03	6010B
L030373-017	22-JUL-03	NP	PP+32-MORTAR	AS	1859.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	19.	ppm	AKH	18-AUG-03	6010B
L030373-018	22-JUL-03	NP	PP+53-DRAIN PIPE	AS	2892.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	42.	ppm	AKH	18-AUG-03	6010B
L030373-019	22-JUL-03	NP	PP+71-BRICK	AS	3142.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	20.	ppm	AKH	18-AUG-03	6010B
L030373-020	23-JUL-03	NP	P/A+0 (2'BGS)	AS	1764.	ppm	AKH	18-AUG-03	6010B
				CD	13.	ppm	AKH	18-AUG-03	6010B
				PB	768.	ppm	AKH	18-AUG-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: L030373

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030373-021	23-JUL-03	NP	P/A+13 (2'BGS)	AS	3551.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	10.	ppm	AKH	18-AUG-03	6010B
L030373-022	23-JUL-03	NP	P/A+25 (3'BGS)	AS	4583.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	109.	ppm	AKH	18-AUG-03	6010B
L030373-023	23-JUL-03	NP	P/A+30 (BRICKS)	AS	2462.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	88.	ppm	AKH	18-AUG-03	6010B
L030373-024	23-JUL-03	NP	PATB+0	AS	1326.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	38.	ppm	AKH	18-AUG-03	6010B
L030373-025	23-JUL-03	NP	PATB+14	AS	2840.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	166.	ppm	AKH	18-AUG-03	6010B
L030373-026	23-JUL-03	NP	PATB+30	AS	2705.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	74.	ppm	AKH	18-AUG-03	6010B
L030373-027	23-JUL-03	NP	PATB+40	AS	6516.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	77.	ppm	AKH	18-AUG-03	6010B
L030373-028	23-JUL-03	NP	PATB+50	AS	8032.	ppm	AKH	18-AUG-03	6010B
				CD	7.7	ppm	AKH	18-AUG-03	6010B
				PB	327.	ppm	AKH	18-AUG-03	6010B
L030373-029	23-JUL-03	NP	PATB+53	AS	1530.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	<10.0	ppm	AKH	18-AUG-03	6010B
L030373-030	23-JUL-03	NP	PATB+60	AS	1033.	ppm	AKH	18-AUG-03	6010B
				CD	<5.0	ppm	AKH	18-AUG-03	6010B
				PB	13.	ppm	AKH	18-AUG-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: L030373

LAB NO	DATE/TIME COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030373-031	23-JUL-03 NP	PATB+70	AS	3339.	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	<10.0	ppm	AKH	18-AUG-03	6010B
L030373-032	23-JUL-03 NP	PATB+80	AS	2671.	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	17.	ppm	AKH	18-AUG-03	6010B
L030373-033	23-JUL-03 NP	PATB+90	AS	117900.	ppm	AKH	19-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	411.	ppm	AKH	18-AUG-03	6010B
L030373-034	23-JUL-03 NP	PATB+100	AS	10020.	ppm	AKH	18-AUG-03	6010B
			CD	8.8	ppm	AKH	18-AUG-03	6010B
			PB	214.	ppm	AKH	18-AUG-03	6010B

Unless otherwise noted results are not blank corrected. NP = Collect time Not Provided.

Approved

Reviewer

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT94010107002)

Batch No: WG030366

LAB NO	DATE/TIME COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
WG030366-1		QC Matrix Spike	AS	SR>4SA	%Recovery	AKH	18-AUG-03	6010B
			CD	100	%Recovery	AKH	18-AUG-03	6010B
			PB	104	%Recovery	AKH	18-AUG-03	6010B
WG030366-2		QC Prep Blank	AS	<10.0	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	<10.0	ppm	AKH	18-AUG-03	6010B
WG030366-3		QC Lab Control Sample	AS	104	%Recovery	AKH	18-AUG-03	6010B
			CD	100	%Recovery	AKH	18-AUG-03	6010B
			PB	104	%Recovery	AKH	18-AUG-03	6010B
WG030366-5		QC Matrix Spike Duplicate	AS	1.5	% RPD	AKH	18-AUG-03	6010B
			CD	<1	% RPD	AKH	18-AUG-03	6010B
			PB	<1	% RPD	AKH	18-AUG-03	6010B
WG030366-6		QC Reporting Limit	AS	10.0	ppm			6010B
			CD	5.0	ppm			6010B
			PB	10.0	ppm			6010B
WG030366-7		QC Matrix Spike	AS	95	%Recovery	AKH	18-AUG-03	6010B
			CD	96	%Recovery	AKH	18-AUG-03	6010B
			PB	102	%Recovery	AKH	18-AUG-03	6010B
WG030366-8		QC Prep Blank	AS	<10.0	ppm	AKH	18-AUG-03	6010B
			CD	<5.0	ppm	AKH	18-AUG-03	6010B
			PB	<10.0	ppm	AKH	18-AUG-03	6010B
WG030366-9		QC Lab Control Sample	AS	105	%Recovery	AKH	18-AUG-03	6010B
			CD	99	%Recovery	AKH	18-AUG-03	6010B
			PB	106	%Recovery	AKH	18-AUG-03	6010B
WG030366-11		QC Matrix Spike Duplicate	AS	<1	% RPD	AKH	18-AUG-03	6010B
			CD	3.2	% RPD	AKH	18-AUG-03	6010B
			PB	1.2	% RPD	AKH	18-AUG-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: WG030366

LAB NO	DATE/TIME COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD

Unless otherwise noted results are not blank corrected. NP = Collect time Not Provided.

Approved

Reviewer

SAMPLENUM	COLLECT DATE	CLIENTID	PROD	RESULT UNITS	ANALYSIS DATE	METHOD
L030373-001	22-Jul-03	PTB-0	AS	26. ppm	18-Aug-03	6010B
L030373-001	22-Jul-03	PTB-0	CD	<5.0 ppm	18-Aug-03	6010B
L030373-001	22-Jul-03	PTB-0	PB	<10.0 ppm	18-Aug-03	6010B
L030373-002	22-Jul-03	PTB-10	AS	880. ppm	18-Aug-03	6010B
L030373-002	22-Jul-03	PTB-10	CD	<5.0 ppm	18-Aug-03	6010B
L030373-002	22-Jul-03	PTB-10	PB	18. ppm	18-Aug-03	6010B
L030373-003	22-Jul-03	PTB-20	AS	2362. ppm	18-Aug-03	6010B
L030373-003	22-Jul-03	PTB-20	CD	<5.0 ppm	18-Aug-03	6010B
L030373-003	22-Jul-03	PTB-20	PB	41. ppm	18-Aug-03	6010B
L030373-004	22-Jul-03	PTB-30	AS	7507. ppm	18-Aug-03	6010B
L030373-004	22-Jul-03	PTB-30	CD	<5.0 ppm	18-Aug-03	6010B
L030373-004	22-Jul-03	PTB-30	PB	<10.0 ppm	18-Aug-03	6010B
L030373-005	22-Jul-03	PTB-40	AS	6471. ppm	18-Aug-03	6010B
L030373-005	22-Jul-03	PTB-40	CD	<5.0 ppm	18-Aug-03	6010B
L030373-005	22-Jul-03	PTB-40	PB	14. ppm	18-Aug-03	6010B
L030373-006	22-Jul-03	PTB-50	AS	12360. ppm	19-Aug-03	6010B
L030373-006	22-Jul-03	PTB-50	CD	<5.0 ppm	18-Aug-03	6010B
L030373-006	22-Jul-03	PTB-50	PB	43. ppm	18-Aug-03	6010B
L030373-007	22-Jul-03	PTB-70	AS	10300. ppm	19-Aug-03	6010B
L030373-007	22-Jul-03	PTB-70	CD	<5.0 ppm	18-Aug-03	6010B
L030373-007	22-Jul-03	PTB-70	PB	17. ppm	18-Aug-03	6010B
L030373-008	22-Jul-03	PTB-80	AS	4285. ppm	18-Aug-03	6010B
L030373-008	22-Jul-03	PTB-80	CD	<5.0 ppm	18-Aug-03	6010B
L030373-008	22-Jul-03	PTB-80	PB	78. ppm	18-Aug-03	6010B
L030373-009	22-Jul-03	PTB-90	AS	2947. ppm	18-Aug-03	6010B
L030373-009	22-Jul-03	PTB-90	CD	<5.0 ppm	18-Aug-03	6010B
L030373-009	22-Jul-03	PTB-90	PB	<10.0 ppm	18-Aug-03	6010B
L030373-010	22-Jul-03	PTB-100	AS	4918. ppm	18-Aug-03	6010B
L030373-010	22-Jul-03	PTB-100	CD	<5.0 ppm	18-Aug-03	6010B
L030373-010	22-Jul-03	PTB-100	PB	15. ppm	18-Aug-03	6010B
L030373-011	22-Jul-03	PTB-110	AS	4099. ppm	18-Aug-03	6010B
L030373-011	22-Jul-03	PTB-110	CD	<5.0 ppm	18-Aug-03	6010B
L030373-011	22-Jul-03	PTB-110	PB	88. ppm	18-Aug-03	6010B
L030373-012	22-Jul-03	PTB-120	AS	3749. ppm	18-Aug-03	6010B
L030373-012	22-Jul-03	PTB-120	CD	<5.0 ppm	18-Aug-03	6010B
L030373-012	22-Jul-03	PTB-120	PB	50. ppm	18-Aug-03	6010B
L030373-013	22-Jul-03	PP+10-BRICK	AS	2060. ppm	18-Aug-03	6010B
L030373-013	22-Jul-03	PP+10-BRICK	CD	<5.0 ppm	18-Aug-03	6010B
L030373-013	22-Jul-03	PP+10-BRICK	PB	69. ppm	18-Aug-03	6010B
L030373-014	22-Jul-03	PP+13-BRICK	AS	2423. ppm	18-Aug-03	6010B
L030373-014	22-Jul-03	PP+13-BRICK	CD	<5.0 ppm	18-Aug-03	6010B
L030373-014	22-Jul-03	PP+13-BRICK	PB	93. ppm	18-Aug-03	6010B
L030373-015	22-Jul-03	PP+28-CONCRETE	AS	411. ppm	18-Aug-03	6010B
L030373-015	22-Jul-03	PP+28-CONCRETE	CD	<5.0 ppm	18-Aug-03	6010B
L030373-015	22-Jul-03	PP+28-CONCRETE	PB	45. ppm	18-Aug-03	6010B
L030373-016	22-Jul-03	PP+32-BRICK	AS	1457. ppm	18-Aug-03	6010B
L030373-016	22-Jul-03	PP+32-BRICK	CD	<5.0 ppm	18-Aug-03	6010B
L030373-016	22-Jul-03	PP+32-BRICK	PB	<10.0 ppm	18-Aug-03	6010B
L030373-017	22-Jul-03	PP+32-MORTAR	AS	1859. ppm	18-Aug-03	6010B
L030373-017	22-Jul-03	PP+32-MORTAR	CD	<5.0 ppm	18-Aug-03	6010B
L030373-017	22-Jul-03	PP+32-MORTAR	PB	19. ppm	18-Aug-03	6010B
L030373-018	22-Jul-03	PP+53-DRAIN PIPE	AS	2892. ppm	18-Aug-03	6010B
L030373-018	22-Jul-03	PP+53-DRAIN PIPE	CD	<5.0 ppm	18-Aug-03	6010B
L030373-018	22-Jul-03	PP+53-DRAIN PIPE	PB	42. ppm	18-Aug-03	6010B

SAMPLENUM	COLLECT DATE	CLIENTID	PROD	RESULT	UNITS	ANALYSIS DATE	METHOD
L030373-019	22-Jul-03	PP+71-BRICK	AS	3142.	ppm	18-Aug-03	6010B
L030373-019	22-Jul-03	PP+71-BRICK	CD	<5.0	ppm	18-Aug-03	6010B
L030373-019	22-Jul-03	PP+71-BRICK	PB	20.	ppm	18-Aug-03	6010B
L030373-020	23-Jul-03	P/A+0 (2'BGS)	AS	1764.	ppm	18-Aug-03	6010B
L030373-020	23-Jul-03	P/A+0 (2'BGS)	CD	13.	ppm	18-Aug-03	6010B
L030373-020	23-Jul-03	P/A+0 (2'BGS)	PB	768.	ppm	18-Aug-03	6010B
L030373-021	23-Jul-03	P/A+13 (2'BGS)	AS	3551.	ppm	18-Aug-03	6010B
L030373-021	23-Jul-03	P/A+13 (2'BGS)	CD	<5.0	ppm	18-Aug-03	6010B
L030373-021	23-Jul-03	P/A+13 (2'BGS)	PB	10.	ppm	18-Aug-03	6010B
L030373-022	23-Jul-03	P/A+25 (3'BGS)	AS	4583.	ppm	18-Aug-03	6010B
L030373-022	23-Jul-03	P/A+25 (3'BGS)	CD	<5.0	ppm	18-Aug-03	6010B
L030373-022	23-Jul-03	P/A+25 (3'BGS)	PB	109.	ppm	18-Aug-03	6010B
L030373-023	23-Jul-03	P/A+30 (BRICKS)	AS	2462.	ppm	18-Aug-03	6010B
L030373-023	23-Jul-03	P/A+30 (BRICKS)	CD	<5.0	ppm	18-Aug-03	6010B
L030373-023	23-Jul-03	P/A+30 (BRICKS)	PB	88.	ppm	18-Aug-03	6010B
L030373-024	23-Jul-03	PATB+0	AS	1326.	ppm	18-Aug-03	6010B
L030373-024	23-Jul-03	PATB+0	CD	<5.0	ppm	18-Aug-03	6010B
L030373-024	23-Jul-03	PATB+0	PB	38.	ppm	18-Aug-03	6010B
L030373-025	23-Jul-03	PATB+14	AS	2840.	ppm	18-Aug-03	6010B
L030373-025	23-Jul-03	PATB+14	CD	<5.0	ppm	18-Aug-03	6010B
L030373-025	23-Jul-03	PATB+14	PB	166.	ppm	18-Aug-03	6010B
L030373-026	23-Jul-03	PATB+30	AS	2705.	ppm	18-Aug-03	6010B
L030373-026	23-Jul-03	PATB+30	CD	<5.0	ppm	18-Aug-03	6010B
L030373-026	23-Jul-03	PATB+30	PB	74.	ppm	18-Aug-03	6010B
L030373-027	23-Jul-03	PATB+40	AS	6516.	ppm	18-Aug-03	6010B
L030373-027	23-Jul-03	PATB+40	CD	<5.0	ppm	18-Aug-03	6010B
L030373-027	23-Jul-03	PATB+40	PB	77.	ppm	18-Aug-03	6010B
L030373-028	23-Jul-03	PATB+50	AS	8032.	ppm	18-Aug-03	6010B
L030373-028	23-Jul-03	PATB+50	CD	7.7	ppm	18-Aug-03	6010B
L030373-028	23-Jul-03	PATB+50	PB	327.	ppm	18-Aug-03	6010B
L030373-029	23-Jul-03	PATB+53	AS	1530.	ppm	18-Aug-03	6010B
L030373-029	23-Jul-03	PATB+53	CD	<5.0	ppm	18-Aug-03	6010B
L030373-029	23-Jul-03	PATB+53	PB	<10.0	ppm	18-Aug-03	6010B
L030373-030	23-Jul-03	PATB+60	AS	1033.	ppm	18-Aug-03	6010B
L030373-030	23-Jul-03	PATB+60	CD	<5.0	ppm	18-Aug-03	6010B
L030373-030	23-Jul-03	PATB+60	PB	13.	ppm	18-Aug-03	6010B
L030373-031	23-Jul-03	PATB+70	AS	3339.	ppm	18-Aug-03	6010B
L030373-031	23-Jul-03	PATB+70	CD	<5.0	ppm	18-Aug-03	6010B
L030373-031	23-Jul-03	PATB+70	PB	<10.0	ppm	18-Aug-03	6010B
L030373-032	23-Jul-03	PATB+80	AS	2671.	ppm	18-Aug-03	6010B
L030373-032	23-Jul-03	PATB+80	CD	<5.0	ppm	18-Aug-03	6010B
L030373-032	23-Jul-03	PATB+80	PB	17.	ppm	18-Aug-03	6010B
L030373-033	23-Jul-03	PATB+90	AS	117900.	ppm	19-Aug-03	6010B
L030373-033	23-Jul-03	PATB+90	CD	<5.0	ppm	18-Aug-03	6010B
L030373-033	23-Jul-03	PATB+90	PB	411.	ppm	18-Aug-03	6010B
L030373-034	23-Jul-03	PATB+100	AS	10020.	ppm	18-Aug-03	6010B
L030373-034	23-Jul-03	PATB+100	CD	8.8	ppm	18-Aug-03	6010B
L030373-034	23-Jul-03	PATB+100	PB	214.	ppm	18-Aug-03	6010B

SAMPLENUM	COLLECT DATE	CLIENTID	PROD	RESULT UNITS	ANALYSIS DATE	METHOD
L030374-001	22-Jul-03	PP+10-BRICK (TCLP)	AS	2.9 ppm	22-Aug-03	6010B
L030374-001	22-Jul-03	PP+10-BRICK (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-001	22-Jul-03	PP+10-BRICK (TCLP)	PB	<0.10 ppm	22-Aug-03	6010B
L030374-002	22-Jul-03	PP+13-BRICK (TCLP)	AS	2.2 ppm	22-Aug-03	6010B
L030374-002	22-Jul-03	PP+13-BRICK (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-002	22-Jul-03	PP+13-BRICK (TCLP)	PB	<0.10 ppm	22-Aug-03	6010B
L030374-003	22-Jul-03	PP+28 CONCRETE (TCLP)	AS	<0.10 ppm	22-Aug-03	6010B
L030374-003	22-Jul-03	PP+28 CONCRETE (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-003	22-Jul-03	PP+28 CONCRETE (TCLP)	PB	<0.10 ppm	22-Aug-03	6010B
L030374-004	22-Jul-03	PP+32-BRICK (TCLP)	AS	2.1 ppm	22-Aug-03	6010B
L030374-004	22-Jul-03	PP+32-BRICK (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-004	22-Jul-03	PP+32-BRICK (TCLP)	PB	<0.10 ppm	22-Aug-03	6010B
L030374-005	22-Jul-03	PP+32-MORTAR (TCLP)	AS	5.1 ppm	22-Aug-03	6010B
L030374-005	22-Jul-03	PP+32-MORTAR (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-005	22-Jul-03	PP+32-MORTAR (TCLP)	PB	<0.10 ppm	22-Aug-03	6010B
L030374-006	22-Jul-03	PP+53-DRAINAGE (TCLP)	AS	5.2 ppm	22-Aug-03	6010B
L030374-006	22-Jul-03	PP+53-DRAINAGE (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-006	22-Jul-03	PP+53-DRAINAGE (TCLP)	PB	<0.10 ppm	22-Aug-03	6010B
L030374-007	22-Jul-03	PP+71-BRICK (TCLP)	AS	3.1 ppm	22-Aug-03	6010B
L030374-007	22-Jul-03	PP+71-BRICK (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-007	22-Jul-03	PP+71-BRICK (TCLP)	PB	<0.10 ppm	22-Aug-03	6010B
L030374-008	23-Jul-03	P/A+0 (2'BGS) (TCLP)	AS	1.4 ppm	22-Aug-03	6010B
L030374-008	23-Jul-03	P/A+0 (2'BGS) (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-008	23-Jul-03	P/A+0 (2'BGS) (TCLP)	PB	0.12 ppm	22-Aug-03	6010B
L030374-009	23-Jul-03	P/A+13(2'BGS) (TCLP)	AS	4.0 ppm	22-Aug-03	6010B
L030374-009	23-Jul-03	P/A+13(2'BGS) (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-009	23-Jul-03	P/A+13(2'BGS) (TCLP)	PB	<0.10 ppm	22-Aug-03	6010B
L030374-010	23-Jul-03	P/A+25 (3'BGS) (TCLP)	AS	5.0 ppm	22-Aug-03	6010B
L030374-010	23-Jul-03	P/A+25 (3'BGS) (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-010	23-Jul-03	P/A+25 (3'BGS) (TCLP)	PB	<0.10 ppm	22-Aug-03	6010B
L030374-011	23-Jul-03	P/A+30 (BRICKS) (TCLP)	AS	2.0 ppm	22-Aug-03	6010B
L030374-011	23-Jul-03	P/A+30 (BRICKS) (TCLP)	CD	<0.05 ppm	22-Aug-03	6010B
L030374-011	23-Jul-03	P/A+30 (BRICKS) (TCLP)	PB	<0 10 ppm	22-Aug-03	6010B

ASARCO

August 18, 2003

Mr. Dave Nation
TACOMA PLANT

Attached are the analytical results and quality control data for sixty-four soil samples collected July 15 through 17, 2003 and received by the laboratory on July 23, 2003.

The samples were digested in accordance with EPA method 3050 on August 8, 2003. Results are reported on a dry weight basis.

The test results meet the requirements of the National Environmental Laboratory Accreditation Conference, in accordance with Chapter 5 of the 1999 NELAC Standard.

If you need any further information, please call me at (801) 262-2459 ext. 26 or email EHolm@ASARCO.com.

Sincerely,

Eric Holm
Laboratory/Environmental
Technician

Cc: GRStanga (w/attach.)
Cc: LTangen (w/attach.)

ASARCO Incorporated • 3422 South 700 West • Salt Lake City Utah 84119-4191 • (801) 262-2459 • FAX (801) 261-2194

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

(Project A4TF CT940I0307009)

Batch No: L030367

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030367-001	16-JUL-03	NP	SMVR1 0-24	AS	1875.	ppm	EH	11-AUG-03	6010B
				PB	447.	ppm	EH	11-AUG-03	6010B
L030367-002	16-JUL-03	NP	SMVR1 24-48	AS	15.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-003	16-JUL-03	NP	SMVR1 48-60	AS	24.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-004	16-JUL-03	NP	SMVR1 60-84	AS	<10.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-005	16-JUL-03	NP	SMVR2 0-24	AS	1239.	ppm	EH	11-AUG-03	6010B
				PB	39.	ppm	EH	11-AUG-03	6010B
L030367-006	16-JUL-03	NP	SMVR2 24-48	AS	3270.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-007	16-JUL-03	NP	SMVR2 48-60	AS	1001.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-008	16-JUL-03	NP	SMVR3 0-24	AS	8752.	ppm	EH	11-AUG-03	6010B
				PB	151.	ppm	EH	11-AUG-03	6010B
L030367-009	16-JUL-03	NP	SMVR3 24-48	AS	225.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-010	16-JUL-03	NP	SMVR 3 48-60	AS	66.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-011	16-JUL-03	NP	SMVR 4 0-24	AS	82.	ppm	EH	11-AUG-03	6010B
				PB	88.	ppm	EH	11-AUG-03	6010B
L030367-012	16-JUL-03	NP	SMVR 4 24-48	AS	34.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-013	16-JUL-03	NP	SMVR 4 48-60	AS	38.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

(Project A4TF CT940I0307009)

Batch No: L030367

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030367-014	16-JUL-03	NP	SMVR 4 60-84	AS	64.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-015	16-JUL-03	NP	SMVR5 0-24	AS	100.	ppm	EH	11-AUG-03	6010B
				PB	92.	ppm	EH	11-AUG-03	6010B
L030367-016	16-JUL-03	NP	SMVR 5 24-48	AS	231.	ppm	EH	11-AUG-03	6010B
				PB	681.	ppm	EH	11-AUG-03	6010B
L030367-017	16-JUL-03	NP	SMVR 5 48-60	AS	<10.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-018	16-JUL-03	NP	SMVR 5 60-84	AS	375.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-019	16-JUL-03	NP	SMVR 6 0-24	AS	48.	ppm	EH	11-AUG-03	6010B
				PB	109.	ppm	EH	11-AUG-03	6010B
L030367-020	16-JUL-03	NP	SMVR 6 24-48	AS	681.	ppm	EH	11-AUG-03	6010B
				PB	1060.	ppm	EH	11-AUG-03	6010B
L030367-021	16-JUL-03	NP	SMVR 6 48-60	AS	20.	ppm	EH	11-AUG-03	6010B
				PB	14.	ppm	EH	11-AUG-03	6010B
L030367-022	16-JUL-03	NP	SMVR 6 60-84	AS	2205.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-023	16-JUL-03	NP	SMVR 7 0-24	AS	104.	ppm	EH	11-AUG-03	6010B
				PB	102.	ppm	EH	11-AUG-03	6010B
L030367-024	16-JUL-03	NP	SMVR 7 24-48	AS	307.	ppm	EH	11-AUG-03	6010B
				PB	18.	ppm	EH	11-AUG-03	6010B
L030367-025	16-JUL-03	NP	SMVR 7 48-60	AS	3497.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B
L030367-026	16-JUL-03	NP	SMVR 7 60-84	AS	1412.	ppm	EH	11-AUG-03	6010B
				PB	<10.	ppm	EH	11-AUG-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

(Project A4TF CT940I0307009)

Batch No: L030367

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030367-027	15-JUL-03	NP	S111A 0-18	AS	8238.	ppm	EH	11-AUG-03	6010B
L030367-028	15-JUL-03	NP	S111A 18-36	AS	17180.	ppm	EH	14-AUG-03	6010B
L030367-029	15-JUL-03	NP	S111A 36-54	AS	9171.	ppm	EH	11-AUG-03	6010B
L030367-030	15-JUL-03	NP	S111A 54-72	AS	3206.	ppm	EH	11-AUG-03	6010B
L030367-031	15-JUL-03	NP	S111B 0-18	AS	53.	ppm	EH	11-AUG-03	6010B
L030367-032	15-JUL-03	NP	S111B 18-36	AS	109600.	ppm	EH	19-AUG-03	6010B
L030367-033	15-JUL-03	NP	S111B 36-54	AS	90980.	ppm	EH	14-AUG-03	6010B
L030367-034	15-JUL-03	NP	S111B 54-72	AS	26930.	ppm	EH	14-AUG-03	6010B
L030367-035	15-JUL-03	NP	S111C 0-18	AS	17080.	ppm	EH	14-AUG-03	6010B
L030367-036	15-JUL-03	NP	S111C 18-36	AS	82770.	ppm	EH	14-AUG-03	6010B
L030367-037	15-JUL-03	NP	S111C 36-54	AS	6568.	ppm	EH	11-AUG-03	6010B
L030367-038	15-JUL-03	NP	S111C 54-72	AS	7254.	ppm	EH	18-AUG-03	6010B
L030367-039	15-JUL-03	NP	S111D 0-18	AS	17840.	ppm	EH	14-AUG-03	6010B
L030367-040	15-JUL-03	NP	S111D 18-36	AS	123300.	ppm	EH	14-AUG-03	6010B
L030367-041	15-JUL-03	NP	S111D 36-54	AS	48020.	ppm	EH	18-AUG-03	6010B
L030367-042	15-JUL-03	NP	S111D 54-72	AS	19270.	ppm	EH	18-AUG-03	6010B
L030367-043	15-JUL-03	NP	S111E 0-18	AS	34680.	ppm	EH	18-AUG-03	6010B
L030367-044	15-JUL-03	NP	S111E 18-36	AS	11940.	ppm	EH	18-AUG-03	6010B
L030367-045	15-JUL-03	NP	S111E 36-54	AS	2194.	ppm	EH	14-AUG-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

(Project A4TF CT940I0307009)

Batch No: L030367

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030367-046	15-JUL-03	NP	S112A 0-18	AS	28410.	ppm	EH	18-AUG-03	6010B
L030367-047	15-JUL-03	NP	S112A 18-36	AS	18100.	ppm	EH	18-AUG-03	6010B
L030367-048	15-JUL-03	NP	S112A 36-54	AS	10670.	ppm	EH	18-AUG-03	6010B
L030367-049	15-JUL-03	NP	S112A 54-72	AS	3650.	ppm	EH	14-AUG-03	6010B
L030367-050	15-JUL-03	NP	S112B 0-18	AS	28880.	ppm	EH	18-AUG-03	6010B
L030367-051	15-JUL-03	NP	S112B 18-36	AS	37830.	ppm	EH	18-AUG-03	6010B
L030367-052	15-JUL-03	NP	S112B 36-54	AS	8078.	ppm	EH	14-AUG-03	6010B
L030367-053	15-JUL-03	NP	S112B 54-72	AS	1817.	ppm	EH	14-AUG-03	6010B
L030367-054	15-JUL-03	NP	S112C 0-18	AS	134400.	ppm	EH	18-AUG-03	6010B
L030367-055	15-JUL-03	NP	S112C 18-36	AS	24030.	ppm	EH	18-AUG-03	6010B
L030367-056	15-JUL-03	NP	S112C 36-54	AS	5288.	ppm	EH	14-AUG-03	6010B
L030367-057	15-JUL-03	NP	S112C 54-72	AS	1555.	ppm	EH	14-AUG-03	6010B
L030367-058	15-JUL-03	NP	S112D 0-18	AS	46150.	ppm	EH	18-AUG-03	6010B
L030367-059	15-JUL-03	NP	S112D 18-36	AS	56240.	ppm	EH	18-AUG-03	6010B
L030367-060	15-JUL-03	NP	S112D 36-54	AS	16560.	ppm	EH	18-AUG-03	6010B
L030367-061	15-JUL-03	NP	S112D 54-72	AS	3337.	ppm	EH	14-AUG-03	6010B
L030367-062	17-JUL-03	NP	LS-42-1-0-12	AS	15690.	ppm	EH	18-AUG-03	6010B
L030367-063	17-JUL-03	NP	LS-42-2-12-24	AS	28060.	ppm	EH	18-AUG-03	6010B
L030367-064	17-JUL-03	NP	LS-42-3-24-36	AS	33080.	ppm	EH	18-AUG-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

(Project A4TF CT940I0307009)

Batch No: L030367

LAB NO	DATE/TIME COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD

Unless otherwise noted results are not blank corrected. NP = Collect time Not Provided.

Approved

Reviewer

SAMPLENUM	COLLECT DATE	CLIENTID	PROD	RESULT	UNITS	ANALYSIS DATE	METHOD
L030367-001	16-Jul-03	SMVR1 0-24	AS	1875.	ppm	11-Aug-03	6010B
L030367-001	16-Jul-03	SMVR1 0-24	PB	447.	ppm	11-Aug-03	6010B
L030367-002	16-Jul-03	SMVR1 24-48	AS	15.	ppm	11-Aug-03	6010B
L030367-002	16-Jul-03	SMVR1 24-48	PB	<10.	ppm	11-Aug-03	6010B
L030367-003	16-Jul-03	SMVR1 48-60	AS	24.	ppm	11-Aug-03	6010B
L030367-003	16-Jul-03	SMVR1 48-60	PB	<10.	ppm	11-Aug-03	6010B
L030367-004	16-Jul-03	SMVR1 60-84	AS	<10.	ppm	11-Aug-03	6010B
L030367-004	16-Jul-03	SMVR1 60-84	PB	<10.	ppm	11-Aug-03	6010B
L030367-005	16-Jul-03	SMVR2 0-24	AS	1239.	ppm	11-Aug-03	6010B
L030367-005	16-Jul-03	SMVR2 0-24	PB	39.	ppm	11-Aug-03	6010B
L030367-006	16-Jul-03	SMVR2 24-48	AS	3270.	ppm	11-Aug-03	6010B
L030367-006	16-Jul-03	SMVR2 24-48	PB	<10.	ppm	11-Aug-03	6010B
L030367-007	16-Jul-03	SMVR2 48-60	AS	1001.	ppm	11-Aug-03	6010B
L030367-007	16-Jul-03	SMVR2 48-60	PB	<10.	ppm	11-Aug-03	6010B
L030367-008	16-Jul-03	SMVR3 0-24	AS	8752.	ppm	11-Aug-03	6010B
L030367-008	16-Jul-03	SMVR3 0-24	PB	151.	ppm	11-Aug-03	6010B
L030367-009	16-Jul-03	SMVR3 24-48	AS	225.	ppm	11-Aug-03	6010B
L030367-009	16-Jul-03	SMVR3 24-48	PB	<10.	ppm	11-Aug-03	6010B
L030367-010	16-Jul-03	SMVR 3 48-60	AS	66.	ppm	11-Aug-03	6010B
L030367-010	16-Jul-03	SMVR 3 48-60	PB	<10.	ppm	11-Aug-03	6010B
L030367-011	16-Jul-03	SMVR 4 0-24	AS	82.	ppm	11-Aug-03	6010B
L030367-011	16-Jul-03	SMVR 4 0-24	PB	88.	ppm	11-Aug-03	6010B
L030367-012	16-Jul-03	SMVR 4 24-48	AS	34.	ppm	11-Aug-03	6010B
L030367-012	16-Jul-03	SMVR 4 24-48	PB	<10.	ppm	11-Aug-03	6010B
L030367-013	16-Jul-03	SMVR 4 48-60	AS	38.	ppm	11-Aug-03	6010B
L030367-013	16-Jul-03	SMVR 4 48-60	PB	<10.	ppm	11-Aug-03	6010B
L030367-014	16-Jul-03	SMVR 4 60-84	AS	64.	ppm	11-Aug-03	6010B
L030367-014	16-Jul-03	SMVR 4 60-84	PB	<10.	ppm	11-Aug-03	6010B
L030367-015	16-Jul-03	SMVR5 0-24	AS	100.	ppm	11-Aug-03	6010B
L030367-015	16-Jul-03	SMVR5 0-24	PB	92.	ppm	11-Aug-03	6010B
L030367-016	16-Jul-03	SMVR 5 24-48	AS	231.	ppm	11-Aug-03	6010B
L030367-016	16-Jul-03	SMVR 5 24-48	PB	681.	ppm	11-Aug-03	6010B
L030367-017	16-Jul-03	SMVR 5 48-60	AS	<10.	ppm	11-Aug-03	6010B
L030367-017	16-Jul-03	SMVR 5 48-60	PB	<10.	ppm	11-Aug-03	6010B
L030367-018	16-Jul-03	SMVR 5 60-84	AS	375.	ppm	11-Aug-03	6010B
L030367-018	16-Jul-03	SMVR 5 60-84	PB	<10.	ppm	11-Aug-03	6010B
L030367-019	16-Jul-03	SMVR 6 0-24	AS	48.	ppm	11-Aug-03	6010B
L030367-019	16-Jul-03	SMVR 6 0-24	PB	109.	ppm	11-Aug-03	6010B
L030367-020	16-Jul-03	SMVR 6 24-48	AS	681.	ppm	11-Aug-03	6010B
L030367-020	16-Jul-03	SMVR 6 24-48	PB	1060.	ppm	11-Aug-03	6010B
L030367-021	16-Jul-03	SMVR 6 48-60	AS	20.	ppm	11-Aug-03	6010B
L030367-021	16-Jul-03	SMVR 6 48-60	PB	14.	ppm	11-Aug-03	6010B
L030367-022	16-Jul-03	SMVR 6 60-84	AS	2205.	ppm	11-Aug-03	6010B
L030367-022	16-Jul-03	SMVR 6 60-84	PB	<10.	ppm	11-Aug-03	6010B
L030367-023	16-Jul-03	SMVR 7 0-24	AS	104.	ppm	11-Aug-03	6010B
L030367-023	16-Jul-03	SMVR 7 0-24	PB	102.	ppm	11-Aug-03	6010B
L030367-024	16-Jul-03	SMVR 7 24-48	AS	307.	ppm	11-Aug-03	6010B
L030367-024	16-Jul-03	SMVR 7 24-48	PB	18.	ppm	11-Aug-03	6010B
L030367-025	16-Jul-03	SMVR 7 48-60	AS	3497.	ppm	11-Aug-03	6010B
L030367-025	16-Jul-03	SMVR 7 48-60	PB	<10.	ppm	11-Aug-03	6010B
L030367-026	16-Jul-03	SMVR 7 60-84	AS	1412.	ppm	11-Aug-03	6010B
L030367-026	16-Jul-03	SMVR 7 60-84	PB	<10.	ppm	11-Aug-03	6010B
L030367-027	15-Jul-03	S111A 0-18	AS	8238.	ppm	11-Aug-03	6010B
L030367-028	15-Jul-03	S111A 18-36	AS	17180.	ppm	14-Aug-03	6010B

SAMPLENUM	COLLECT DATE	CLIENTID	PROD	RESULT	UNITS	ANALYSIS DATE	METHOD
L030367-029	15-Jul-03	S111A 36-54	AS	9171.	ppm	11-Aug-03	6010B
L030367-030	15-Jul-03	S111A 54-72	AS	3206.	ppm	11-Aug-03	6010B
L030367-031	15-Jul-03	S111B 0-18	AS	53.	ppm	11-Aug-03	6010B
L030367-032	15-Jul-03	S111B 18-36	AS	109600.	ppm	19-Aug-03	6010B
L030367-033	15-Jul-03	S111B 36-54	AS	90980.	ppm	14-Aug-03	6010B
L030367-034	15-Jul-03	S111B 54-72	AS	26930.	ppm	14-Aug-03	6010B
L030367-035	15-Jul-03	S111C 0-18	AS	17080.	ppm	14-Aug-03	6010B
L030367-036	15-Jul-03	S111C 18-36	AS	82770.	ppm	14-Aug-03	6010B
L030367-037	15-Jul-03	S111C 36-54	AS	6568.	ppm	11-Aug-03	6010B
L030367-038	15-Jul-03	S111C 54-72	AS	7254.	ppm	18-Aug-03	6010B
L030367-039	15-Jul-03	S111D 0-18	AS	17840.	ppm	14-Aug-03	6010B
L030367-040	15-Jul-03	S111D 18-36	AS	123300.	ppm	14-Aug-03	6010B
L030367-041	15-Jul-03	S111D 36-54	AS	48020.	ppm	18-Aug-03	6010B
L030367-042	15-Jul-03	S111D 54-72	AS	19270.	ppm	18-Aug-03	6010B
L030367-043	15-Jul-03	S111E 0-18	AS	34680.	ppm	18-Aug-03	6010B
L030367-044	15-Jul-03	S111E 18-36	AS	11940.	ppm	18-Aug-03	6010B
L030367-045	15-Jul-03	S111E 36-54	AS	2194.	ppm	14-Aug-03	6010B
L030367-046	15-Jul-03	S112A 0-18	AS	28410.	ppm	18-Aug-03	6010B
L030367-047	15-Jul-03	S112A 18-36	AS	18100.	ppm	18-Aug-03	6010B
L030367-048	15-Jul-03	S112A 36-54	AS	10670.	ppm	18-Aug-03	6010B
L030367-049	15-Jul-03	S112A 54-72	AS	3650.	ppm	14-Aug-03	6010B
L030367-050	15-Jul-03	S112B 0-18	AS	28880.	ppm	18-Aug-03	6010B
L030367-051	15-Jul-03	S112B 18-36	AS	37830.	ppm	18-Aug-03	6010B
L030367-052	15-Jul-03	S112B 36-54	AS	8078.	ppm	14-Aug-03	6010B
L030367-053	15-Jul-03	S112B 54-72	AS	1817.	ppm	14-Aug-03	6010B
L030367-054	15-Jul-03	S112C 0-18	AS	134400.	ppm	18-Aug-03	6010B
L030367-055	15-Jul-03	S112C 18-36	AS	24030.	ppm	18-Aug-03	6010B
L030367-056	15-Jul-03	S112C 36-54	AS	5288.	ppm	14-Aug-03	6010B
L030367-057	15-Jul-03	S112C 54-72	AS	1555.	ppm	14-Aug-03	6010B
L030367-058	15-Jul-03	S112D 0-18	AS	46150.	ppm	18-Aug-03	6010B
L030367-059	15-Jul-03	S112D 18-36	AS	56240.	ppm	18-Aug-03	6010B
L030367-060	15-Jul-03	S112D 36-54	AS	16560.	ppm	18-Aug-03	6010B
L030367-061	15-Jul-03	S112D 54-72	AS	3337.	ppm	14-Aug-03	6010B
L030367-062	17-Jul-03	LS-42-1-0-12	AS	15690.	ppm	18-Aug-03	6010B
L030367-063	17-Jul-03	LS-42-2-12-24	AS	28060.	ppm	18-Aug-03	6010B
L030367-064	17-Jul-03	LS-42-3-24-36	AS	33080.	ppm	18-Aug-03	6010B

Boring Logs

July 2003 Sampling Event

PRE Excavation Sounconmat.
Ven. Plan. 7/15/03

Personal, JC, TW, DN, PW
Overcast, calm, 75°F.
Start By collecting Profile
Sample @ PS-01
Filled 3 Jars for Profile
Sample

EUT-0202-100 @ 0900
7/15/03
PS-01 - 4 HOLES @ 6' - 1FT SAMPLES
└ DEFERED TO LATER

(+) As_2O_3 PROFILE - SEE LOCATION ON
FIELD FIG 2 - 0845 PDT - ENCOUNTERED
As_2O_3 @ ≈ 18" BGS
COLLECTED 3 PROFILE SAMPLES

* FIELD VERIFIED LOCATION SS-9
& NOTED REVISED LOCATION ON
FIELD FIG 1.

S-112 A-D - 4 HOLES @ 6' TO
W/ SAMPLE INTERVALS @ 1'

S-112 C - 0935 START

DEPTH (BGS) INTERVAL	SAMPLE
0-18"	RECOVERED ≈ 1 4" 0-4" GRAVEL SAND W/ SOME BRICK
S-112C 0-18	4"-8" BRICK & DIRT W/ SOME WHT COLOR 8"-16" DIRT W/ SOME BRICK FRAGMENTS
~~S-112C-12-24~~	N/A
18"-36"	RECOVERED ≈ 1/2 OF SS: TOP 4" DIRT
S-112C-18-36	SANDY SILT; TO BOTTOM OF SS SILTY SAND BROWN, LITTLE BRICK

JULY EVENT

7/15/03 EVERETT

S-112C -

DEPTH INTERVAL BGS	SAMPLE
36"-~~48"~~ 54	FULL SS RECOVERED 36-42" - CLYSILT W/
S-112C-36-54	SOME BRICK, BROWN 42-54 - CYLSILT W/ WHT CRYSTALLINE (As_2O_3 PROBABLY) W/ BRICK FRAGS IN BOTTOM
54"-72"	FULL SS RECOVERED TOP 4" BROWN SANDY SILT W/O BRICK
S-112C-54-72	REMAINING DEPTH (18") BROWN/GREY SILTY - 14" GLACIAL TILL

END HOLE @ 72" BGS 1005 PDT

JULY EVENT

S-112B - SEE FIG 2 - FIELD

DEPTH INTERVAL BGS	SAMPLE
S-112B-0-18 0-18"	TOP 4" GRAVEL FILL 4"-18" SILTY SAND W/ BRICK FRAGS @ 8", SOME WHT CRYSTALLINE & BRICK INTERMIXED TO 18" - LT BROWN MUCH BRICK @ 18"IN
18"-36"	
S-112B-18-36	LITTLE RECOVERY MOIST - SANDY BROWN W/ BRICK FRAGS - SOME GREY

7/15/03 EVERETT

DEPTH INTERVAL (BGS)	SAMPLE
36-54"	75% RECOVERY
S-112B-36-54	BRICK @ TOP TO 6" (± 42") - GLACIAL TILL TO 54" - BROWN GREY - MOIST ABOVE TILL RIGHT BELOW BRICK - GOOD VISUAL DISTINCTION
54"-72"	
S-112B-54-72"	75%+ RECOVERY GLACIAL TILL - LTBROWN/GREY - SANDY SILT - WTR @ BOTTOM ± 69" BGS

DEPTH INTERVAL BGS	SAMPLE
0-18"	60%+ RECOVERY
S-112A-0-18"	TOP 6" - SOD -
SEE FIG 2 FIELD	TOPSOIL DARK BROWN
FOR LOCATION	BRICK TO BOTTOM OF HOLE - NO SOIL INTERMIXED
18-36"	50%± RECOVERY
S-112A-18-36	MOIST - BRICK SOIL, SOMEWHAT CHRYSOTILE ACL INTERMIXED MORE BRICK @ BTM OF HOLE
36-54"	50% RECOVERY
S-112A-36-54	SILTY SAND, BROWN VERY LITTLE BRICK FRAGS, LIGHT BROWN GLACIAL TILL AT BTM OF SS

July event

JULY EVENT

7/15/03 EVERETT

DEPTH INTERVAL BGS	SAMPLE
54"-72" S-112A -54-72	80% RECOVERY REDISH/BRN BRICK & SOIL INTERMIXED TOP 4", CLEAR DEMARCATION TO GLACIAL TILL - LT BRN & GREY TILL TO BTM OF SS @ 72" BGS TILL ENCOUNTERED ≈ 64" ±
S-112D -0-18" 0-18" SEE FIG 2-FIELD FOR LOCATION	FULL RECOVERY - TOP 3" - SOIL/GRAVEL 4" BGS BRICK FRAGS & SOIL GRADING TO BRICK @ BTM OF SS (18" BGS)

DEPTH INTERVAL (BGS)	SAMPLE
18-36" S-112D-18-36	FULL RECOVERY SOIL & BRICK FRAGS 18-24" BGS BRICK 24-32" SANDY DEBRIS W/ WHT CHRYSTALS TO 36"
36"-54" S-112D-~~48~~ 36-54 - TD MAY BE ≈ 60"	DRILL PENETRATED ≈ 6" - FELL DOWNHOLE - MOIST - SANDY W/ BRICK FRAGS 2" - GRADING TO WEATHERED TILL & TILL - LT BROWN & MOIST @ 42" WOOD @ 52" TO BTM - BACK BRN - BLACK
54-72 (60" - 78" TD) S-112D-54-72	FULL RECOVERY - TILL WEATHERED WET ≈ 60" ±
CLEAR DEMARCATION	NO BRICKS, BROWN

FINNISH 1200PDT TO BTM OF SS

JULY EVENT

7/15/03 EVERETT

S-111-A-D 1220 PDT

DEPTH INTERVAL (BGS)	SAMPLE
0-18" S-111A-0-18	50% RECOVERY TOPSOIL/SUBSOIL 6"; SANDY SILT-BRN TO DEPTH, WOOD IN BOTTOM OF SS. NO BRICK/FRAGS
DRIVE 4 SS W/O AUGER DUE TO STEEP SLOPE - HOLE STAYED OPEN	
18"-36" S-111A-18-36	60% RECOVERY SANDY SILT-LT. BRN, GRADING TO SILT @ BTM OF SS NO BRICK, SOME SML GRAVELS
36-54" S-111A-36-54	65% RECOVERY - SILT LT BRN - 4"; BRICK (~40") 4" HORIZON DEBRIS & BLACK SOIL BELOW; WEATHERED TILL TO BTM OF SS

DEPTH INTERVAL BGS	SAMPLE
54-72" S-111A-54-72	FULL RECOVERY - SANDY SILT W/BRICK FRAGS - 54-58"; WEATHERED TILL GRADING TO GLACIAL TILL TO BTM OF SS. CLEAR DEMARCATION @ TILL; SOME WHT CHRYSTALS AT BRICK HORIZON, WELL INTERMIXED
S-111D-0-18 0-18" 1340 PDT	75% RECOVERY 0-10" - SOD - SUBSOIL SILT, BRICK & DEBRIS LAYER CLEARLY @ 10" W/ WHT CHRYSTALS; BLACK, SANDY DISTINCT FROM SURFACE SOIL HORIZON 10"-18"

7/15/03 EVERETT

DEPTH INTERVAL (BGS)	SAMPLE
S-111D-18-36 18"-36"	50% RECOVERY BRICKS/DEBRIS & WHT CRYSTALS LITTLE SOIL, VISUALLY DISTINCT - BLACK "SALT & PEPPER"
S-111D-36-54 18-36-54	80% RECOVERY - BRICK & DEBRIS - BLACK; SOME WHT CRYSTALS WEATHERED TILL @ 52" w/ WOOD @ BTM; ALL INTERMIXED & DISTINCT FROM TILL
S-111D-54-72 54-72"	85% RECOVERY - @ 54" - GLACIAL TILL MOIST @ BTM DISTINCT COLOR (GREY) FROM DEBRIS LAYER IN PREVIOUS SAMPLE; NO BRICK/ DEBRIS

DEPTH INTERVAL (BGS)	SAMPLE
S-111B-0-18 0-18"	<15% RECOVERY TOPSOIL/SOD ONLY
S-111B-18-36 18-36"	50% RECOVERY BRICK & DEBRIS W/ WHT CRYSTALS, WOOD @ BTM of SS, WELL INTERMIXED
S-111B-36-54 36"-54"	25% RECOVERY BRICK, THEN WOOD THEN TILL VERY DISTINCT HORIZON MOIST - TILL BY 54"
S-111B-54-72 54"-72"	70% RECOVERY MOIST SILT - WEATHERED LT BRN; DENSE SILT & TILL @ BTM of SS (72"); NO BRICK OR DEBRIS DISTINCT HORIZON w/ PREV SAMPLE
HAND PIT	

JULY EVENT

7/15/03 EVERETT 1445 PDT
S-111C — SEE FIG 2 FIELD

DEPTH INTERVAL (BGS)	SAMPLES
0-18"	RECOVERY ≈ 70%
S-111C-0-18"	TOPSOIL/SUBSOIL-4" THEN 6" FILL-BRN, SILTY BRICKS @ 10" FRAGS W/ SILTY SOIL-BRN TO 18"
18-36"	RECOVERY ≈ 50%
S-111C-18-36	BRICKS & FRAGS & SOIL INTERMIXED. DISTINCT HORIZON TO FILL (BRN) & SILT @ ≈ 32"; NO FRAGS BELOW THIS
36-54"	RECOVERY ≈ < 10%
S-111C-36-54	BROWN SILT W/ SOME GRAVEL, NO REAL BRICK FRAGS SEEMED LIKE WERE DRILLING THRU BRICKS

DEPTH INTERVAL (BGS)	SAMPLES
54-72"	RECOVERY ≈ 100%
S-111C-54-72	WEATHERED, WET FILL @ 54"-58". MOIST — DRY FILL GRADING TO TIGHT SILT @ 72". BROWN & GREY, DISTINCT HORIZON W/ PREV SAMPLE; NO BRICK OR DEBRIS
1500 PDT	
S-111E — SEE FIG 2 FIELD	
1515 PDT	
0-18"	100% RECOVERY
S-111E-0-18	0-8" SOD TOPSOIL & SUBSOIL/FILL. DISTINCT HORIZON ≈ 8" — BLACK/SANDY W/ WHT CHRYSOTILE TO 18" — DEBRIS WELL INTERMIXED

JULY EVENT

7/15/03 EVERETT

DEPTH INTERVAL (BGS)	SAMPLE
18-36"	RECOVERY ≈ 80%
S-111E-18-36	18" DOWN - BLK & WHT (SALT & PEPPER) DEBRIS BRICK @ 24"-28". SILT & TILL BELOW 30" W/O BRICK OR DEBRIS. CLEAN HORIZON
36-54"	RECOVERY ≈ 100%
SE-111E-36-54	GLACIAL TILL: GREY TIGHT, NO DEBRIS OR BRICKS/FRAGS WEATHERED @ 3½" & TIGHT BELOW 40"
1540 PDT	

STOPPED S-111E @ 54" BGS.

DILNelson 7/15/03

7/16/03 EVERETT 0800

START ON SMVR BORINGS ON GMVD

DEPTH INTERVAL (BGS)	SAMPLE
TD = 8', 2'-0" SAMPLE INTERVALS	SEE FIELD FIG 4 FOR LOCATION
SMVR-7	RECOVERY ≈ 85%
0-2' (+4") →	(TOP 4" - AC PAVE NOT SAMPLED)
SMVR-7-0-24	12" ROAD BASE - CLEAR HORIZON @ 12" BGS (TA")
INTERVALS: (SMVR)	BLACK/GREY W/ WHT CRYSTALS & BRICK FRAGS TO 24"
* 0-24	SOME TILL IN GRAVEL
* 24-48	SOME (MIN) MIXING IN LOWER SUB-BASE.
* 48-60	
* 60-~~96~~ 84	

JULY EVENT

JULY EVENT

7/16/03 EVERETT

DEPTH INTERVAL (BGS)	SAMPLE
SMVR 7-24-48 (24-48")	RECOVERY ≈ 90% WEATHERED TILL - REDDISH BROWN W/ SILT/GRAVEL, NO BRICKS/FRAG/DEBRIS
SMVR 7-48-60 (48-60")	RECOVERY ≈ 90% WEATHERED TILL - REDDISH BROWN - SILT & GRAVEL; NO BRICK/FRAGS/DEBRIS DRY, CONSOLIDATED
SMVR 7-60-84	RECOVERY ≈ 100% SILTY SAND 60-68"; WEATHERED - REDDISH BROWN, NO BRICKS/FRAG OR DEBRIS; GRADING TO GLACIAL TILL TO BOTTOM of HOLE, GREY & BRN, FEW GRAVELS, DRY, NO BRICKS, FRAG OR DEBRIS MOIST AT BOTTOM

0845 PDT

DEPTH INTERVAL (BGS)	SAMPLE
SMVR-6 - 0940 PDT	SEE FIG 4 FIELD FOR LOCATION: 12' E of W CURB ON EMVD, 13' S of EVH
0-24 SMVR-6-0-24 (0-8" AC PAVING - 0-24 STARTS @ 8" BGS)	RECOVERY ≈ 100% 0-14 - PAVING & SUBBASE BROWN 14-24 APPEARS TO BE SMELTER DEBRIS BLACK & WHT SAND & GRAVEL INTERMIXED - SAMPLE LOWER 10" of SS. (SOME FILL/SILT ABOVE 14" - BROWN) CLEAR HORIZON @ 14"
SMVR-6-24-48 24"-48" TOP	RECOVERY ≈ 60% SANDY GRAVEL W/ DEBRIS INTERMIXED BLACK/BRN - SOME SMALL BRICK FRAGS

7/16/03 EVERETT
SMVR-6-24-48 CONT

DEPTH INTERVAL (BGS)	SAMPLE
	HORIZON DISTINCT @ ≅ 44" TO WEATHERED SILT/TILL - REDDISH BRN, W/ SOME GRAVELS NO DEBRIS AT BTM
SMVR-6-48-60 (48-60)	RECOVERY ≅ 50% WEATHERED SILT REDDISH BRN, LITTLE SIGN OF DEBRIS; BTM APPEARS TO BE TILL; SOME WOOD IN 48-56 LAYER, DRY
SMVR-6-60-84 (60-84)	RECOVERY ≅ 85% SILT/GRAVEL - LT BRN W/GREY; DRY, NO SIGN OF DEBRIS & FRAGS OR BRICK PROBABLY FILL; DOESN'T LOOK LIKE TILL.

1015 PDT

DEPTH INTERVAL (BGS)	SAMPLE
SMVR-5	SEE FIELD FIG 4 FOR LOCATION
	1040 PDT
0-24	RECOVERY ≅ 100%
SMVR-5-0-24 (TOP 7" BGS IS AS PAVEMENT)	0-13" AC W/SUBBASE + SOME FILL XTION @ 13" TO FILL W/BRICK FLAKES. CLEAR HORIZON @ 13" TO BTM of SS OF BLK & WHT DEBRIS W/SAND & GRAVEL WELL MIXED
24-48	RECOVERY ≅ 75%
SMVR-5-24-48	DEBRIS & GRAVEL - BLACK TO 28"; FILL @ 28" W/ BRICK FLAKES & INTERMIXED DEBRIS TO 36", GREY
CLEAN HORIZON @ 36"	36-48 FILL - REDDISH BRN W/SOME GRAVEL MOSTLY SILT. NO DEBRIS.

JULY EVENT

JULY EVENT

7/16/03 EVERETT

DEPTH INTERVAL (BGS)	SAMPLE
SMVR-5-48-60 (48-60")	RECOVERY ≅ 60% CONTINUATION OF SILTY FILL W/SOME GRAVEL, NO DEBRIS
SMVR-5-60-84 (60-84)	RECOVERY ≅ 80% CONTINUATION OF SILTY FILL W/SOME GRAVEL, REDDISH BROWN, NO DEBRIS OR BRICKS AT ALL TO BTM OF SS.

1100 PDT

SMVR-5,
20' SOUTH of EVR
12' E of WEST CURB ON EMVD

DEPTH INTERVAL (BGS)	SAMPLE
SMVR-4	SEE FIELD FIG 4 FOR LOCATION 1130 PDT
0-24	RECOVERY ≅ 100%
SMVR-4-0-24 (AC PAVING TO N/A BGS) FIRST TRY HIT CONCRETE UNDER AC AFTER 3'. MOVE ≅ 5' SOUTH.	CLINT'S RECORDS OF TRENCH E-W ACROSS EMVD SHOWED 6"-8" CONCRETE.

SECOND TRY - REFUSAL, TRYED BORING & NO LUCK; MOVE ≅ 16' W TO POINT IMMEDIATELY OFF SIDEWALK TO SEE IF WE CAN LOCATE OLD STRUCTURE UNDER GRASS.

0-6" - TOPSOIL/SOD
6-12" FILL, SILTY
12-24 CLEAN HORIZON SOIL W/ DEBRIS, BLK & GREY W/SOME WHT CHRYSTALS, INTERMIXED, SILT, REDDISH BRN @ BTM OF SS.

7/16/03 EVERETT

DEPTH INTERVAL (BGS)	SAMPLE
SMVR-4-24-48 (24-48")	RECOVERY ≅ 100% SILTY, BRN/RED W/SOME BRICK FRAGS 24-30". FILL/TILL 30"-42", GREY/BRN W/SILT SOME GRAVEL, DEBRIS & WHT CRYSTALS IN BTM 6" & SOME ORGANIC (ROOTS) - DENSE, SILTY, GREY DRY, SOME GRAVEL) 1"
	CLEAN HORIZONS
SMVR-4-48-60 (48-60")	RECOVERY ≅ 100% WEATHERED TILL/FILL SILTY GREY/REDDISH MOTTLING, SOME ORGANICS IN UPPER 6", GRADING TO DENSER SILT W/DEPTH NO SIGN OF DEBRIS OR BRICKS/FRAGS

DEPTH INTERVAL (BGS)	SAMPLE
SMVR4-60-84 (60-84")	RECOVERY ≅ 100% SILTY SAND, MOIST GREY, DENSE, UNIFORM THRU-OUT PROFILE, LITTLE GRAVEL, NO SIGN OF DEBRIS BRICKS OR FRAGS
1230 PDT	
LOCATION OF SMVR4 IS 4' WEST OF CURB ON W. SIDE OF E MVD, 63'± S OF EM13.	
1435	
SMVR-1-0-24 (0-24") (SEE FIG 4 FIELD FOR LOCATION)	RECOVERY ≅ 100% 4" AC BEFORE 0" 0-12"-SAND, DEBRIS & BRICK, BROWN/BLACK & RED, SOME WHT CRYST, 12"-CLEAR HORIZON - 12"-24" FILL MOTTLED SILT RED/BROWN - NO FRAGMENTS BELOW 12"
WET @ 24"	

JULY EVENT

JULY EVENT

7/16/03 EVERETT

DEPTH INTERVAL (BGS)	SAMPLE
SMVR-1-24-48 (24-48")	RECOVERY ≈ 100% SILTY SAND 24-48, MOTTLED RED/ORANGE & GRAY/BROWN, LITTLE GRAVEL, HOMOGENIOUS THRU-OUT CORE - MOIST - NO DEBRIS OR BRICKS/FRAGS
SMVR-1-48-60 (48-60")	RECOVERY ≈ 100% SANDY W/GRAVEL & SOME COBBLE, GRADING TO SILTY SAND @ BTM, BRN/GREY W/ SOME REDDISH MOTTLING, WET @ 60"; NO DEBRIS BRICK OR FRAGS
SMVR-1-60-84 (60-84")	RECOVERY ≈ 100% TOP 8" SANDY W/GRAVEL & WET; XTION TO SILT W/ LITTLE SAND, NO GRAVEL NO DEBRIS, GREY, DRY

@ ≈ 68"

1500 PDT

DEPTH INTERVAL (BGS)	SAMPLE
SMVR-2-0-24 (0-24")	1530 PDT RECOVERY ≈ 100% ≈ 6" AC ABOVE EL 0" TOP 4" AC & SUBBASE; CHG. TO REDDISH/BRN SILT W/ INTERSPERSED GRAVEL TO 24"; NO SAND; SIGN OF DEBRIS OR BRICKS/FRAGS.
SMVR-2-24-48 (24"-48")	RECOVERY ≈ 100% UPPER 8" RED/BRN MOTTLED SILT W/ SOME GRAVEL/SAND; 32-48" GREY CLY SILT W/ NO GRAVEL - VERY HOMOGENOUS, TIGHT & DRY TO 48"; NO DEBRIS, BRICKS OR FRAGS.

JULY EVENT

7/16/03 EVERETT

DEPTH INTERVAL (BGS)	SAMPLE
SMVR-2-48-60 (48-60")	RECOVERY ≈ 100% GLACIAL TILL - CONTINUATION OF PREVIOUS SAMPLE; DRY, TIGHT, GREY CLY SILT TO 60"
1545 PDT STOP @ 60"	
SMVR-3-0-24 (0-24") SEE FIELD FIG 4 FOR LOCATION 1600 PDT	RECOVERY ≈ 100% TOP ≈ 5" AC BEFORE 0"; AC/ROAD FILL 0-12"; CLEAR HORIZON @ 12" - BRICK, DEBRIS, WHT CHRYSTALS INTERMIX TO ≈ 22"; MOTTLED BRN SILT AT 24", WET (MOIST).
SMVR-3-24-48 (24-48")	RECOVERY ≈ 100% TOP 4" DEBRIS & SOIL; AT 28" CLEAR HORIZON TO 6" LAYER - TAN CLY SILT;

DEPTH INTERVAL (BGS)	SAMPLE
SMVR-3-24-48 CONT	≈ 34" HORIZON & GRADES TO SILTY SAND, NO DEBRIS AFTER 28" BGS, SILTY SAND TO 48" & SOMEWHAT MOIST
SMVR-3-48-60 (48"-60")	RECOVERY ≈ 100% GLACIAL TILL - GREY SILTY SAND DENSE, NO GRAVEL, NO DEBRIS OR BRICKS/FRAGS HOMOGENOUS THRU-OUT
END @ 60" TD 1625 PDT	

7/17/03 EVERETT - 0800 PDT
LS-42 - 6 BORINGS to 3 ft
& COMPOSITE 1 ft INTERVALS
FROM ALL 6 = 3 COMPOSITE
SAMPLES - SEE FIG 3 FIELD
FOR LOCATIONS

DEPTH INTERVAL BGS	SAMPLE
LS-~~34C~~ 42	RECOVERY ≈ 100
0-12"	TOPSOIL/SUBSOIL W/ BRICK FRAGS, WELL MIXED (SMALL FRAGS) BRN, CLEAN BTTOM @ 12"
12-24"	SILTY FILL, BRN, SOME BRICK FRAGS, NO GRAVEL, DENSE
24-36"	WEATHERED TILL W/ SOME FILL MOTTLED GREY W/ RED, GRADING TO SILTY SAND @ 36"
STOP @ 36"	NO BRICKS OR DEBRIS

DEPTH INTERVAL BGS	SAMPLE
LS-~~34F~~ 42	RECOVERY ≈ 65%
0-12"	TOPSOIL/SUBSOIL - LOOSE GREY/BRN BRICK FRAGS @ 12"
12-24"	SOIL W/ BRICK FRAGS, CLEAN HORIZON ≈ 12" SOMEWHAT CHRYSTALS WELL INTERMIXED W/ BRICK & SILTY SAND, DRK BRN.
24-36"	NO RECOVERY

JULY EVENT

7/17/03 EVERETT

SAMPLE INTERVAL SAMPLE (BGS)

LS-34A2-B HAND AUGER

0-12" TOPSOIL/SUBSOIL BRICK & DEBRIS @ 8-12"

12-24" BRICK & SANDY SOIL WELL INTERMIXED; DISTINCT HORIZON W/ PREV INTERVAL, 80/50 BRICK/SOIL & SOME WOOD CHIPS

24-36 SANDY SOIL, BLK W/ BRICK & WOOD CHIPS, EASY AUGER WOOD @ BTM @ 36"+. SOME CONT CRYSTALS, WELL MIXED THRU-OUT

DEPTH-INTERVAL SAMPLE (BGS)

LS-42A RECOVERY ± 90%

0-12" TOP 4" GRAVEL FILL; 4"-10" GRAVEL & SILT FILL, GREY, LOOSE NO BRICKS OR DEBRIS

12-24" SILT & GRAVEL W/ BRICK & DEBRIS, LOOSE WELL MIXED W/ GRAVELS (1/2") BRN & GREY

24-36" SILT & GRAVEL W/ BRICKS & DEBRIS, WELL MIXED, BRN & BLK, ~~WEATHERED~~ FILL W/ WOOD @ 34"± WEATHERED TILL? CLEAN TRANSITION SILTY W/ SOME GRAVEL @ 36", DENSE

JULY EVENT

7/7/03

DEPTH INTERVAL (BGS)	SAMPLES
LS42-D	RECOVERY ≅ 100%
0-12"	SURF. VEG & GRAVEL FILL: 0-6", LOOSE SILTY GRAVEL W/ BRICK TO 12" GREY, LT BRN.
12-24"	HORIZON TO DRK BRN & BLACK ≅ 14". GRAVEL & BRICK W/ DEBRIS LOOSE WELL MIXED TO 24", LOTS OF FRAGS.
24-36"	CONTINUE BRICK FRAGS & DEBRIS - DRK BRN & BLACK TO 32", CLEAR HORIZON @ 32" & XTION TO SILTY BRN FILL/TILL W/ SOME GRAVEL & LITTE GRAVEL NO BRICKS/DEBRIS AFTER 52"

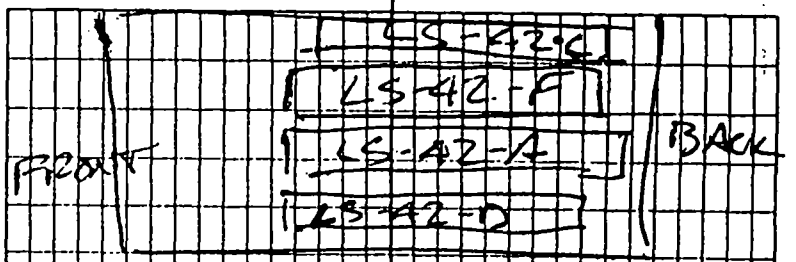


PHOTO DIRECTION

DEPTH INTERVAL BGS	SAMPLE
LS42-E 0-12"	TOPSOIL/SUBSOIL W/ SOME SMALL BRICK CHIPS, LOOSE
12-24"	REAL SOD TO AUGER BRICK & SAND W/ WHT CHRYSTALS WELL MIXED
24-36"	BRICKS & BLK SAND TO 36" & BEYOND, HARD TO AUGER, SOME GRAVELS MIXED IN

JULY EVENT

7/22/03 EVERETT
09/5 PDT
TRENCH ON PILCHUCK - S. SIDE
STATION S to N

+3' - (BGS) - 0-1 - SANDY FILL
1-2 - DEBRIS/BLK
2-3.5 REDDISH FILL
w/ SOME FLECKS
>3.5 FILL GRADING
TO TILL - GREY @ 6'

+10' SIMILAR TO STATION +3'
SOME BRICK FRAGS

+13-+15 SAME PROFILE LARGER
BRICKS & FRAGS
WELL INTERMIXED
2 SAMPLES ("PILCHUCK
PARALLEL") of BRICKS
LARGER ROCKS/STONES
(+6" - 12" & ABOVE
ENCOUNTERED ≈ 3'-4'

+15-20' LOTS OF BRICK @ 3'-4' BGS
+6" SIZE, WELL MIXED
DISTINCT LAYER @ 4' BGS

STATION	NOTES
+16-18'	4' BGS BRICKS/DEBRIS & SOME WOOD - LOOKS LIKE COLLAPSED FLUE GLACIAL TILL @ 4.5' BGS
4' ± LENGTH of POCKET of DEBRIS STARTING @ +15	SOME WHT CHRYSTALS ≈ 2-3' BGS - WELL INTERMIXED w/ BRICKS & DEBRIS
+24 - SOUTH END of FIRST SIDEWALK INDEX	
+22 - +24	0-18" BGS FILL BRICK FRAGS @ 18" BRICKS & DEBRIS w/ INTERMIXED CHRYSTALS @ 2' BGS TILL @ BTM - 4.5' BGS
+28	ABANDONED WTRLINE SHALLOW ROCK/CONC ≈ 0-12" SAMPED

7/22/03 EVERETT

STATION	NOTES
+28	WOOD / BRICKS @ 2' BGS DEBRIS LAYER GETS SHALLOWER AS WE MOVE NORTH
+30 - +32'	NORTH / < 12" BGS COMPLETE BRICKS (SAMPLED)
+36	DEPTH TO TILL 4' BGS
+38	CONC; SIDEWALK (?) 0-6" + 12" SLABS ±
	→ ALSO REFRACTORY SAND (?) SAMPLED - +32' BRICKS / DEBRIS W/ WHT CHRYSTALS INTERMIXED ± 1'-3.5' BGS TILL @ 4' CONC @ SURFACE UNDER SOD W/ BRICKS IMMEDIATELY BELOW (< 1' BGS)
+40	APPEARS WALL / FNDTN; BRICKS & CONC. @ 3.5' BGS, WHOLE BRICKS & LAYED IN-PLACE UNDERLAIN BY CLEAR HORIZON OF TILL @ ≈ 4' BGS

STATION	NOTES
4½ - 48	BRICKS (OLD) CONC. FENCE FOOTINGS 0-18" BRICKS SHALLOW 18"
44	BRICKS @ 2' BGS INTERMIXED
42-44'	W/ SOIL; ≈ 3' BGS BRICK & WHT CHRYSTALS, TILL @ 4' - CLEAR HORIZON
	BTM OF FLUE VISABLE @ 4' BGS
+53'	EDGE OF FIRST DRIVEWAY INDEX BRICK & DEBRIS < 6" BGS
	DRAIN PIPE ≈ 2.5' - (6")
INVERT	≈ 2.5' - CARRY ACROSS TRENCH; CLEAR TILL HORIZON @ ≈ 3.5' BGS. BRICKS & DEBRIS FROM -6" - 3.5' BGS
	→ WALL ≈ 53 (?)
@ 53'	STEP OFF D/W TO EAST; TOP 12" (6.5' E CTR/CTR) FILL
	DRAIN @ 2.5' BGS DEBRIS & BRICKS FROM 1' - 4.5' - TILL @ 5'
	WHT CRYSTALS @ +55 @ 4' BGS

JULY EVENT

7/22/03 / EVERETT

STATION	NOTES
+56	NO BRICK IN ALL HORIZONS & TILL @ 5' BGS; DEBRIS @ 1' BGS; WTR LINE ABAND
+60	SAME - SOME SMALL BRICK CHIPS
+65	SAME - SOME SML BRICK & WOOD CHIPS - WOODY @ 3' BGS
+69	POST @ 66 @ 4'
INDEX - NEDGE D/W	
1200 PDT BREAK	→ DEBRIS (BLK) @ 2' TILL @ 5' BGS, FEW BRICK CHIPS
+69	RE-ESTABLISH 0-53 TRENCH LINE @ 1240 PDT; BRICKS @ 1' BGS
+71	ENCOUNTERED WALL - BRICKS & MORTAR & DEBRIS @ ≈18" BGS. SAMPLED BRICK W/ MORTAR; MUCH OF STRUCT IN-TACT WALL/FLOOR EXTEND TO NORTH, BRICK FTG TO 3'

STATION	NOTES
+71	FTG TO ≈ 4', TILL BELOW; LARGELY INTACT BRICK FLOOR, 1 COURSE, VISIBLE BOTH SIDES OF TRENCH @ 2' BGS, CLEAR HORIZONS, DEBRIS & RESID ON TOP OF FLOOR FROM 1'-2' BGS.
+79	SAME @ +79 ENCOUNTERED GEO FABRIC @ 1.5' BGS - PROBABLY TPGA. DEBRIS/BRICK ON TOP OF FLOOR (BRICK @ 2' BGS), DEBRIS/BRICK SHALLOWER - W/ 1' BGS AS MOVE NORTH WOOD ABUT 3' BGS; FLOOR ENDS (DUE TO TPGA?).
+89	- TPGA MARKER - BACK FILL BETWEEN ≈ 483 TO +88 EX TO 5' BGS & CONTINUE TO NORTH - TILL @ ≈ 5'
+85-86	BRICK FLOOR ≈ 2.5' BGS

JULY EVENT

JULY EVENT

7/22/03 EVERETT

STATION	NOTES
+95	BRICK FRAGS INTERMIXED @ 18" BGS & SHALLOWER
+100	CONCRETE 3'x3' ≈ 1' BGS
INDEX - S. SIDE of SHORT S/W	TILL TRENDING SHALLOWER TO ≈ 3.5-4' BGS, CLEAR HORIZON @ 4'; BRICK FROM 1'-3.5' BGS, WELL MIXED TP6B MARKER EXCAVATED @ ≈+100'. FABRIC @ +102'
+105	BACKFILL & FABRIC FROM TP6B; POSS FLOOR @ ≈ 2.5' BGS @ ≈+107; TILL ≈ 4' BGS W/ DEBRIS FROM 1'-3.5' BGS
+107	TILL @ 4.5' BGS
+112	BRICK & DEBRIS 0.5'-3.5' W/ CLEAR TILL HORIZON ≈ 4' BGS; BLK DEBRIS ≈ 2' BGS
+118	SHALLOW BRICK
+120	FABRIC @ 0.5', SOME BRICK
+122	END TRENCH; TILL 4' BGS
1425 PDT	

PILCHUCK TRENCH BOTTOM (PTB)

STATION	NUMBER
~~PTB~~ PTB 120	PTB - 120
" 110	" - 110
" 100	" - 100
" 90	" - 90
80	" - 80
70	" - 70
~~60~~	~~" - 60~~
NOT SAMPLED ~~50~~	~~" - 50~~
40	" - 40
SAMPLED 30	" - 30
20	" - 20
10	" - 10
~~0~~	" - 0

STOP 1615

OTHER SAMPLES 7/22/03:
PILCHUCK PARALLEL +10; PP +13 (BOTH BRICKS);
PP +32 (BRICK); PP +32 (~~CONCRETE~~ MORTAR OR REFRACT SAND)
PP +28 (CONCRETE)
PP +53 (DRAIN PIPE)
PP +71 (BRICK)

JULY EVENT

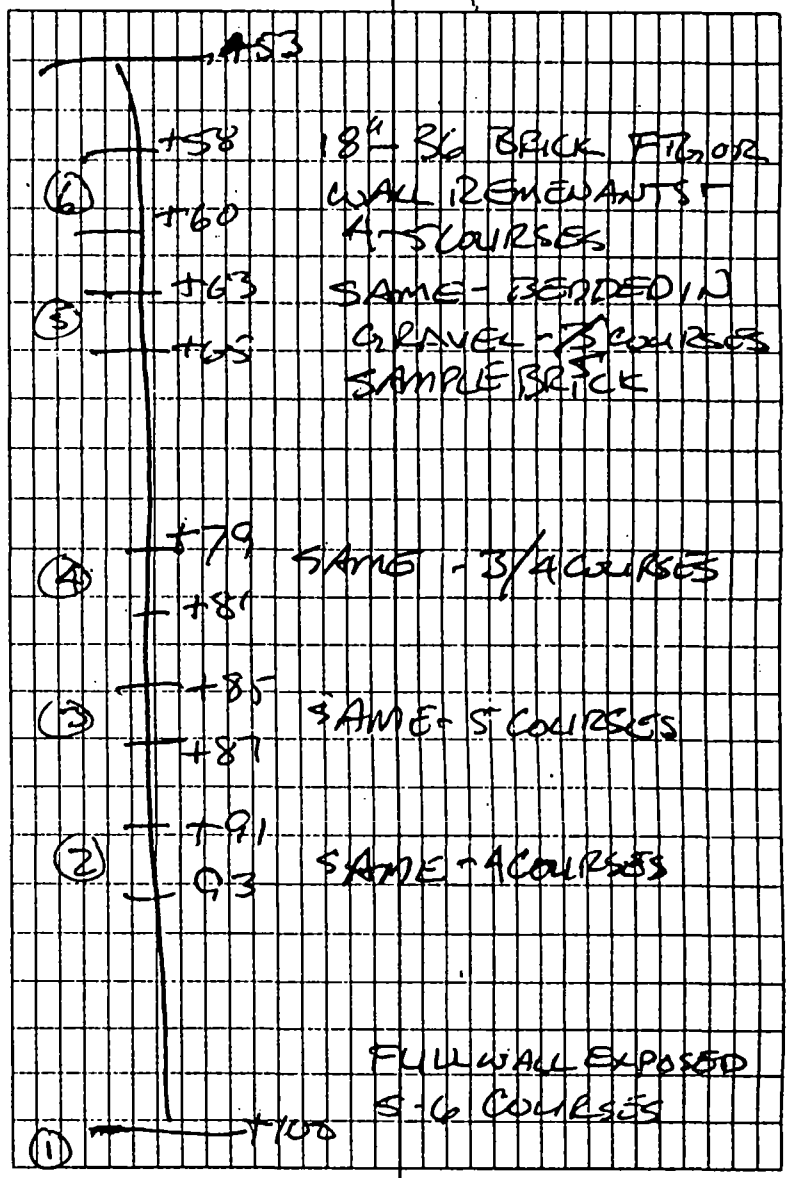
7/23/03 EVERETT

STATION	NOTES
+10	FILL 0-12" BGS BRICK & MORTAR 18"-36" BGS TILL @ ≈ 4 to 4.5 BGS, CLEAR HORIZON
+0	INTERMITANT BRICK TO +0 FROM +10, TRENDING LESS AS MOVE WEST, OTHERWISE SAME AS +10; TILL @ 4' BGS; BRICKS @ ≈ 2-2.5' BGS WL END OF TRENCH SOIL SAMPLED ≈ 2' BGS

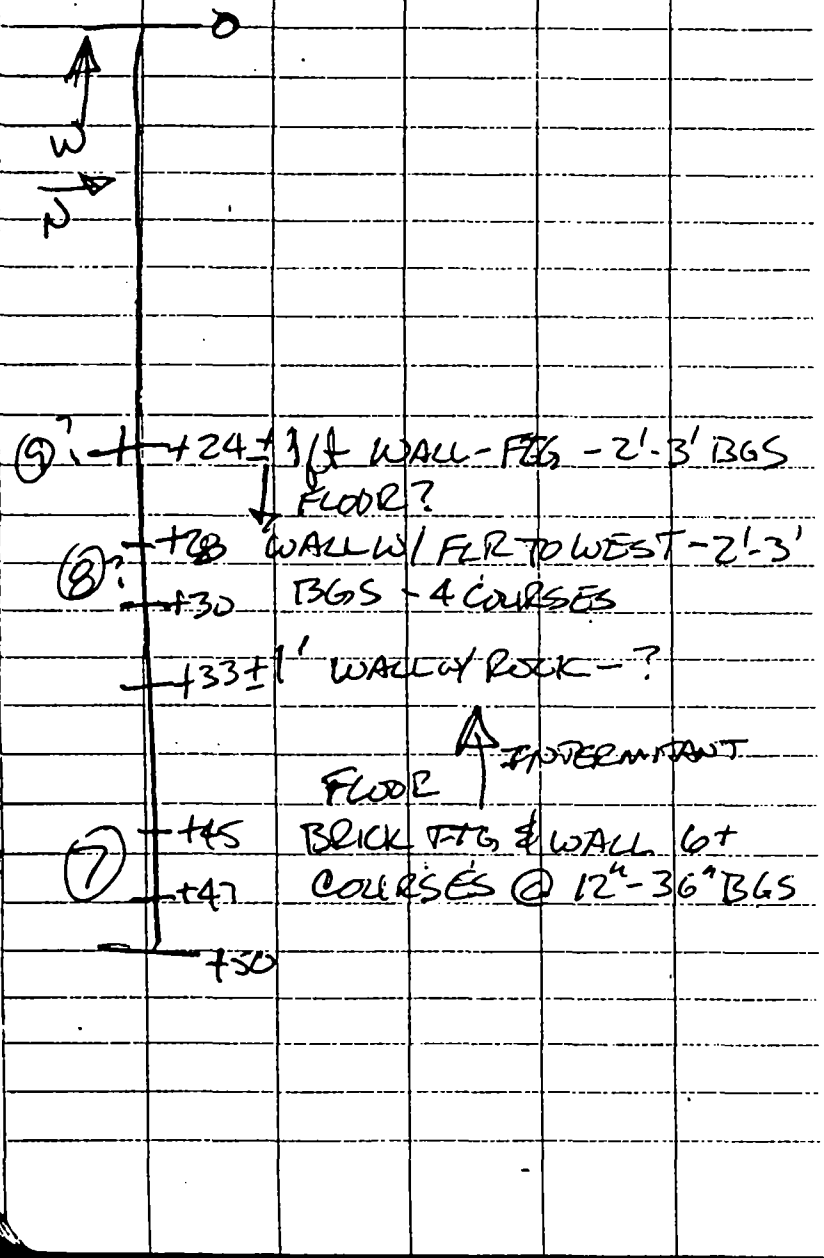
STEP DOWN to +53 to +100:

+53 to 100 GENERAL PROFILE:

0-18 BGS TOPSOIL & FILL
18-36 FILL W/ SMELTER RESID.
36-48 REDISH BROWN FILL/TILL
>48± TILL - CLEAR HORIZON



7/23/03 EVERETT



PICKLICK/ALLEY TRENCH BOTTOM SAMPLES (PART B)

STATION	SAMPLE NO
+0	PART B - 0
+14	" - 14
+30	" - 30
+40	" - 40
+50	" - 50
~~+60~~ 53	" - 53
+60	" - 60
+70	" - 70
+80	" - 80
+90	" - 90
+100	" - 100

OTHER SAMPLES ON 7/23/03:
PICKLICK/ALLEY +30 (2 SAMPLES - BRICKS)
PICKLICK/ALLEY +25 (3' BGS)
" +13 (2' BGS)
" +0 (2' BGS)

BACKFILL POT @ 1445 7/23/03

JULY EVENT

Chain of Custody's

July 2003 Sampling Event

Hydrometrics, Inc.

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

CHAIN OF CUSTODY RECORD

PROJ. NO: CT940I010 7002 EVERETT REMEDIATION

PROJECT NAME: EVERETT SOURCE MATERIAL VERIFICATION PLAN

SAMPLERS: (Signature) DK Nation

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	TOTAL As Cd Pb	TCLP As Cd Pb							REMARKS
7/~~24~~ 23/03	Ø				P/A+0 (2'BGS)	1		A							[illegible]
	+13				P/A+13 (2'BGS)	1									"
	+25				P/A+25 (3'BGS)	1									"
	+30				P/A+30 (BRICKS)	2									BRICKS - REMOVE SURFACE
	Ø				PATB+0	1									DIRT & LOOSE MTL, CRUSH,
	+14				PATB+14	1									GRIND & ANALYZE ENTIRE
	+30				PATB+30	1									BRICK SAMPLE
	+40				PATB+40	1									SAMPLES FROM EVERETT
	+50				PATB+50	1									PILCHUCK/ALLEY TRENCH BTM
	+53				PATB+53	1									(PATB) - TOTALS - XRF [illegible]
	+60				PATB+60	1									WET CHEM AS REQ'D -
	+70				PATB+70	1									EXPECT As ≈ [illegible]
	+80				PATB+80	1									BUT COULD EXCEED
	+90				PATB+90	1									10000 ppm As
	+100				PATB+100	1									

Relinquished (Signature)	Date/Time	Received by: (Signature)	Lab	Shipped via: FedEx, UPS or Other ____ Air Bill # ____
DK Nation	7/25/03 1415			
Relinquished (Signature)	Date/Time	Received by: (Signature)	Remarks: REIMBURSABLE BY ENVIRONMENTAL TRUST	
Relinquished (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Enclosed: ☐ Parameter List with DTLs ☐ Cover Letter

Split Samples:
[ ]Accepted [ ]Declined ____
Signature

HFORM-1-10/98

Hydrometrics, Inc.

CHAIN OF CUSTODY RECORD

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

PROJ. NO: CT94OI0107002 EVERETT REMEDIATION

PROJECT NAME: EVERETT SOIL MATERIAL VERIFICATION PLAN

SAMPLERS: (Signature) DKNatwi

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	TOTAL As, Cd, Pb	TCLP As, Cd, Pb							REMARKS
7/22/03	+10				PP+10-BLICK	1	X	X							REMOVE SURFACE DIRT &
	+13				PP+13-BLICK	1	X	X							OTHER MATERIAL THAT IS
	+28				PP+28-CONCRETE	1	X	X			FOR ALL				LOOSE, CRUSH & GRIND
	+32				PP+32-BLICK	1	X	X			SAMPLES				& ANALYZE ENTIRE SAMPLE
	+32				PP+32-MORTAR	1	X	X							(eg, WHOLE BLICK NOT JUST
	+53				PP+53-BRAMPA	1	X	X							SURFACE)
	+71				PP+71-BRICK	1	X	X							
															ALL SAMPLES FROM
															BLICHUCK PATH - PARALLEL
															TRENCH
															TOTALS - XRF UNLESS WET CHEM
															AS NEEDED
															TCLP - WET CHEM

Relinquished (Signature)	Date/Time	Received by: (Signature)	Lab	Shipped via: FedEx, UPS or Other ____ Air Bill # ____
DKNatwi	7/25/03 1415			
Relinquished (Signature)	Date/Time	Received by: (Signature)	Remarks: REIMBURSABLE BY ENVIRONMENTAL TRUST	
Relinquished (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Enclosed: ☐ Parameter List with DTLs ☐ Cover Letter

Split Samples: [ ]Accepted [ ]Declined ____ Signature

HFORM-1-10/98

Hydrometrics, Inc.

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

CHAIN OF CUSTODY RECORD

PROJ. NO: CT940I0107002 EVERETT REMEDIATION

PROJECT NAME: EVERETT SOURCE MATERIAL VERIFICATION PLAN

SAMPLERS: (Signature) DK Nation

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	TOTAL As, Cd, Pb								REMARKS
7/22/03	Ø				PTB-0	1	X								ALL SAMPLES FROM PILCHUCK TRENCH BOTTOM (PTB): TOTALS EXCEPT WET CHEM AS NEEDED. SOME SAMPLES MAY BE > 10,000 ppm As BUT EXPECT MOST ≤ 2000 As OR BELOW.
	10				PTB-10	1									
	20				PTB-20	1									
	30				PTB-30	1									
	40				PTB-40	1									
	50				PTB-50	1									
	70				PTB-~~60~~ 70	1									
	80				PTB-~~70~~ 80	1									
	90				PTB-~~80~~ 90	1									
	100				PTB-~~90~~ 100	1									
	110				PTB-110	1									
	120				PTB-120	1	X								

Relinquished (Signature)	Date/Time	Received by: (Signature)	Lab	Shipped via: FedEx, UPS or Other ____ Air Bill # ____
DK Nation	7/22/03 1415			
Relinquished (Signature)	Date/Time	Received by: (Signature)	Remarks REIMBURSABLE BY ENVIRONMENTAL TRUST	
Relinquished (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Enclosed: ☐ Parameter List with DTLs ☐ Cover Letter

Split Samples:
[ ]Accepted [ ]Declined ____
Signature

HFORM-1-10/98

S111 & S112

Hydrometrics, Inc.

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

CHAIN OF CUSTODY RECORD

PROJ. NO: CT940I0107002 Everett Remediation

PROJECT NAME: Everett Source Material Verification plan

SAMPLERS: (Signature)

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	T.A.S								REMARKS
7-15-03					S111 A 0-18	1									
					S111 A 18-36	1									
					S111 A 36-54	1									
					S111 A 54-72	1									
					S111 B 0-18	1									
					S111 B 18-36	1									
					S111 B 36-54	1									
					S111 B 54-72	1									
					S111 C 0-18	1									
					S111 C 18-36	1									
					S111 C 36-54	1									
					S111 C 54-72	1									
					S111 D 0-18	1									
					S111 D 18-36	1									
					S111 D 36-54	1									

Relinquished (Signature)	Date/Time	Received by: (Signature)	Lab	Shipped via: FedEx, UPS or Other ____ Air Bill # ____
	7-18-03 12:00			
Relinquished (Signature)	**Date/Time**	**Received by: (Signature)**	**Remarks**	
Relinquished (Signature)	**Date/Time**	**Received for Laboratory by: (Signature)**	**Date/Time**	**Enclosed:** ☐ Parameter List with DTLs ☐ Cover Letter

Split Samples:
[ ]Accepted [ ]Declined ____ Signature

HFORM-1-10/98

S111 + S112

Hydrometrics, Inc.

CHAIN OF CUSTODY RECORD

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

PROJ. NO: CT940I0107002 Everett Remediation

PROJECT NAME: Everett Source Material Verification Plan

SAMPLERS: (Signature)

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	TAS	REMARKS
7-15-03					S111 D 54-72	1		
					S111 E 0-18	1		
					S111 E 18-36	1		
					S111 E 36-54	1		
					S112 A 0-18	1		
					S112 A 18-36	1		
					S112 A 36-54	1		
					S112 A 54-72	1		
					S112 B 0-18	1		
					S112 B 18-36	1		
					S112 B 36-54	1		
					S112 B 54-72	1		
					S112 C 0-18	1		
					S112 C 18-36	1		
					S112 C 36-54	1		

Relinquished (Signature)	Date/Time	Received by: (Signature)	Lab	Shipped via: FedEx, UPS or Other_____ Air Bill #_____
	7-18-03 12:00			
Relinquished (Signature)	**Date/Time**	**Received by: (Signature)**	**Remarks**	
Relinquished (Signature)	**Date/Time**	**Received for Laboratory by: (Signature)**	**Date/Time**	**Enclosed:** ☐ Parameter List with DTLs ☐ Cover Letter

Split Samples:
[ ]Accepted [ ]Declined_____
Signature

HFORM-1-10/98

Hydrometrics, Inc.

CHAIN OF CUSTODY RECORD

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

PROJ. NO: CT940I0107002 Everett Remediation

PROJECT NAME: Everett Source Material Verification Plan

SAMPLERS: (Signature) [signature]

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	As								REMARKS
7-15-03					S112 C 54-72	1									
					S112 D 0-18	1									
					S112 D 18-36	1									
					S112 D 36-54	1									
					S112 D 54-72	1									

Relinquished (Signature)	Date/Time	Received by: (Signature)	Lab	Shipped via: FedEx, UPS or Other_____ Air Bill #_____
[signature]	7-18-03 12:00			
Relinquished (Signature)	Date/Time	Received by: (Signature)	Remarks	
Relinquished (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Enclosed: [ ] Parameter List with DTLs [ ] Cover Letter

Split Samples: [ ]Accepted [ ]Declined_____ Signature

HFORM-1-10/98

Hydrometrics, Inc.

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

CHAIN OF CUSTODY RECORD

PROJ. NO: CT940I0107002 Everett Remediation

PROJECT NAME: Everett Source Material Verification Plan

SAMPLERS: (Signature) [signature]

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	I, As, Pb								REMARKS SMVR.
7-16-03					SMVR1 0-24	1									
					SMVR1 24-48	1									
					SMVR1 48-60	1									
					SMVR1 60-84	1									
					SMVR 2 0-24	1									
					SMVR 2 24-48	1									
					SMVR 2 48-60	1									
					SMVR 3 0-24	1									
					SMVR 3 24-48	1									
					SMVR 3 48-60	1									
					SMVR 4 0-24	1									
					SMVR 4 24-48	1									
					SMVR 4 48-60	1									
					SMVR 4 60-84	1									
					SMVR 5 0-24	1									

Relinquished (Signature)	Date/Time	Received by: (Signature)	Lab	Shipped via: FedEx, UPS or Other ____ Air Bill # ____
[signature]	7-18-03 1200			
Relinquished (Signature)	Date/Time	Received by: (Signature)	Remarks	
Relinquished (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Enclosed: ☐ Parameter List with DTLs ☐ Cover Letter

Split Samples:
[ ]Accepted [ ]Declined ____
Signature

HFORM-1-10/98

Hydrometrics, Inc.

CHAIN OF CUSTODY RECORD

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

PROJ. NO: CT940I0107002 Everett Remediation

PROJECT NAME: Everett Source Material Verification Plan

SAMPLERS: (Signature)

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	T. As & Pb								REMARKS SMVR
7-16-03					SMVR 5 24-48	1									
					SMVR 5 48-60	1									
					SMVR 5 60-84	1									
					SMVR 6 0-24	1									
					SMVR 6 24-48	1									
					SMVR 6 48-60	1									
					SMVR 6 60-84	1									
					SMVR 7 0-24	1									
					SMVR 7 24-48	1									
					SMVR 7 48-60	1									
					SMVR 7 60-84	1									

Relinquished (Signature)	Date/Time	Received by: (Signature)	Lab	Shipped via: FedEx, UPS or Other_____ Air Bill #_____
	7-18-03 12:00			
Relinquished (Signature)	**Date/Time**	**Received by: (Signature)**	**Remarks**	
Relinquished (Signature)	**Date/Time**	**Received for Laboratory by: (Signature)**	**Date/Time**	**Enclosed:** ☐ Parameter List with DTLs ☐ Cover Letter

Split Samples:
[ ]Accepted [ ]Declined_____
Signature

HFORM-1-10/98

Hydrometrics, Inc.

CHAIN OF CUSTODY RECORD

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

PROJ. NO: CT940I0107002 Everett Remediation

PROJECT NAME: Everett Source Material Verification Plan

SAMPLERS: (Signature) [signature]

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	TAS	TCLP AS							REMARKS LS-42.
7-17-03			X		LS-42-1-0-12	1	↓	↓							
↓			X		LS-42-2-12-24	1	↓	↓							
↓			X		LS-42-3-24-36	1	↓	↓							

Relinquished (Signature)	Date/Time	Received by: (Signature)	Lab	Shipped via: FedEx, UPS or Other_____ Air Bill #_____
[signature]	7-18-03 / 12:00			
Relinquished (Signature)	Date/Time	Received by: (Signature)	Remarks	
Relinquished (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Enclosed: ☐ Parameter List with DTLs ☐ Cover Letter

Split Samples:
[ ]Accepted [ ]Declined_____
Signature

HFORM-1-10/98

Data

September 2003 Sampling Event

ASARCO

OCT 14 2003

October 8, 2003

Mr. Dave Nation
TACOMA PLANT

Attached are the analytical results and quality control data for sixty-six soil samples collected on September 16 and 17, 2003 and received by the laboratory on September 24 and 26, 2003.

The samples were digested in accordance with EPA method 3050 on October 6 and 7, 2003. Results are reported on a dry weight basis.

The test results meet the requirements of the National Environmental Laboratory Accreditation Conference, in accordance with Chapter 5 of the 1999 NELAC Standard.

If you need any further information, please call me at (801) 262-2459 ext. 24 or email EHolm@ASARCO.com.

Sincerely,

Eric Holm
Laboratory/Environmental
Technician

Cc: GRStanga (w/attach.)
Cc: LTangen (w/attach.)

ASARCO Incorporated 3422 South 700 West, Salt Lake City, Utah 84119-4191 (801) 262-2459 FAX (801) 261-2194

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: L030524

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030524-001	16-SEP-03	NP	SMV-A1-18	AS	3263.	ppm	EH	07-OCT-03	6010B
				CD	11.	ppm	EH	07-OCT-03	6010B
				PB	642.	ppm	EH	07-OCT-03	6010B
L030524-002	16-SEP-03	NP	SMV-A1-36	AS	1847.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	46.	ppm	EH	07-OCT-03	6010B
L030524-003	16-SEP-03	NP	SMV-A1-54	AS	369.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-004	16-SEP-03	NP	SMV-B1-18	AS	949.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	209.	ppm	EH	07-OCT-03	6010B
L030524-005	16-SEP-03	NP	SMV-B1-36	AS	2182.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	110.	ppm	EH	07-OCT-03	6010B
L030524-006	16-SEP-03	NP	SMV-B1-54	AS	701.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	15.	ppm	EH	07-OCT-03	6010B
L030524-007	16-SEP-03	NP	SMV-B1-72	AS	254.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-008	16-SEP-03	NP	SMV-C1-18	AS	483.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	314.	ppm	EH	07-OCT-03	6010B
L030524-009	16-SEP-03	NP	SMV-C1-36	AS	12180.	ppm	EH	08-OCT-03	6010B
				CD	5.0	ppm	EH	07-OCT-03	6010B
				PB	185.	ppm	EH	07-OCT-03	6010B
L030524-010	16-SEP-03	NP	SMV-C1-54	AS	5348.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	22.	ppm	EH	07-OCT-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: L030524

LAB NO	DATE/TIME COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030524-011	16-SEP-03	NP SMV-C1-72	AS	1141.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-012	16-SEP-03	NP SMV-D1-18	AS	41310.	ppm	EH	08-OCT-03	6010B
			CD	21.	ppm	EH	07-OCT-03	6010B
			PB	905.	ppm	EH	07-OCT-03	6010B
L030524-013	16-SEP-03	NP SMV-D1-36	AS	8870.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	31.	ppm	EH	07-OCT-03	6010B
L030524-014	16-SEP-03	NP SMV-D1-54	AS	4126.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-015	16-SEP-03	NP SMV-D1-72	AS	1434.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-016	16-SEP-03	NP SMV-E1-18	AS	5582.	ppm	EH	07-OCT-03	6010B
			CD	6.5	ppm	EH	07-OCT-03	6010B
			PB	118.	ppm	EH	07-OCT-03	6010B
L030524-017	16-SEP-03	NP SMV-E1-36	AS	4011.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	20.	ppm	EH	07-OCT-03	6010B
L030524-018	16-SEP-03	NP SMV-E1-54	AS	1757.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-019	16-SEP-03	NP SMV-E1-72	AS	1102.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	12.	ppm	EH	07-OCT-03	6010B
L030524-020	16-SEP-03	NP SMV-E1-90	AS	826.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	<10.	ppm	EH	07-OCT-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: L030524

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030524-021	16-SEP-03	NP	SMV-E2-18	AS	4743.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	184.	ppm	EH	07-OCT-03	6010B
L030524-022	16-SEP-03	NP	SMV-E2-36	AS	3479.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	23.	ppm	EH	07-OCT-03	6010B
L030524-023	16-SEP-03	NP	SMV-E2-54	AS	2283.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-024	16-SEP-03	NP	SMV-E2-72	AS	856.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-025	17-SEP-03	NP	SMV-E3-18	AS	2735.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	331.	ppm	EH	07-OCT-03	6010B
L030524-026	17-SEP-03	NP	SMV-E3-36	AS	2780.	ppm	EH	07-OCT-03	6010B
				CD	18.	ppm	EH	07-OCT-03	6010B
				PB	2893.	ppm	EH	07-OCT-03	6010B
L030524-027	17-SEP-03	NP	SMV-E3-54	AS	9207.	ppm	EH	07-OCT-03	6010B
				CD	5.8	ppm	EH	07-OCT-03	6010B
				PB	230.	ppm	EH	07-OCT-03	6010B
L030524-028	17-SEP-03	NP	SMV-E3-72	AS	11270.	ppm	EH	08-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	12.	ppm	EH	07-OCT-03	6010B
L030524-029	16-SEP-03	NP	SMV-F1-18	AS	1140.	ppm	EH	07-OCT-03	6010B
				CD	13.	ppm	EH	07-OCT-03	6010B
				PB	1169.	ppm	EH	07-OCT-03	6010B
L030524-030	16-SEP-03	NP	SMV-F1-36	AS	532.	ppm	EH	07-OCT-03	6010B
				CD	6.0	ppm	EH	07-OCT-03	6010B
				PB	248.	ppm	EH	07-OCT-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: L030524

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030524-031	16-SEP-03	NP	SMV-F1-54	AS	1535.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	18.	ppm	EH	07-OCT-03	6010B
L030524-032	17-SEP-03	NP	SMV-F2-18	AS	624.	ppm	EH	07-OCT-03	6010B
				CD	7.9	ppm	EH	07-OCT-03	6010B
				PB	304.	ppm	EH	07-OCT-03	6010B
L030524-033	17-SEP-03	NP	SMV-F2-36	AS	2265.	ppm	EH	07-OCT-03	6010B
				CD	13.	ppm	EH	07-OCT-03	6010B
				PB	1331.	ppm	EH	07-OCT-03	6010B
L030524-035	17-SEP-03	NP	SMV-F2-72	AS	67.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	32.	ppm	EH	07-OCT-03	6010B
L030524-036	17-SEP-03	NP	SMV-H1-18	AS	111.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	89.	ppm	EH	07-OCT-03	6010B
L030524-037	17-SEP-03	NP	SMV-H1-36	AS	3224.	ppm	EH	07-OCT-03	6010B
				CD	20.	ppm	EH	07-OCT-03	6010B
				PB	1314.	ppm	EH	07-OCT-03	6010B
L030524-038	17-SEP-03	NP	SMV-H1-54	AS	486.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	18.	ppm	EH	07-OCT-03	6010B
L030524-039	17-SEP-03	NP	SMV-H1-72	AS	354.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-040	17-SEP-03	NP	SMV-H2-18	AS	729.	ppm	EH	07-OCT-03	6010B
				CD	14.	ppm	EH	07-OCT-03	6010B
				PB	832.	ppm	EH	07-OCT-03	6010B
L030524-041	17-SEP-03	NP	SMV-H2-36	AS	25.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	22.	ppm	EH	07-OCT-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: L030524

LAB NO	DATE/TIME COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030524-042	17-SEP-03 NP	SMV-H2-54	AS	33.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	20.	ppm	EH	07-OCT-03	6010B
L030524-043	17-SEP-03 NP	SMV-I2-18	AS	1471.	ppm	EH	07-OCT-03	6010B
			CD	57.	ppm	EH	07-OCT-03	6010B
			PB	1651.	ppm	EH	07-OCT-03	6010B
L030524-044	17-SEP-03 NP	SMV-I2-36	AS	256.	ppm	EH	07-OCT-03	6010B
			CD	14.	ppm	EH	07-OCT-03	6010B
			PB	16.	ppm	EH	07-OCT-03	6010B
L030524-045	17-SEP-03 NP	SMV-I2-54	AS	<10.	ppm	EH	07-OCT-03	6010B
			CD	12.	ppm	EH	07-OCT-03	6010B
			PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-046	17-SEP-03 NP	SMV-I1-18	AS	2410.	ppm	EH	07-OCT-03	6010B
			CD	25.	ppm	EH	07-OCT-03	6010B
			PB	1127.	ppm	EH	07-OCT-03	6010B
L030524-047	17-SEP-03 NP	SMV-I1-36	AS	3253.	ppm	EH	07-OCT-03	6010B
			CD	27.	ppm	EH	07-OCT-03	6010B
			PB	1402.	ppm	EH	07-OCT-03	6010B
L030524-048	17-SEP-03 NP	SMV-I1-54	AS	2224.	ppm	EH	07-OCT-03	6010B
			CD	25.	ppm	EH	07-OCT-03	6010B
			PB	779.	ppm	EH	07-OCT-03	6010B
L030524-049	17-SEP-03 NP	SMV-I1-72	AS	149.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	31.	ppm	EH	07-OCT-03	6010B
L030524-050	17-SEP-03 NP	SMV-I1-90	AS	138.	ppm	EH	07-OCT-03	6010B
			CD	5.5	ppm	EH	07-OCT-03	6010B
			PB	20.	ppm	EH	07-OCT-03	6010B
L030524-051	17-SEP-03 NP	SMV-I1-108	AS	125.	ppm	EH	07-OCT-03	6010B
			CD	6.1	ppm	EH	07-OCT-03	6010B
			PB	14.	ppm	EH	07-OCT-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: L030524

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030524-052	17-SEP-03	NP	SMV-J1-18	AS	4585.	ppm	EH	07-OCT-03	6010B
				CD	140.	ppm	EH	07-OCT-03	6010B
				PB	5051.	ppm	EH	07-OCT-03	6010B
L030524-053	17-SEP-03	NP	SMV-J1-36	AS	379.	ppm	EH	07-OCT-03	6010B
				CD	50.	ppm	EH	07-OCT-03	6010B
				PB	54.	ppm	EH	07-OCT-03	6010B
L030524-054	17-SEP-03	NP	SMV-J1-54	AS	18.	ppm	EH	07-OCT-03	6010B
				CD	29.	ppm	EH	07-OCT-03	6010B
				PB	12.	ppm	EH	07-OCT-03	6010B
L030524-055	17-SEP-03	NP	SMV-K1-18	AS	781.	ppm	EH	07-OCT-03	6010B
				CD	11.	ppm	EH	07-OCT-03	6010B
				PB	517.	ppm	EH	07-OCT-03	6010B
L030524-056	17-SEP-03	NP	SMV-K1-36	AS	346.	ppm	EH	07-OCT-03	6010B
				CD	15.	ppm	EH	07-OCT-03	6010B
				PB	8061.	ppm	EH	07-OCT-03	6010B
L030524-058	17-SEP-03	NP	SMV-K2-36	AS	305.	ppm	EH	07-OCT-03	6010B
				CD	21.	ppm	EH	07-OCT-03	6010B
				PB	178.	ppm	EH	07-OCT-03	6010B
L030524-059	17-SEP-03	NP	SMV-K2-54	AS	297.	ppm	EH	07-OCT-03	6010B
				CD	19.	ppm	EH	07-OCT-03	6010B
				PB	154.	ppm	EH	07-OCT-03	6010B
L030524-060	16-SEP-03	NP	SMV-D2-18	AS	5768.	ppm	EH	07-OCT-03	6010B
				CD	7.8	ppm	EH	07-OCT-03	6010B
				PB	336.	ppm	EH	07-OCT-03	6010B
L030524-061	16-SEP-03	NP	SMV-D2-36	AS	8132.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	361.	ppm	EH	07-OCT-03	6010B
L030524-062	16-SEP-03	NP	SMV-D2-54	AS	5106.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	13.	ppm	EH	07-OCT-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT94010107002)

Batch No: L030524

LAB NO	DATE/TIME COLLECTED		DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
L030524-063	16-SEP-03	NP	SMV-D2-72	AS	1417.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-064	16-SEP-03	NP	SMV-D2-90	AS	482.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-065	17-SEP-03	NP	SMV-D3-18	AS	2816.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	291.	ppm	EH	07-OCT-03	6010B
L030524-066	17-SEP-03	NP	SMV-D3-36	AS	3204.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	33.	ppm	EH	07-OCT-03	6010B
L030524-067	17-SEP-03	NP	SMV-D3-54	AS	1076.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	<10.	ppm	EH	07-OCT-03	6010B
L030524-068	17-SEP-03	NP	SMV-D3-72	AS	398.	ppm	EH	07-OCT-03	6010B
				CD	<5.0	ppm	EH	07-OCT-03	6010B
				PB	<10.	ppm	EH	07-OCT-03	6010B

Unless otherwise noted results are not blank corrected. NP = Collect time Not Provided.

Vince Kelly
Approved

Vince Kelly
Reviewer

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT940I0107002)

Batch No: WG030477

LAB NO	DATE/TIME COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
WG030477-1		QC Matrix Spike	AS	116	%Recovery	EH	07-OCT-03	6010B
			CD	98	%Recovery	EH	07-OCT-03	6010B
			PB	103	%Recovery	EH	07-OCT-03	6010B
WG030477-2		QC Prep Blank	AS	<10.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	<10.	ppm	EH	07-OCT-03	6010B
WG030477-3		QC Lab Control Sample	AS	109	%Recovery	EH	07-OCT-03	6010B
			CD	105	%Recovery	EH	07-OCT-03	6010B
			PB	113	%Recovery	EH	07-OCT-03	6010B
WG030477-5		QC Matrix Spike Duplicate	AS	11	% RPD	EH	07-OCT-03	6010B
			CD	6.5	% RPD	EH	07-OCT-03	6010B
			PB	11	% RPD	EH	07-OCT-03	6010B
WG030477-6		QC Reporting Limit	AS	10.	ppm			6010B
			CD	5.0	ppm			6010B
			PB	10.	ppm			6010B
WG030477-7		QC Matrix Spike	AS	SR>4SA	%Recovery	EH	07-OCT-03	6010B
			CD	96	%Recovery	EH	07-OCT-03	6010B
			PB	96	%Recovery	EH	07-OCT-03	6010B
WG030477-8		QC Prep Blank	AS	<10.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	<10.	ppm	EH	07-OCT-03	6010B
WG030477-9		QC Lab Control Sample	AS	94	%Recovery	EH	07-OCT-03	6010B
			CD	92	%Recovery	EH	07-OCT-03	6010B
			PB	94	%Recovery	EH	07-OCT-03	6010B
WG030477-11		QC Matrix Spike Duplicate	AS	3.7	% RPD	EH	07-OCT-03	6010B
			CD	1.6	% RPD	EH	07-OCT-03	6010B
			PB	<1.0	% RPD	EH	07-OCT-03	6010B
WG030477-13		QC Matrix Spike	AS	103	%Recovery	EH	07-OCT-03	6010B
			CD	98	%Recovery	EH	07-OCT-03	6010B
			PB	100	%Recovery	EH	07-OCT-03	6010B

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

Tacoma

Everett (Project A4TF CT94010107002)

Batch No: WG030477

LAB NO	DATE/TIME COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	METHOD
WG030477-14		QC Prep Blank	AS	<10.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	<10.	ppm	EH	07-OCT-03	6010B
WG030477-15		QC Lab Control Sample	AS	106	%Recovery	EH	07-OCT-03	6010B
			CD	100	%Recovery	EH	07-OCT-03	6010B
			PB	106	%Recovery	EH	07-OCT-03	6010B
WG030477-17		QC Matrix Spike Duplicate	AS	3.1	% RPD	EH	07-OCT-03	6010B
			CD	<1.0	% RPD	EH	07-OCT-03	6010B
			PB	2.2	% RPD	EH	07-OCT-03	6010B
WG030477-19		QC Matrix Spike	AS	SR>4SA	%Recovery	EH	07-OCT-03	6010B
			CD	97	%Recovery	EH	07-OCT-03	6010B
			PB	97	%Recovery	EH	07-OCT-03	6010B
WG030477-20		QC Prep Blank	AS	<10.	ppm	EH	07-OCT-03	6010B
			CD	<5.0	ppm	EH	07-OCT-03	6010B
			PB	<10.	ppm	EH	07-OCT-03	6010B
WG030477-21		QC Lab Control Sample	AS	105	%Recovery	EH	07-OCT-03	6010B
			CD	98	%Recovery	EH	07-OCT-03	6010B
			PB	105	%Recovery	EH	07-OCT-03	6010B
WG030477-23		QC Matrix Spike Duplicate	AS	2.0	% RPD	EH	07-OCT-03	6010B
			CD	<1.0	% RPD	EH	07-OCT-03	6010B
			PB	1.6	% RPD	EH	07-OCT-03	6010B

Unless otherwise noted results are not blank corrected. NP = Collect time Not Provided.

Vince Kelly
Approved

Vince Kelly
Reviewer

Boring Logs

September 2003 Sampling Event

EVERETT SMELTER SITE
9/16/03 0800
BORE HOLES PER XSECTION MAP
SAMPLE DESIGNATIONS:
SMV - SOURCE MTL VERIFICATION
-A1- TRANSECT/HOLE (XSECTION DRWG)
-18- DEPTH INTERVAL (NBR DENOTES BTM OF INTERVAL)

START W/ TRANSECT F 1
(SAMPLE ID - SMV - F1 - DEPTH)
HOLE NBRS PROGRESS FROM E TO W.

SAMPLE #	DESCRIPTION
F1-18	TOPSOIL/FILL, NO DEBRIS
F1-36	FILL, 6-8" GRAVEL ≈ 1" NO DEBRIS, BRN/GREY WEATHERED TILL @ BTM
F1-54	BRN/GREY TILL @ BTM NO DEBRIS OR BRICK

TD=54" BGS (BELOW GRND SURFACE)

SAMPLE NO	DESCRIPTION
E1-18	50% RECOVERY - SOFT - TOPSOIL/BRN FILL - NO DEBRIS
E1-36	70% RECOVERY - BRN/GREY WEATHERED GRADING TO GREY TILL @ 36" w/ SOME GRAVEL, HARD, NO DEBRIS
E1-54	N>100/ft (42'-54") - TILL - DRK GRY @ 36-48, LT GREY TO 54", SOME GRAVEL WEATHERED @ 36-40" & UNDISTURBED BELOW 40" 100% RECOVERY
E1-72	100% RECOVERY - GLACIAL TILL GREY - SOME GRAVEL @ 54" GRADING TO SILT BY 60" - HARD UNIFORM TILL TO 72" NO DEBRIS
E1-90	SAME AS E1-72 - 70% RECOVERY

TD=90" BGS SANDY SILT GLACIAL TILL TO 90"

SEPT. EVENT

EVERETT SMELTER 9/16/03 - SMV

SAMPLE NO	DESCRIPTION
A1-18	RECOVERY ≈ 80% - TOPSOIL SUBSOIL TO 6"; FILL SILTY SAND W/ NO DEBRIS TO 18"
A1-36	RECOVERY ≈ 80% - FILL 18-24" BRN - SANDY SILT, GRADING TO WEATHERED TILL @ 36" BRN/GREY-MOTTLED, DRY & SILT @ 36", NO DEBRIS IN CORE, A FEW BRICK FRAGMENTS IN CUTTINGS
A1-54	>80% RECOVERY - WEATHERED TILL @ 54" - BRN/REDDISH/GREY-MOTTLED - GRADING TO SILTY TILL @ 54" - UNDISTURBED - MOIST BUT NOT WET, NO DEBRIS OBSERVED

TD = 54"

1150 PDT

9/16/03

SAMPLE NO		DESCRIPTION by T.D.K.
SMUC1	0-6"	Topsoil w/organics
-18	6"-12"	silty, sandy fill
	12"-18"	silty, sandy fill
-36	18"-36"	50% recovery silty w/brick fragments
	36"-42"	silty, sandy fill
-54	42"-54"	till, difficult penetration 80% recovery (same)
	54-72"	
-72	72"	Total Depth

TD = 72"

Sept. event

EVERETT SMELTER 9/18/03 - SMV

SAMPLE NO	DESCRIPTION
1345 PDT	
SMV-E2-18	70% RECOVERY - 0-8" TOPSOIL/SUBSOIL, BRICK @ 8" to 18, (DROVE THRU BRICK)
E2-36	RECOVERY >80% - BRICKS TO 24", CLEAR HORIZON W/ FILL/TILL BELOW - BROWN SILTY SAND GRADING TO "GREY SILTY TILL @ 36" DRY NO DEBRIS/BRICKS BELOW 24"
-54	100% RECOVERY - WEATHERED TILL @ 36 - BY 40" UNDISTURBED TILL - GREY, MOIST, HARD SILT, MOTTLED 36-42" - GREY SILT TILL TO 54"
-72	TILL - 100% RECOVERY - WET GRAVEL 54-58". DRY GRAY CLY SILT >60 to 72",
TD=72"	NO DEBRIS/BRICKS

SAMPLE NO	DESCRIPTION
SMV-	
D1-18	>80% RECOVERY - TOPSOIL TO 4". BRICK & DEBRIS INTERMIXED FROM >4" to 18" - SOME WHT CRYSTALS @ 12", DRY
D1-36	35% RECOVERY - BROWN WEATHERED TILL/FILL, NO BRICKS OR DEBRIS OBSERVED
D-54	65% RECOVERY - WEATHERED TILL - BROWN, MOIST, SANDY SILT, MOTTLED, NO DEBRIS
D-72	>80% RECOVERY WET @ 54-58" (GRAVEL IN SILT) - CLY SILT 58-72" DRY TILL - NO DEBRIS
TD=72"	

SEPT. EVENT

EVERETT SMELTER 9/16/03

SAMPLE NO.	DESCRIPTION
BORING @ TRANSECT B – 6' TD STATION 20 ~~25~~ ±, 20' ~~SO~~ EAST OF FENCE, (N-S) 33' ~~42'~~ N OF E-W FENCE – SEE FIELD LOCATE FOR PILCHUCK PATH TRENCH ON 7/22/03 IN THIS BOOK	
SMV-B1-18 (ABOUT PTB+20±)	SKIMMED SURFACE WHERE TRENCH SOIL STOCKPILED 80% RECOVERY – TOP 6" SUBSOIL, LOOSE DEBRIS & SOIL MIXED 6"–18", BRICK FRAGS BROWN, DRY
B1-36	<10% RECOVERY – BRICK IN END OF SPOON – A LITTLE SOIL & DEBRIS ABOVE BRICK
B1-54	<30% RECOVERY – BRICK FRAGS & DEBRIS TOP 2", WEATHERED TILL W/ GRAVEL GRADING TO SILTY TILL @ 54" (APPROX) DRY, GREY

SAMPLE NO	DESCRIPTION
SMV-B1-72	RECOVERY ≈100% – GREY SILTY TILL, DRY SOME ANGULAR GRAVEL INTERMIXED (< 1/2" DIA), HARD, NO DEBRIS/BRICKS
TD = 72"	
SMV-~~D1~~ D2-18 (CUT OUT TOP SOD LIKE B1-18)	≈20 E OF N-S FENCE ON E SIDE OF PILCHUCK ≈ STATION PTB+100 SUBSOIL TO 8", SOIL & BRICK/DEBRIS INTERMIXED TO 18", DRY, BROWN
D2-36	>70% RECOVERY, BRICK & DEBRIS & SOIL MIXED – BLK/BROWN CLEAR HORIZON ≈30 W/ BROWN WEATHERED TILL – SILT – W/O DEBRIS TO 36'
D2-54	WEATHERED TILL (BROWN) GRADING TO GREY MOTTLED TILL W/ SOME GRAVEL, DRY, NO DEBRIS

SEPT. EVENT

EVERETT SMELTER 9/16/03

SAMPLE NO	DESCRIPTION
SMV-D2-72	RECOVERY ≈ 100% - HARD, GREY GLACIAL TILL SILT W/ SOME GRAVEL DRY, NO DEBRIS - SOME α-CONTAMINATION AT CATCHER - DISCARDED
SMV-02-90 TD = 90"	RECOVERY ≈ 90% - GLACIAL TILT - SILT W/ SOME GRAVEL, GREY, DRY, HARD. NO DEBRIS OR BRICKS

1645 PDT END

9/17/03 - 0915

SAMPLE NO	DESCRIPTION
SMV-I1-18	60% RECOVERY - 0-8" TOPSOIL; DEBRIS & BRICK WELL INTERMIXED 8-18" W/ SOME WHT CRYSTALS, DRY
I1-36	80% RECOVERY - FILL W/ SOME SMELTER DEBRIS & BRICK TO 36"; DRY
I1-54	RECOVERY ≈ 50% - DEBRIS W/ BRICK WELL INTERMIXED W/ SOIL MOIST @ BTM, SOME GRAVEL ≈ 1", FILL.
VISUALLY DISTINCT HORIZON @ ≈ 48"	
I1-72	RECOVERY ≈ 30% - MOIST SAND W/ SOME GRAVEL, LOOSE, NO DEBRIS SEEN, WEATHERED BROWN TILL @ BTM
I1-90	RECOVERY ≈ 75% - WET WEATHERED TILL @ 72-76", MOTTLED BROWN GRADING TO SILTY TILL @ 90".
NO DEBRIS	
I1-108 TD = 108"	RECOVERY ≈ 100% - MOIST TILL - GREY BRN @ 90"-94", GRADING TO SILTY GLACIAL TILL W/ SOME ANGULAR GRAVEL FROM 94"-108", HARD NO DEBRIS

SEPT. EVENT

SEPT. EVENT

EVERETT SMELTER 9/17/03

SAMPLE NO	DESCRIPTION
SMV-H1-18	50% RECOVERY - TOPSOIL/SUBSOIL TO 8"; FILL W/ GEOFABRIC @ 18", NO DEBRIS/BRICK DRY, LOOSE
H1-36	60%-70% RECOVERY - FILL W/ SOME BRICK FRAGS/DEBRIS WELL MIXED, DRY; GRADING TO WEATHERED TILL @ 36" - BRN. CLEAR HORIZON
H1-54	RECOVERY ≅ 50% - WEATHERED TILL - BRN MOTTLED W/ RED, SILTY W/ SOME GRAVEL, MOIST NO DEBRIS
H1-72	100% RECOVERY - WET TILL W/ GRAVEL 54-58"; SILTY TILL, GREY, MOIST, HARD TO 72", NO DEBRIS
TD=72"	

54" = I2-~~H2~~ ~~I2~~ ~~I2~~ J1-90
H2-~~72~~ 90 K1-~~90~~ 72

SAMPLE NO	DESCRIPTION
SMV-~~H2~~ ~~I2~~ I2-18	100% RECOVERY - TOPSOIL/FILL TO 12" CLEAR HORIZON W/ BRICKS > 12" to 18"; WEATHERED TILL @ 18"; DRY
I2-36	RECOVERY ≅ 100% - WET @ 18" @ HORIZON W/ BRICK ABOVE; WEATHERED TILL GRADING TO TILL @ 36", NO DEBRIS > 18", HARD
24"-36" DRY/MOIST	
I2-54	RECOVERY ≅ 100% - TILL MOIST SILTY STIFF TO 54", NO DEBRIS, GREY.
TD=54"	
J1 ~~K1~~-18	RECOVERY ≅ 100% TOPSOIL TO 6". FILL W/ BRICK FRAGS TO 18", BLACK FLUE DUST (?) & DEBRIS FROM 6-18" WELL MIXED W/ SOIL, DRY

EVERETT SMELTER 9/17/03

SAMPLE NO	DESCRIPTION
J1-36	100% RECOVERY, CLEAR HORIZON @ 18" W/DEBRIS & <18", WEATHERED TILL MOTTLED BRN/GREY GRADING TO SILTY GLACIAL TILL @ 36". NO DEBRIS >18".
J1-54	RECOVERY ≅ 100% - WET W/GRAVEL 36-40"; TILL 40" TO 54" W/GRAVEL TO ~~48"~~ 44". GRY MOIST TILL TO 54"; NO DEBRIS
TD=54"	
K1-19	RECOVERY ≅ 80% TOPSOIL TO 2" SANDY SILT TAN, LOOSE TO 18" DRY, NO DEBRIS SEEN.
K1-36	RECOVERY ≅ <10% SANDY SILT IN CATCHER, NO DEBRIS, SOFT POUNDING
K1 TD=54"	

SAMPLE NO	DESCRIPTION RECOVERY
K1-54	RECOVERY ≅ 0
	PULLED AHEAD TO SOUTH FT & REDRILLED
K2-~~18~~ 36	RECOVERY ≅ 20% - TAN WEATHERED TILL W/WELL GRADED GRAVEL, DRY NO DEBRIS SEEN
K2-54	RECOVERY ≅ 50% - SAME AS ABOVE, UNCONSOLIDATED FILL/TILL, MEDIUM DRIVING DIFFICULTY BUT LOOSE IN SPOON, NO DEBRIS
TD=54"	
H2-18	RECOVERY ≅ , TOPSOIL 2", SUBSOIL & FILL TO 18"; LIGHT BRN/TAN, SANDY GRAVEL W/SOME SILT, LOOSE DRY, NO DEBRIS

SEPT. EVENT

EVERETT SMELTER 9/17/03

SAMPLE NO	DESCRIPTION
H2-36	RECOVERY ≅ 50%, SAME AS ABOVE, LOOSE UNCONSOL. FILL, ROCK IN CATCHER - NO DEBRIS.
H2-54	RECOVERY ≅ 80%. FILL TO 42", WEATHERED TILL-BRN & MOTTLED TO ≅ 48"; GLACIAL TILL ≅ 48" GREY HARD DRY SILT W/ LITTLE GRAVEL.
TD-54"	

EVERETT SMELTER 9/17/03

SAMPLE NO	DESCRIPTION by T.D.K.
F2 - 18"	80% Recovery 0"-6" - Topsoil 6"-12" - Debris/fill 12"-18 - silty fill
F2 - 36"	10% Recovery Brick, debris, fill
F2 - 54"	No Sample Recovery
F2 - 72"	10% Recovery weathered till, brown w/rock - one large rock preventing 54" sample collection!
TD - 72"	

SEPT. EVENT

EVERETT SMELTER 9/17/03

SAMPLE NO	DESCRIPTION
E3-18"	50% Recovery 6" topsoil, organics 6" silty topsoil or fill
E3-36"	20% Recovery debris, brick, slag
E3-54"	50% Recovery brick, completely brick
E3-72"	75% Recovery 6" of weathered till ~12" of hard, grey till
TD-72"	

EVERETT SMELTER 9/17/03

SAMPLE NO	DESCRIPTION
D3-18"	40% Recovery topsoil, organics w/ some brick debris
D3-36"	75% Recovery debris for the 1st 6", then brown, weathered till, loose
D3-54"	80-90% Recovery 9" weathered till, grey w/ some mottling 9"-18" - grey till w/ moderate drilling difficulty
D3-72"	100% Recovery Very difficult drilling Grey, dense till, moist with gravel at bottom 6"
TD-72"	

SEPT. EVENT

Chain of Custody's

September 2003 Sampling Event

Hydrometrics, Inc.

CHAIN OF CUSTODY RECORD

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

PROJ. NO

PROJECT NAME

SAMPLERS: (*Signature*)

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	ARSENIC	CADMIUM	LEAD							REMARKS
9/17			✓		SMV-K1-18	1-Bag										
"			✓		SMV-K1-36	"										
"			✓		SMV-K1-54	"										
9/17			✓		SMV-K2-36	"										
"			✓		SMV-K2-54	"										
9.16					SMV-D2-18	"										
					SMV-D2-36	"										
					SMV-D2-54	"										
					SMV-D2-72	"										
					SMV-D2-90	"										
9.17					SMV-D3-18	"										
					SMV-D3-36	"										
					SMV-D3-54	"										
					SMV-D3-72	"										

Relinquished (*Signature*)	Date/Time	Received by: (*Signature*)	Lab	Shipped via: FedEx, UPS or Other_____ Air Bill #_____
[signature]	9-19-03 1500			
Relinquished (*Signature*)	**Date/Time**	**Received by: (*Signature*)**	**Remarks**	
Relinquished (*Signature*)	**Date/Time**	**Received for Laboratory by: (*Signature*)**	**Date/Time**	**Enclosed:** ☐ Parameter List with DTLs ☐ Cover Letter
		[signature]	9-24-03	

Split Samples:
[ ]Accepted [ ]Declined_____
Signature

HFORM-1-10/98

Hydrometrics, Inc.

CHAIN OF CUSTODY RECORD

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

PROJ. NO

PROJECT NAME

SAMPLERS: (*Signature*)

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	ARSENIC	CADMIUM	LEAD						REMARKS
9/17			✓		SMV-I2-18	1-Bxs	↓	↓	↓						
"			✓		SMV-I2-36	"									
"			✓		SMV-I2-54	"									
9/17			✓		SMV-I1-18	"									
"			✓		SMV-I1-36	"									
"			✓		SMV-I1-54	"									
"			✓		SMV-I1-72	"									
"			✓		SMV-I1-90	"									
"			✓		SMV-I1-108	"									
9/17			✓		SMV-J1-18	"									
"			✓		SMV-J1-36	"									
"			✓		SMV-J1-54	"									

Relinquished (*Signature*)	Date/Time	Received by: (*Signature*)	Lab	Shipped via: FedEx, UPS or Other_____ Air Bill #_____
[signature]	9/17/03 15:00			
Relinquished (*Signature*)	Date/Time	Received by: (*Signature*)	Remarks	
Relinquished (*Signature*)	Date/Time	Received for Laboratory by: (*Signature*)	Date/Time	Enclosed: ☐ Parameter List with DTLs ☐ Cover Letter
		[signature]	9.24.03	

Split Samples:
[ ]Accepted [ ]Declined_____
Signature

HFORM-1-10/98

Hydrometrics, Inc.

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

CHAIN OF CUSTODY RECORD

PROJ. NO	PROJECT NAME

SAMPLERS: (*Signature*)

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	Arsenic	Cadmium	Lead						REMARKS
9/16			✓		Smv-F1-18	1-3AG									
"			✓		Smv-F1-36	"									
"			✓		Smv-F1-54	"									
9/16			✓		Smv-F2-18	"									
"			✓		Smv-F2-36	"									
"			✓		Smv-F2-54	"									No recovery
"			✓		Smv-F2-72	"									
9/17			✓		Smv-H1-18	"									
"			✓		Smv-H1-36	"									
"			✓		Smv-H1-54	"									
"			✓		Smv-H1-72	"									
9/17			✓		Smv-H2-18	"									
"			✓		Smv-H2-36	"									
"			✓		Smv-H2-54	"									
			✓												

Relinquished (*Signature*)	Date/Time	Received by: (*Signature*)	Lab	Shipped via: FedEx, UPS or Other____ Air Bill #____
[signature]	9-19-03 1500			
Relinquished (*Signature*)	**Date/Time**	**Received by: (*Signature*)**	**Remarks**	
Relinquished (*Signature*)	**Date/Time**	**Received for Laboratory by: (*Signature*)**	**Date/Time**	**Enclosed:** ☐ Parameter List with DTLs ☐ Cover Letter
		[signature]	9-21-03	

Split Samples:
[ ]Accepted [ ]Declined_____
Signature

HFORM-1-10/98

Hydrometrics, Inc.

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

CHAIN OF CUSTODY RECORD

PROJ. NO	PROJECT NAME

SAMPLERS: (*Signature*)

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	ARSENIC	CADMIUM	LEAD						REMARKS
9/16			✓		SMV-E1-18	1-BAG									
"			✓		SMV-E1-36	"									
"			✓		SMV-E1-54	"									
"			✓		SMV-E1-72	"									
"			✓		SMV-E1-90	"									
9/16			✓		SMV-E2-18	"									
"			✓		SMV-E2-36	"									
"			✓		SMV-E2-54	"									
"			✓		SMV-E2-72	"									
9/17			✓		SMV-E3-18	"									
"			✓		SMV-E3-36	"									
"			✓		SMV-E3-54	"									
"			✓		SMV-E3-72	"									
			✓												
			✓												

Relinquished (*Signature*)	Date/Time	Received by: (*Signature*)	Lab	Shipped via: FedEx, UPS or Other_____ Air Bill #_____
[signature]	9-17-03 1500			
Relinquished (*Signature*)	Date/Time	Received by: (*Signature*)	Remarks	
Relinquished (*Signature*)	Date/Time	Received for Laboratory by: (*Signature*)	Date/Time	Enclosed: ☐ Parameter List with DTLs ☐ Cover Letter
		[signature]	9-24-03	

Split Samples:
[ ]Accepted [ ]Declined_____
Signature

HFORM-1-10/98

Hydrometrics, Inc.

CHAIN OF CUSTODY RECORD

5219 North Shirley St, Suite 100, Ruston, WA 98407 (253) 752-1470 FAX (253) 752-7663

PROJ. NO:

PROJECT NAME: Everett

SAMPLERS: (*Signature*) AHTFCT940I0107002

DATE	STA #	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CONTAINERS	ARSENIC	CADMIUM	LEAD						REMARKS
9/16			✓		SMV-A1-18	1-BAG	—	—	—						
"			✓		SMV-A1-36	"	—	—	—						
"			✓		SMV-A1-54	"	—	—	—						
9/16			✓		SMV-B1-18	"	—	—	—						
"			✓		SMV-B1-36	"	—	—	—						
"			✓		SMV-B1-54	"	—	—	—						
"			✓		SMV-B1-72	"	—	—	—						
9/16			✓		SMV-C1-18	"	—	—	—						
"			✓		SMV-C1-36	"	—	—	—						
"			✓		SMV-C1-54	"	—	—	—						
"			✓		SMV-C1-72	"	—	—	—						
9/16			✓		SMV-D1-18	"	—	—	—						
"			✓		SMV-D1-36	"	—	—	—						
"			✓		SMV-D1-54	"	—	—	—						
"			✓		SMV-D1-72	"	—	—	—						

Relinquished (*Signature*)	Date/Time	Received by: (*Signature*)	Lab	Shipped via: FedEx, UPS or Other_____ Air Bill #_____
[signature]	9-15-03 1570			
Relinquished (*Signature*)	**Date/Time**	**Received by: (*Signature*)**	**Remarks**	
Relinquished (*Signature*)	**Date/Time**	**Received for Laboratory by: (*Signature*)**	**Date/Time**	**Enclosed:** ☐ Parameter List with DTLs ☐ Cover Letter
		[signature]	9-24-03	

Split Samples: [ ]Accepted [ ]Declined_____ *Signature*

HFORM-1-10/98

Appendix E

APPENDIX E

CONSOLIDATED SOIL CONCENTRATION AND CHARACTERIZATION TABLE

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
US-01	SA-13	414	0-1	Residential	846	-	281	Sandy Silt - Dark brown, slightly moist, roots at 0-1', loose, trace 1/4" and smaller gravel (fill)
		415	1-2	Residential	1024	-	212	
		416	2-3	Residential	13	-	12	Sandy Silt - light brown to orange-brown with orange mottling, moist to slightly moist, some vegetative matter, medium dense (glacial till)
		417	3-4	Residential	227	-	10	
		418	4-5	Residential	42	-	10	
US-02	TP-10A	163	0-1	Residential	473	-	112	Silty loam - brown, slightly moist to dry (fill)
		164	1-2	Residential	2460	-	331	Silty Sand - gray brown, slightly moist, medium to fine grained (becomes finer with depth) red brick fragments (smelter debris)
		165	2-3	Source Area	3571	-	445	
		166	3-4	Residential	2399	-	224	
		167	4-5	Source Area	12491	-	1309	Sandy Silt - light brown mottled black, slightly moist, red brick fragments (flue floor) some 1" rounded gravel (smelter debris)
		168	5-6	Residential	2209	-	20	Sandy silt - light brown moist slightly plastic, trace 1/4" and smaller gravel (fill)
	TP-10B	156	0-1	Residential	866	-	420	Silty Sand - Yellow brown slightly moist to dry, wood fragments, trace red brick fragments, some medium to coarse sand in a 1" lense (Smelter Debris)
		157	1-2	Residential	1356	-	268	
		158	2-3	Source Area	3151	-	284	
		159	3-4	Source Area	3277	-	298	
		160	4-5	Source Area	15433	-	599	
		161	5-6	Source Area	6748	-	24	Silt - Yellow brown slightly moist to dry, wood fragments, trace red brick frags, some medium to coarse sand in a 1" lense (Smelter Debris)
		101	6-7	Residential	453	-	10	Silty Sand - Brown to gray, fine grained, dry, medium dense to very dense, trace 1/4" subrounded gravel (Glacial Till)
		102	8-9	Residential	401	-	-	
		103	10-11	Residential	490	-	-	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
US-03	S-36	729	4-6	Source Area	3260	1.5	6.3	Moist, light brown, silt with small gravel and 5% brick fragments
		730	6-7	Residential	775	1.1	<5.0	Moist, light brown silt with >3/4" gravel and brick fragments; moist, light gray silt at 6.5' with small gravel and no brick
		731	7-9	Residential	499	1.1	<5.0	
		732	9-10	Residential	159	<1.0	19	Dry, light gray silt with occasional small gravel
		733	10	Residential	118	<1.0	<5.0	light gray silt with occasional small gravel
	SAIC-S36		Surface	Residential	764	7	194	*See Note
			0.5	Residential	1100	4	119	
			1.0	Residential	994	5	53	
			2.0	Residential	1420	4	86	
			3.0	Residential	849	1	18	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
US-04	S-28	631	Surface	Source Area	3010	5	250	Topsoil, organic material, sandy, red brick chips
		632	0.5	Source Area	5620	11	550	Brown silty sand, red brick, small gravels
		633	1-2	Source Area	14740	20	750	Brown red, white silty sand with brick chips, smelter debris
		634	2-3	Source Area	16840	13	480	Brown silty sand, red brick smelter debris
		635	3-4	Source Area	7030	2	81	tan, silty sand, small gravels
		636	4-5.5	Source Area	7480	3	110	tan, silty sand, small gravels, wet
		637	5.5-7	Source Area	6240	5	130	light gray silt, very dense, small gravel
	SAIC-S28		Surface	Residential	1190	4	388	*See Note
			0.5	Residential	1800	5	500	
			1.0	Source Area	4810	8	1300	
			2.0	Source Area	6230	4	91	
			3.0	Source Area	6020	1	7	
	SMV-D3	D3-18	0-1.5	Residential	2816	<5.0	291	40% recovery - topsoil, organics with some brick debris
		D3-36	1.5-3	Source Area	3204	<5.0	33	75% recovery - debris for the first 6", then brown weathered till, loose
		D3-54	3-4.5	Residential	1076	<5.0	<10	80-90% recovery - 9" weathered till, gray with some mottling; 9-18" gray till with moderate drilling difficulty
		D3-72	4.5-6	Residential	398	<5.0	<10	100% recovery - very difficult drilling gray, dense till, moist with gravel at bottom 6"
US-05	SS-12		Surface	Residential	864	5	864	*See Note
US-06	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
US-07	S-72	500	Surface	Residential	295	2	59	Topsoil, organic - rich
		501	0.5	Residential	380	2	58	
		502	1-2	Residential	1300	5	341	Brown sand, silty, organic - rich
		503	2-3	Source Area	8000	18	506	Brown sand, silty, plus gray material (flue dust?)
		504	3-4	Source Area	21200	6	115	light brown sand, silty, brick fragments, gray material (flue dust?)
		505	4-6	Source Area	5400	1	10	light brown sand, clayey, oxidation rust spots
		506	6-7	Residential	1700	2	50	gray, silty, sandy, clayey, pebbles
	SAIC-S72		Surface	Residential	891	1	82	*See Note
			0.5	Residential	1140	2	119	
			1.0	Source Area	5360	5	268	
			3.0	Sub-Title C	53100	22	161	
	SS-11		Surface	Source Area	4670	6	425	*See Note

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
US-08	IA-2		Surface	Residential	510	4	180	*See Note
			1.0	Source Area	3400	8	270	
			2.0	Source Area	6800	15	1600	
	TP-11A	151	0-1	Source Area	3148	-	101	Silty Loam - brown, some gravel (fill)
		152	1-2	Source Area	4692	-	209	brown, fine sand and silt, trace gravel, trace red brick fragments, some 2" darker brown horizons at 2-3'
		153	2-3	Source Area	12893	-	558	
		154	3-4	Sub-Title C	53824	-	186	four to five rows of mortared brick, gray medium sand and silt, greenish yellow residue coating brick and filling cracks, moist (smelter debris)
		155	4-5	Source Area	23094	-	22	orange/brown fine sand and silt with trace gravel. Becomes very dense at 5'. Brown to black trace roots at base of excavation. (fill)
	TP-11B	145	0-1	Residential	1722	-	87	Silty Loam - brown, with trace gravel (fill)
		146	1-2	Source Area	6869	-	267	brown to dark brown, fine sand and silt with some fine to medium gravel, trace red bricks (Smelter Debris)
		147	2-3	Source Area	19691	-	742	
		148	3-4	Source Area	19937	-	86	four to five rows of red brick and light gray medium sand. Slight yellow to white staining on sand and brick (Smelter Debris)
		149	4-5	Sub-Title C	36165	-	30	Orange/brown grading to light brown, fine sand and silt, trace gravel. Tree roots at base of excavation (fill)
		150	5-6	Source Area	11897	-	10	
		110	6-7	Source Area	8408	-	11	Silty sand - light brown, fine to very fine grained, slightly moist, with 1" rounded gravel. (fill)
		111	8-9	Residential	1450	-	10	Silty sand - light brown with trace orange mottling, dry to slightly moist, medium dense, some interbedded fine grained sand lenses 1/4-1/8" thick that transitions to dry silt. Up to 30% silt. (Glacial till)
		112	10-11	Residential	504	-	-	
		113	12-13.5	Residential	212	-	-	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
US-09	S-27	623	Surface	Residential	390	4	210	Topsoil, organic material, sandy
		624	0.5	Source Area	3510	5	180	brown silty sand, brick chips, small gravel
		625	1-2	Source Area	4620	3	81	tan sandy silt, small gravel
		626	2-3	Source Area	5306	6	1063	brown silty sand, brick chips, black stains
		627	3-4	Residential	660	2	32	tan, silty sand, oxidized, small gravels
		628	4-6	Residential	2530	2	15	tan, silty sand, oxidized
		629	6-7	Residential	2480	1	10	tan silty sand
		722	7-9	Residential	1773	2.5	30	light gray silt, soft, moist, small gravel
		723	9-10	Residential	1355	1	<5.0	light gray silt, very dense, small gravel
	SAIC-S27		Surface	Residential	2600	3	301	*See Note
			0.5	Residential	2090	1	20	
			1.0	Source Area	3010	1	1	
			2.0	Residential	930	1	1	
			3.0	Residential	1880	1	6	
	SMV-E3	E3-18	0-1.5	Residential	2735	<5.0	331	50% recovery - 6" topsoil, organics; 6" silty topsoil or fill
		E3-36	1.5-3	Residential	2780	18	2893	20% recovery - debris, brick, slag
		E3-54	3-4.5	Source Area	9207	5.8	230	50% recovery - brick, completely brick
		E3-72	4.5-6	Source Area	11270	<5.0	12	75% recovery - 6" of weathered till; ~12" of hard, gray till

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
US-10	SA-4	391	0-1	Source Area	11792	-	12116	Silty loam - dark brown, moist to slightly moist, roots to 4", trace brick fragments at 1'
		392	1-2	Residential	2618	-	530	Sandy Silt - Dark brown to yellow brown, slightly moist to dry; sand is fine grained, trace 1/2" subrounded gravel; brick fragments 2" chunk of wood at top (smelter debris)
		393	2-3	Residential	13	-	-	Silty Sand - grayish brown (orange brown at top) with bands of oxidation at 2-3', slightly moist to dry, medium to fine grained, trace root matter to 4', trace 2" and smaller subrounded gravel (Glacial till)
		394	3-4	Residential	26	-	-	
		395	4-5	Residential	14	-	-	
		396	5-6	Residential	10	-	-	
	SMV-K1	K1-18	0-1.5	Residential	781	11	517	Recovery ~/=80% - topsoil to 2" sandy silt tan, loose to 18" dry, no debris seen.
		K1-36	1.5-3	Residential	346	15	8061	Recovery ~/=<10% - sandy silt in catcher, no debris, soft pounding
		K1-54	3-4.5	-	-	-	-	0% recovery - redrilled
	SMV-K2	K2-36	1.5-3	Residential	305	21	178	Pulled ahead to south 1 foot and redrilled - recovery ~/=70% - tan weathered till with well graded gravel, dry no debris seen
		K2-54	3-4.5	Residential	297	19	154	Recovery ~/=50% - same as above, unconsolidated fill/till, medium driving difficulty but loose in spoon, no debris.

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
US-11	SAIC-S22		Surface	Residential	1490	112	2540	*See Note
			0.5	Source Area	4230	51	1240	
			1.0	Source Area	3590	24	96	
			2.0	Residential	1710	22	122	
			3.0	Residential	455	14.8	<5.0	
	S-22	782	4-6	Residential	18	181	<5.0	Light gray, slightly moist silt with occasional fine gravel - coarse gravel at 5.3'
		783	6-7	Residential	450	112	<5.0	Slightly moist, light gray, silty fine sand
		784	7-9	Residential	236	64	<5.0	Slightly moist, light gray, uniform, medium-grained sand
		785	9-11	Residential	233	77	<5.0	Slightly moist, light gray sandy silt
		786	11-13	Residential	58	116	<5.0	Light gray sand, silt with large (1") iron stained lenses
		787	13-15	Residential	19	6.8	<5.0	Moist, light gray, sandy silt with occasional fine gravel
		788	15	Residential	18	<1	<5.0	Moist, dense, light gray, sandy silt with occasional gravels
US-12	none		-	-	-	-	-	-
UR-01	SA-16	408	0-1	Residential	405	-	-	Silty Sand - Dark brown to orange brown, with orange mottling, moist to slightly moist, medium to fine grained, trace red brick fragments at 0-2'; 1" and smaller subrounded gravel (smelter debris)
		409	1-2	Residential	51	-	-	
		410	2-3	Residential	166	-	-	
		411	3-4	Residential	10	-	-	Silty Sand - Gray-brown, with orange staining at 3', dry, dense, with 3" and smaller subrounded gravel (glacial till)
		412	4-5	Residential	10	-	-	
UR-02	none		-	-	-	-	-	-
UR-03	S-37	725B	4.5-5	Residential	18	<1	<5.0	Moist, light gray silt, dense with gravel, sandy silt from 4.0-4.2'
		727	6-7	Residential	<5.0	<1	<5.0	As above, less dense
		728	7-8	Residential	<5.0	<1	<5.0	Dry, light gray silt with gravel

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
UR-04	SAIC-S29		Surface	Residential	484	4.5	563	*See Note
			0.5	Residential	935	10	1220	
			1.0	Residential	737	12	27.6	
			2.0	Residential	488	<0.5	9.8	
			3.0	Residential	188	0.59	21.2	
UR-05	SS-10		Surface	Residential	381	-	-	*See Note
UR-06	none		-	-	-	-	-	-
UR-07	none		-	-	-	-	-	-
UR-08	IA-1		Surface	Residential	300	-	-	*See Note
			1.0	Residential	990	-	-	
			2.0	Source Area	3100	-	-	
UR-09	SMV-F2	F2-18	0-1.5	Residential	624	7.9	304	80% recovery - 0-6" topsoil; 6-12" debris/fill; 12-18" silty fill
		F2-36	1.5-3	Residential	2265	13	1331	10% recovery - brick, debris, fill
		F2-54	3-4.5	-	-	-	-	No recovery.
		F2-72	4.5-6	Residential	67	<5.0	32	10% recovery - weathered till, brown with rock - one large rock preventing 54" sample collection!
UR-10	SAIC-S25		Surface	Residential	311	5.4	446	*See Note
			0.5	Residential	146	1.7	117	
			1.0	Residential	272	2.1	97.5	
			2.0	Residential	80	<0.5	33.3	
			3.0	Residential	5	<0.5	<5.0	
	SAIC-S26		Surface	Residential	421	5.7	513	*See Note
			0.5	Residential	800	6.8	533	
			1.0	Residential	642	9	86.4	
			2.0	Residential	81	<0.5	17.1	
			3.0	Residential	62	<0.5	<5.0	
UR-11	SAIC-S35		Surface	Residential	298	1.3	72	*See Note
			0.5	Residential	435	1.2	52.1	
			1.0	Residential	239	<0.5	8.6	
			2.0	Residential	727	2.7	199	
			3.0	Residential	849	3.1	99.3	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
UR-12	none		-	-	-	-	-	-
UR-13	none		-	-	-	-	-	-
UR-14	S-34	734	5	Residential	89	1.6	11	Slightly moist light brown silt with occasional gravels
		735	6	Residential	119	1.2	23	
		736	7	Residential	53	<1.0	12	Slightly moist, light brown silt with gravel, light gray silt at 7.2'
		738	9	Residential	12	<1.0	<5.0	Moist, light gray silt, with large (>1") gravel and weathered gravel
		739	11	Residential	11	<1.0	<5.0	
	SAIC-S34		Surface	Residential	276	3.2	191	*See Note
			0.5	Residential	312	2.6	181	
			1.0	Residential	415	4.3	223	
			2.0	Residential	1550	6.6	342	
			3.0	Residential	1160	5.7	344	
UR-15	none		-	-	-	-	-	-
UR-16	SMV-H2	H2-18	0-1.5	Residential	729	14	832	Topsoil 2"; subsoil and fill to 18"; light brown/tan, sandy gravel with some silty, loose, dry, no debris
		H2-36	1.5-3	Residential	25	<5.0	22	Recovery ~/=50% - same as above, loose unconsolidated fill, rock in catcher - no debris
		H2-54	3-4.5	Residential	33	<5.0	20	Recovery ~/=80% - fill to 42"; weathered till - brown and mottled to ~/=48" gray hard dry silt with little gravel.
UR-17	none		-	-	-	-	-	-
UR-18	SAIC-23		Surface	Residential	475	23.8	1500	*See Note
	SAIC-24		Surface	Residential	395	12	632	*See Note
			0.5	Residential	456	15.2	443	
			1.0	Residential	152	6.5	278	
			2.0	Residential	48	<0.5	<5.0	
			3.0	Residential	3	<0.5	<5.0	
UR-19	none		-	-	-	-	-	-
UR-20	SAIC-S33		Surface	Residential	240	1.4	96.1	*See Note
UR-21	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
UR-22	SA-18	420	0-1	Residential	1798	-	-	Silty Loam - Dark brown, slightly moist, worms, root matter (fill)
		421	1-2	Residential	288	-	-	Silty Sand - light brown mottled orange, fine to medium grained, medium dense to loose, trace 1/2" subrounded gravel (fill)
		422	2-3	Residential	18	-	-	
		423	3-4	Residential	10	-	-	Sandy Silt - Gray with some orange staining, dry, dense to hard, trace 1" subrounded gravel; 1" lense of coarse yellowish white and black sand at 4-5' (glacial till)
		424	4-5	Residential	13	-	-	
UR-23	none		-	-	-	-	-	-
UR-24	none		-	-	-	-	-	-
LS-01	none		-	-	-	-	-	-
LS-02	S-8	507	Surface	Source Area	10800	9	562	Topsoil, organic - rich
		508	0.5	Source Area	6700	3	158	Brown silt, sandy, gravelly
		509	1-2	Source Area	5300	1	40	
		511	2-3	Source Area	18000	2	14	Gray silt, gravelly, clayey, dark organic material
		512	3-4	Residential	1500	1	10	Hit water at 2.5', gray silt, clayey, oxidation spots
		513	4-6	Residential	1400	1	10	gray silt, clayey, some gravel
		514	6-7	Residential	1000	1	4	gray, silt, clayey, dense
		705	7-9	Residential	129	<1.0	<5.0	Light gray silt, very dense, dry, some gravel (1" sand layer at 6.5' medium fine, well sorted)
		706	10-10.2	Residential	123	<1.0	<5.0	Light gray silt, very dense, dry, some gravel
		707	11-11.2	Residential	64	<1.0	<5.0	Light gray silt, very dense, dry, small gravel
		708	13-13.2	Residential	123	1.2	<5.0	Light gray silt, fine sand
		709	15-15.2	Residential	75	<1.0	<5.0	Light gray silt, fine sand, coarser than previous sample, small gravel (5%), possible water
	SAIC-S8		Surface	Residential	917	4	644	*See Note

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-03	TP-9	119	0-1	Sub-Title C	33665	-	947	brown, sandy loam, some fine gravel and red brick fragments (fill)
		120	1-2	Source Area	10503	-	795	2" gray, medium sand underlain by light brown to gray to black mottled silty gravel. Gravel up to 2" & well rounded; black wood fragments (fill)
		121	2-3	Source Area	5668	-	672	
		122	3-4	Source Area	7821	-	16	orange/brown silty sand & gravel; transitioning to light gray/brown silt & sand with trace fine gravel; very minor weep at 5' (fill)
		123	4-5	Residential	1564	-	14	
		124	5-6	Residential	535	-	-	light brown/gray silt and fine sand, trace fine gravel, becoming very dense and dry at 6'
LS-04	none		-	-	-	-	-	-
LS-05	none		-	-	-	-	-	-
LS-06	none		-	-	-	-	-	-
LS-07	none		-	-	-	-	-	-
LS-08	none		-	-	-	-	-	-
LS-09	none		-	-	-	-	-	-
LS-10	SAIC-S9		Surface	Residential	1030	3	238	*See Note
			0.5	Source Area	7210	5	213	
			1.0	Source Area	6170	2	58	
			2.0	Source Area	3300	1	19	
			3.0	Residential	1080	1	5	
LS-11	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-12	S-47	567	Surface	Residential	2580	12	1200	Topsoil, sandy, organic material, brick pieces
		568	0.5	Source Area	3420	18	1560	Topsoil, sandy, organic material
		569	1-2	Source Area	4980	20	1550	Gravel, sandy, little silt
		570	2-3	Residential	2890	21	48	Brown sand, gravelly, little silt, some brick
		571	3-4	Residential	1660	14	38	Brown sand, silty, black clay lenses, trace gravel
		572	4-6	Residential	1630	2	12	Tan sand, clayey, little gravel, oxidation staining
		573	6-7	Residential	1670	3	51	Light gray sand, silty, clay lenses, some organic material
		710	7	Residential	466	1.4	<5.0	light gray silt, very dense, small gravel
		711	10	Residential	223	1	<5.0	Light gray silt, dense 1/2" gravel
		712	11	Residential	642	1	<5.0	Light gray silt, dense 1/2-3/4" gravel
	SAIC-S47		Surface	Source Area	3880	6	626	*See Note
			0.5	Source Area	4080	12	1130	
			1.0	Source Area	5380	15	1390	
			2.0	Source Area	5130	12	1640	
			3.0	Residential	2150	6.1	15.9	
	SMV-F1	F1-18	0-1.5	Residential	1140	13	1169	Topsoil/Fill; No debris
		F1-36	1.5-3	Residential	532	6	248	Fill; 6"-8" gravel ~/=1"; No debris; brown/gray weathered till at bottom
		F1-54	3-4.5	Residential	1535	<5.0	18	Brown/gray till at bottom; No debris or brick
LS-13	none		-	-	-	-	-	-

EVERETT SAMPLING EVENTS BY GRID NUMBER

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-14	PATB+	14	3.5	Residential	2840	<5	166	*See Note
		30	4.5	Residential	2705	<5	74	
		40	4.5	Source Area	6516	<5	77	
	P/A+	13	2	Source Area	3551	<5	10	
		25	3	Source Area	4583	<5	109	
	TP-8	138	0-1	Source Area	3738	-	625	Sandy Loam - Brown, trace 1/2" subrounded gravel & red brick frags (Smelter Debris)
		139	1-2	Residential	2797	-	415	
		140	2-3	Source Area	4619	-	309	Gravelly Silty Sand - Yellow Brown to gray some black staining at 2-3', slightly moist, medium to fine grained; approximately 10-20% 2" and smaller subrounded gravel, abundant brick fragments (smelter debris)
		141	3-4	Source Area	7237	-	200	
		142	4-5	Source Area	4669	-	17	Sandy Silt - Yellow brown with some orange mottling, moist, fine to coarse sand, trace rounded 1/4" gravel (fill)
		143	5-6	Residential	564	-	11	Gravelly sand - Light gray, medium grained, slightly moist to dry, <10% subrounded gravel (glacial till)
LS-15	PATB+	50	4	Source Area	8032	8	327	*See Note
LS-16	none		-	-	-	-	-	-
LS-17	IA-6		Surface	Source Area	16000	5	79	*See Note
			1.0	Residential	1400	3	440	
			2.0	Source Area	3500	7	360	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-18	SMVR5	0-24	0-2	Residential	100	-	92	Recovery ~/= 100%; 0-13" AC with sub-base and some fill; x-tion at 13" to fill with brick flakes; clear horizon at 13" to bottom of SS of black and white debris with sand and gravel well mixed.
		24-48	2-4	Residential	231	-	681	Recovery ~/= 75%; debris and gravel - black to 28"; fill at 28" with brick flakes and intermixed debris to 36"; gray 36-48 fill - reddish brown with some gravel, mostly silt; no debris
		48-60	4-5	Residential	<10	-	<10	Recovery ~/= 60%; continuation of silty fill with some gravel, no debris
		60-84	5-7	Residential	375	-	<10	Recovery ~/= 80%; continuation of silty fill with some gravel, reddish brown, no debris or bricks at all to bottom of SS
	EV-12	245	0-0.5	Residential	49	-	-	Gray, medium grained sand, 50% fine gravel, moist (road base fill)
		246	2-3.5	Residential	56	-	-	Sandy Silt, gray, trace gravel, moist
		247	5-6.5	Residential	776	-	-	Sandy Silt, tan to gray, mottled orange, coarse sand lense at 6.25', moist
		248	10.5-11.5	Residential	187	-	-	Silty Sand - tan to gray, mottled orange, loose, moist
		249	12.5-13.5	Residential	60	-	-	Silty Sand - gray, trace gravel, dense, slightly moist
LS-19	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-20	PATB+	53	4	Residential	1530	<5	<10	*See Note
		60	4	Residential	1033	<5	13	
		70	4	Source Area	3339	<5	<10	
		80	4	Residential	2671	<5	17	
		90	4	Sub-Title C	117900	<5	411	
		100	4	Source Area	10020	9	214	
	S-13	528	Surface	Residential	1400	5	556	Topsoil, organic material, clay
		529	0.5	Residential	1600	5	533	Topsoil, sandy, silty, organic material
		530	1-2	Source Area	14000	8	662	Sandy silt, gravel, brown with light gray sand, brick
		531	2-3	Source Area	4500	1	96	Light gray silt, clayey, sandy
		532	3-4	Source Area	11200	1	25	Brown sand, some gravel, silt
		533	4-6	Source Area	6500	1	13	Sand, gravel, light brown, clayey
		534	6-7	Residential	1100	1	56	light gray sandy silt, some brick
		747	7-7.2	Residential	214	<1.0	<5.0	Slightly moist, gray silt with occasional gravel
		748	9-10	Residential	717	<1.0	<5.0	Dry as above
		749	11-13	Residential	313	<1.0	<5.0	2" uniform fine sand lens at 22', dry, gray silt from 11.2-12'
		750	13-14	Residential	409	<1.0	<5.0	Dry, gray silt with occasional well rounded gravel <3/4"
		751	15-15.2	Residential	490	<1.0	<5.0	Moist, sandy gray silt, some silty sand, Lenses
	SAIC-S13		Surface	Residential	1350	4	1190	*See Note
			0.5	Residential	1500	4	488	
			1.0	Source Area	9150	4	732	
			2.0	Source Area	6100	1	671	
			3.0	Residential	2620	3	29	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-20	TP-7	132	0-1	Residential	2220	-	523	Brown Sandy Loam (fill)
		133	1-2	Source Area	8771	-	594	brown loam grading into silty sand and gravel with traces of red brick fragments, some black mottling (Smelter Debris)
		134	2-3	Source Area	9935	-	415	Gray silty fine sand and gravel with yellowish staining and trace red brick fragments (Smelter Debris)
		135	3-4	Source Area	10644	-	47	Orange Silty Sand grading to orange/brown to light brown Silty Sand & Gravel (fill)
		136	4-5	Source Area	6586	-	10	
		137	5-6	Residential	2952	-	12	Silty Sand - light brown to gray with some orange mottling, fine to very fine grained moist, med dense, trace fine gravels (Glacial till)
		106	6-7	Residential	684	-	-	
		107	8-9	Residential	698	-	-	Silty Sand - light brown, fine grained, loose to med dense, moist (Glacial till)
		108	10-11	Residential	541	-	-	
LS-21	none		-	-	-	-	-	-
LS-22	SAIC-S49		Surface	Residential	2010	5.3	233	*See Note
LS-23	S-46	515	Surface	Residential	1600	7	376	Topsoil, piece of brick
		516	0.5	Residential	1600	7	407	Brown silt, sandy, gravelly
		517	1-2	Residential	2100	8	442	Topsoil, piece of brick
		518	2-3	Source Area	3400	11	712	topsoil, some gravel, brick
		519	3-4	Source Area	3300	12	821	Topsoil, black clay, brick
		520	4-6	Residential	900	11	552	Topsoil, black clay
		758	6-7	Residential	2006	1.3	5.8	Tan sand, silt, gravel, some clay
		759	7-7.5	Residential	603	1.2	13	Moist, light gray silt
		761	9	Residential	1052	1.4	<5.0	Moist, light gray, gravelly, sandy silt
		762	11-12	Residential	512	1.3	<5.0	slightly moist, light gray sandy silt, with occasional fine gravel
		763	13-15	Residential	134	<1.0	<5.0	Dry as above
		764	15-16	Residential	133	<1.0	<5.0	As above with coarse gravel

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-23	SAIC-S46		Surface	Residential	1860	5	268	*See Note
			0.5	Residential	2590	6	383	
			1.0	Source Area	3170	7	361	
			2.0	Source Area	3120	6	410	
			3.0	Residential	2440	9	568	
	EV-3	S-1A	1-2.5	Residential	288	2	66	3" brown gravel light clay; 3" dark brown (resinous) fine gravel; 6" gray/brown sand and gravel and some silt
		S-3	4-5.5	Residential	248	1	44	6" gray/brown sand and gravel, some silt; 7" dark brown very coarse sand; 3" orange/brown fine sand, little silt, trace fine gravel (moist)
		S-6	8.5-10	Residential	212	<1.0	4	Gray brown silt and fine sand light fine gravel, trace clay (dry) with light fine-coarse gravel, red oxidixed surface staining
		S-7	10-11.5	Residential	34	1	4	
		S-10	14.5-16.8	Residential	83	1	7	as above with trace coarse sand
		S-12	24-25.5	Residential	66	<1.0	4	as above with little clay
		S-14B	34-35.5	Residential	14	<1.0	6	light brown fine-coarse sand (damp) 2" light brown silt, some clay oxidized along laminations (dry)
		S-17	44-45.5	Residential	5	<1.0	3	Light brown, very coarse sand, little fine-medium sand (damp)
		S-18	49-50.5	Residential	3	<1.0	2	Light brown, fine sand (wet)
LS-24	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-25	SMV-E2	E2-18	0-1.5	Source Area	4743	<5.0	184	70% recovery - 0-8" topsoil/subsoil, brick at 8-18" (drove through brick)
		E2-36	1.5-3	Source Area	3479	<5.0	23	Recovery >80% - bricks to 24", clear horizon with fill/till below - brown silty sand grading to gray silty till at 36", dry no debris/brick below 24"
		E2-54	3-4.5	Residential	2283	<5.0	<10	100% recovery - weathered till at 36" - by 40" undisturbed till - gray, moist, hard silt mottled 36-42" - gray silt till to 54"
		E2-72	4.5-6	Residential	856	<5.0	<10	Till - 100% recovery - wet with gravel 54-58"; dry gray clay silt >60-72", no debris/brick
LS-26	SMV-E1	E1-18	0-1.5	Source Area	5582	6.5	118	50% recovery - soft - Topsoil/brown fill - no debris
		E1-36	1.5-3	Source Area	4011	<5.0	20	70% recovery - brown/gray weathered grading to gray till at 36" with some gravel, hard, no debris
		E1-54	3-4.5	Residential	1757	<5.0	<10	Till - dark gray at 36-48; light gray to 52"; some gravel weathered at 36-40" and undisturbed below 40". 100% recovery
		E1-72	4.5-6	Residential	1102	<5.0	12	100% recovery - glacial till gray - some gravel at 54" grading to silt by 60" - hard, uniform till to 72". No debris.
		E1-90	6-7.5	Residential	826	<5.0	<10	Same as E1-72 - 70% recovery - sandy silt glacial till to 90"
	SS-9		Surface	Residential	182	1	87	*See Note
LS-27	none		-	-	-	-	-	-
LS-28	none		-	-	-	-	-	-
LS-29	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-30	S111E	0-18	0-1.5	Sub-Title C	34680	-	-	100% recovery; 0-18" soil, topsoil & subsoil/fill. Distinct horizon ~/= 8" - black/sandy with white crystals to 18" - debris well intermixed
		18-36	1.5-3	Source Area	11940	-	-	Recovery ~/= 80%; 18" down - black and white (salt and pepper) debris brick at 24"-28"; silt and till below 30" without brick or debris. Clean horizons.
		36-54	3-4.5	Residential	2194	-	-	Recovery ~/= 100%; glacial till; gray tight, no debris or bricks/fragments weathered at 36" and tight below 40"
LS-31	none		-	-	-	-	-	-
LS-32	none		-	-	-	-	-	-
LS-33	SMV-D1	D1-18	0-1.5	Sub-Title C	41310	21	905	>80% recovery - topsoil to 4"; brick and debris intermixed from >4-18" - some white crystals at 12", dry
		D1-36	1.5-3	Source Area	8870	<5.0	31	35% recovery - brown weathered till/fill, no bricks or debris observed
		D1-54	3-4.5	Source Area	4126	<5.0	<10	65% recovery - weathered till-brown, moist, sandy silt, mottled, no debris
		D1-72	4.5-6	Residential	1434	<5.0	<10	>80% recovery - wet at 54-58"; (gravel in silt) - clay silt 58-72" dry till - no debris
LS-34	IA-5		Surface	Source Area	23000	350	2300	*See Note
			1.0	Source Area	28000	23	540	
			2.0	Source Area	20000	7	120	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-34	S-111	522	Surface	Residential	205	1	33	Brown sand, silt, tan clay, organic material
		523	0.5	Source Area	4100	11	264	Sand, silt, some gravel, organic material
		524	1-2	Sub-Title C	70000	75	1480	Brown silty clay, white sand, brick
		525	2-3	Sub-Title C	430000	96	2910	white sand, brown silt, brick
		526	3-4	Sub-Title C	622500	18	2804	white sand, (crystalline), brick, brown silt
		527	4-5	Sub-Title C	150000	17	388	gray sand, silt, brick, dark gray clay, pebbles
		714A	5-6	Sub-Title C	36000	9.3	90	Moist, gray, medium sand, silt, black streaks, small gravel, strong odor
		714B	6.25-7.25	Source Area	19140	2	5	Light gray silt, fine sand, small gravel, dense
		715	8-8.5	Source Area	15000	2.4	1.4	light gray silt, very dense, small gravel
		716	9	Source Area	11950	1	5	
		717	10.8-11.3	Residential	1800	0.94	2	
	S111A	0-18	0-1.5	Source Area	8238	-	-	50% Recovery; Topsoil/subsoil 6"; sandy silt-brown to depth; wood in bottom of SS. No brick fragments.
		18-36	1.5-3	Source Area	17180	-	-	60% recovery; Sandy silt-light brown, grading to silt at bottom of SS no brick, some small gravels
		36-54	3-4.5	Source Area	9171	-	-	65% recovery; silt light brown - (brick ~40") 4" horizon debris & black soil below; weathered till to bottom of SS
		54-72	4.5-6	Source Area	3206	-	-	Full recovery; sandy silt with brick fragments - 54"-58"; weathered till grading to glacial till to bottom of SS. Clear demarcation at till; some white crystals at brick horizon, well intermixed.

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-34	S111B	0-18	0-1.5	Residential	53	-	-	<15% recovery; topsoil/sod only
		18-36	1.5-3	Sub-Title C	109600	-	-	50% recovery; brick and debris with white crystals, wood at bottom of SS, well intermixed
		36-54	3-4.5	Sub-Title C	90980	-	-	25% recovery; brick, then wood, then till, very distinct from horizon moist - till by 54"
		54-72	4.5-6	Source Area	26930	-	-	70% recovery; moist silt weathered light brown; dense silt and till at bottom of SS (72"); no brick or debris, distinct horizon with previous sample
	S111D	0-18	0-1.5	Source Area	17840	-	-	75% recovery; 0-10" - sod-subsoil silt; brick and debris layer clearly at 10" with white crystals; black, sandy, distinct from surface soil horizon 10"-18"
		18-36	1.5-3	Sub-Title C	123300	-	-	50% recovery; brick/debris and white crystals, little soil, visually distinct - black "salt and pepper"
		36-54	3-4.5	Sub-Title C	48020	-	-	80% recovery; brick & debris - black; some white crystals weathered till at 52" with wood at bottom; all intermixed and distinct from till
		54-72	4.5-6	Source Area	19270	-	-	35% recovery; at 54" - glacial till, moist at bottom, distinct color (gray) from debris layer in previous sample; no brick/debris

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-34	SA-6	353	0-1	Source Area	3633	-	304	Silty Loam - brown, slightly moist with organic matter
		354	1-2	Sub-Title C	39777	-	1327	Brick - red, slightly moist to dry, trace gravel with white material fragments (smelter debris)
		356	2-3	Sub-Title C	40938	-	41	
		357	3-4	Sub-Title C	33201	-	20	
		359	4-5	Source Area	7903	-	10	Silty Sand - yellow brown grading to gray with depth some oxidation mottling, slightly moist, medium to fine grained, medium dense to dense, some subrounded 1' gravel (Glacial till)
		360	5-6	Residential	1260	-	10	
		361	7.5-9	Residential	2761	-	10	
LS-35	SMVR6	0-24	0-2	Residential	48	-	109	Recovery ~/= 100%; 0-14" - paving & sand sub-base brown; some fill/silt above 14" brown; 14"-24" appears to be smelter debris black and white, sand and gravel intermixed - sample lower 10" of SS. Clear horizon at 14"
		24-48	2-4	Residential	681	-	1060	Recovery ~/= 60%; top - sandy gravel with debris intermixed black/brown - some small brick fragments; horizon distinct at ~/= 44" to weathered silt/till - reddish brown, with some gravels no debris at bottom
		48-60	4-5	Residential	20	-	14	Recovery ~/= 50%; weathered silt, reddish brown, little sign of debris; bottom appears to be till; some wood in 48-56 layer, dry
		60-84	5-7	Residential	2205	-	<10	Recovery ~/= 50%; Silt/gravel - light brown with gray; dry, no sign of debris and fragments or brick probably fill; doesn't look like till.

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-36	S-15	595	Surface	Residential	103	1	36	Organic material, sandy, crushed gravel
		596	0.5	Residential	230	2	110	Brown, silty sand
		597	1	Residential	870	3	150	Brown silty sand, 5% clays, brick material
		598	2	Residential	1670	4	230	Brown silty clay, small gravels
		599	3	Residential	1780	2	95	Brown silty/very little clay, wet
		600	4	Residential	650	1	19	Tan silty clay - Hit top of flume? Hard, pipe? Sized off & had 1' void
		601	6	Source Area	3040	1	34	Tan silty clay
		753	7	Residential	1074	<1.0	<5.0	Moist, light gray silt with occasional gravel
		754	9-10	Residential	293	<1.0	<5.0	Slightly moist as above
		755	11-13	Residential	526	<1.0	<5.0	Sandy silt Lens 10.7-11' - very moist, light gray silt with occasional <1% well rounded gravel
		756	13-14	Residential	123	<1.0	<5.0	Dry, light gray silt with occasional <1% coarse gravel
		757	15	Residential	258	<1.0	<5.0	
	SAIC-S15		Surface	Residential	50	1	87	*See Note
			0.5	Residential	513	1	85	
			1.0	Residential	577	2	205	
			2.0	Residential	2650	5	241	
			3.0	Sub-Title C	44700	5	632	
	SMV-C1	C1-18	0-1.5	Residential	483	<5.0	314	0-6" Topsoil with organics; 6-12" silty, sandy fill; 12-18" silty, sandy fill
		C1-36	1.5-3	Source Area	12180	5	185	50% recovery, silty with brick fragments
		C1-54	3-4.5	Source Area	5348	<5.0	22	36-42" silty, sandy fill; 42-54" till, difficult peatetration, 80% recovery
		C1-72	4.5-6	Residential	1141	<5.0	<10	till, difficult peatetration, 80% recovery

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-37	S-112	602	Surface	Residential	1510	3	303	Brown to black organic material, sandy, some small gravel
		603	0.5	Sub-Title C	143600	230	2061	Silty, red (brick color) little clays, some oxidation
		604	1-2	Sub-Title C	143500	17	1820	Brown silty sand, some red, some oxidation, hard
		605	2-3	Sub-Title C	83600	19	1130	red silty/(brick), some oxidation, little clays
		606	3-4	Sub-Title C	34950	5	328	sandy silt, red, some oxidation
		607	4-6	Source Area	20550	11	1370	Brown sandy silt (brick chips) & had 1' void
	S112A	0-18	0-1.5	Source Area	28410	-	-	60%+ recovery; top 6" - sod - topsoil dark brown; brick to bottom of hole - no soil intermixed
		18-36	1.5-3	Source Area	18100	-	-	50%+/- Recovery; moist brick, soil, some white crystalline all intermixed, more brick at bottom of hole
		36-54	3-4.5	Source Area	10670	-	-	50% Recovery; silty sand, brown very little brick fragments, light brown glacial till at bottom of SS.
		54-72	4.5-6	Source Area	3650	-	-	80% Recovery; Reddish/brown brick and soil intermixed top 4", clear demarcation to glacial till to bottom of SS at 72" BGS till encountered ~/= 64"+/-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-37	S112B	0-18	0-1.5	Source Area	28880	-	-	Top 4" gravel and fill; 4"-18" Silty sand with brick fragments at 8"; some white crystalline and brick intermixed to 18" - light brown; much brick at bottom
		18-36	1.5-3	Sub-Title C	37830	-	-	Little recovery; moist-sandy brown with brick fragments - some gray
		36-54	3-4.5	Source Area	8078	-	-	75% Recovery; brick at top to 6" (~42") - glacial till to 54" - brown and gray - moist above till, right below brick - good visual distinction.
		54-72	4.5-6	Residential	1817	-	-	75% recovery - glacial till - light brown/gray - sandy silt - water at bottom ~/=69" below ground sample
	S112C	0-18	0-1.5	Sub-Title C	134400	-	-	Recovered = 1' & 4"; 0-4" Gravel/Sand with some brick; 4"-8" Brick and Dirt with some white color; 8"-16" Dirt with some brick fragments
		18-36	1.5-3	Source Area	24030	-	-	Recovered = 1/2 of SS; top 4" dirt sandy silt; to bottom of SS silty sand brown, little brick
		36-54	3-4.5	Source Area	5288	-	-	Full SS recovered - 36"-42" Clay silt with white crystalline (As2O3 probably) with brick fragments in bottom
		54-72	4.5-6	Residential	1555	-	-	Full SS recovered; Top 4" brown sandy silt without brick; remaining depth (14") brown/gray silt - glacial till

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-37	S112D	0-18	0-1.5	Sub-Title C	46150	-	-	Full Recovery; top 3" - soil/gravel; 4" BGS brick fragments and soil grading to brick at bottom of SS (18" BGS)
		18-36	1.5-3	Sub-Title C	56240	-	-	Full Recovery; soil and brick fragments 18"-24" BGS; brick 24"-32", sandy debris w/ white crystals to 36"
		36-54	3-4.5	Source Area	16560	-	-	Drill penetrated ~/= 6" - fell down hole - moist - sandy with brick fragments 2" - grading to weathered till and fill - light brown and moist at 42" wood at 52" to bottom - bark brown-black
		54-72	4.5-6	Source Area	3337	-	-	Full recovery; till weathered wet ~/= 60" +/- no bricks, brown to bottom of SS clear demarcation
LS-38	S111C	0-18	0-1.5	Source Area	17080	-	-	Recovery ~/= 70%; topsoil/subsoil - 4"; then 6" till-brown; silt and brick at 10"; fragments with silty soil - brown to 18"
		18-36	1.5-3	Sub-Title C	82770	-	-	Recovery ~/= 50%; bricks and fragments and soil intermixed. Distinct horizon to till (brown) and silt at ~/=32"; no fragments below this.
		36-54	3-4.5	Source Area	6568	-	-	Recovery ~/= <10%; brown silt with some gravel, no real brick fragments - seemed like we're drilling through bricks
		54-72	4.5-6	Source Area	7254	-	-	Recovery ~/= 100%; weathered, wet till at 54"-58"; moist - dry till grading to tight silt at 72"; brown and gray, distinct horizon with previous sample; no brick or debris.
LS-39	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-40	SAIC-S17		Surface	Residential	235	2	222	*See Note
			0.5	Residential	241	1	169	
			1.0	Residential	366	3	256	
			2.0	Residential	976	1	79	
			3.0	Residential	1190	1	1	
	TP-5	126	0-1	Residential	1161	-	473	Sandy Loam - Brown, little fine well rounded gravel (fill)
		127	1-2	Source Area	5370	-	92	Sand - Gray/brown sandy interval with abundant red brick fragments, some white mottling (Smelter debris)
		128	2-3	Residential	2777	-	34	Gravelly Silt & Sand - Orange/Brown, transitioning into light brown silt and sand with trace gravel (fill)
		129	3-4	Residential	827	-	13	Light brown/gray silt and sand, with trace of fine gravel, moist (no free water) drier at 4-5' and very dense (glacial till)
		130	4-5	Residential	502	-	10	
LS-41	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-42	LS-42	1-0-12	0-1	Source Area	15690	-	-	Recovery = 90%; top 4" gravel fill; 4-12", gravel and silt fill, gray, loose no bricks or debris
		2-12-24	1-2	Source Area	28060	-	-	Silt and gravel with brick and debris, loose, well mixed with gravels (7 1/2") brown and gray
		3-24-36	2-3	Sub-Title C	33080	-	-	Silt and gravel with bricks and debris, well mixed; brown and black; weathered till/fill with wood and 34"+/- clean transition silty with some gravel at 36", dense
	S113	609	Surface	Source Area	26550	9	860	Topsoil, organic material (brick chips) sandy
		610	0.5	Sub-Title C	38650	17	850	Brown sandy silt, brick chips, small slag
		611	1-2	Sub-Title C	30150	12	610	Brownish-red silts with brick chips
		612	2-3	Source Area	25540	9	983	brownish-red silts, small gravels, small slag
		613	3-4	Source Area	9060	6	666	Brown silty sand, small gravel
		614	4-6	Residential	2620	3	14	tan sandy silt, small gravel
		740	6-6.2	Source Area	13030	4	201	Brown silt with black organic? Streaking
		741	7-9	Source Area	4795	1	5	Light gray silt with light brown marbelling, moist
		743	9-10	Residential	864	<1.0	<5.0	very dense, light gray silt, with gravels, slightly moist
		744	11-12	Residential	389	<1.0	<5.0	dense, light gray, sandy silt with occasional <1-2" gravel, moist
		745	13	Residential	346	<1.0	<5.0	As above with sandy silt, Lense at 13', slightly moist
		746	15	Residential	282	<1.0	<5.0	Dry, dense, light gray silt with occasional gravel
LS-43	SAIC-S45		Surface	Source Area	7450	8	452	*See Note
			1.0	Source Area	13700	10	581	
			2.0	Source Area	4730	4	447	
			3.0	Residential	1940	2	27	
LS-44	none		-	-	-	-	-	-
LS-45	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-46	SA-7	344	0-1	Source Area	19122	-	486	Silty Loam - dark brown, slightly moist to dry, some medium grained sand, organic matter. Trace brick fragments at 2' (fill)
		345	1-2	Sub-Title C	38751	-	563	
		346	2-3	Source Area	14277	-	10	Sandy Silt - light brown to gray brown, some orange mottling, medium dense, slightly moist to dry, some 1" subrounded gravel (fill)
		347	3-4	Source Area	7476	-	10	
		348	4-5	Source Area	5245	-	10	
		349	5-6	Residential	1348	-	10	
		351	7.5-9	Residential	402	-	-	Silty sand with gravel - gray to brown, slightly moist to dry, fine grained to silt, dense to very dense (more dense with depth), trace vegetative matter, some 1/4" subrounded gravel (glacial till)
		352	10-11	Residential	258	-	-	
LS-47	SMVR7	0-24	0-2	Residential	104	-	102	Recovery ~/= 85%; (top 4" AC pave not sampled) 12" road base - clear horizon ~/= 12" BGS (+4"); black/gray w/ white crystals
		24-48	2-4	Residential	307	-	18	Recovery ~/= 90%; weathered till - reddish brown with silt/gravel; no bricks/fragments/debris
		48-60	4-5	Source Area	3497	-	<10	Recovery ~/= 90%; weathered till - reddish brown with silt and gravel; no
		60-84	5-7	Residential	1412	-	<10	Recovery ~/= 100%; silty sand 60"-68"; weathered-reddish brown; no bricks,
	EV-10	238	0-0.5	Residential	55	-	-	Sand and Gravel - brown/gray, medium to coarse sand, 50% gravel, semi-rounded; trace silt; moist, (road base fill)
		239	2-2.8	Residential	1660	-	-	Silty Sand - dark to light brown, trace gravel, 1/2" black layer; moist
		240	2.8-3.5	Source Area	7660	-	-	Fine sand & Silt - brown/orange, trace gravel, moist
		241	5-5.5	Residential	773	-	-	Sandy Silt - light brown, mottled orange, trace gravel, moist
		243	10-10.5	Residential	1728	-	-	Silty Sand - gray brown, trace gravel, moist, dense from 10.5-11', cobble at 11'
		244	10.5-11	Residential	280	-	-	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-48	none		-	-	-	-	-	-
LS-49	none		-	-	-	-	-	-
LS-50	S-92	287	Surface	Residential	2569	6	415	Black sandy silt, grass and roots
		288	0.5	Source Area	29000	14	1098	Brown, fine-medium sand, small gravels, brick fragments, some root material
		289	1-2	Source Area	7534	3	663	Brown silt, fine sand, trace clay
		290	2-3	Source Area	3215	12	5	Light brown silt, fine sand, small gravel
		291	3-4	Source Area	3681	3	122	Light brown silt, fine sand, small gravel with black silt layer (2")
		292	4-6	Residential	1780	<1.0	<5.0	Light brown fine sand, some silt, trace small gravel
		293	6-7	Residential	753	<1.0	<5.0	Gray brown fine sand, trace silt/small gravel, dense
		294	7-9	Residential	735	<1.0	<5.0	Gray fine sand, little silt, trace small gravel
		295	9-11	Residential	253	<1.0	<5.0	Gray brown silty fine sand, trace small gravel
LS-51	none		-	-	-	-	-	-
LS-52	PTB-20		4.5	Residential	2362	<5	41	*See Note
	SMV-B1	B1-18	0-1.5	Residential	949	<5.0	209	(about PTB+20+/-) skimmed surface where trench soil stock piled - 80% recovery - Top 6" subsoil, loose, debris and soil mixed 6-18"; brick fragments brown, dry
		B1-36	1.5-3	Residential	2182	<5.0	110	<10% recovery - brick in end of spoon - a little soil and debris above brick
		B1-54	3-4.5	Residential	701	<5.0	15	<30% recovery - brick fragments and debris top 2", weathered till with gravel grading to silty till at 54" (approx) dry, gray.
		B1-72	4.5-6	Residential	254	<5.0	<10	recovery ~/=100% - gray silty till, dry some angular gravel intermixed (<1/2" dia), hard, no debris, bricks.

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-53	PTB	30	4	Source Area	7507	<5	<10	*See Note
		40	4	Source Area	6471	<5	14	
	TP-4	112	0-1	Residential	565	-	152	Sandy Loam - dark brown (fill)
		113	1-2	Residential	1981	-	144	Gravelly Silt - brown, gravel well rounded to 2"; occasional brick debris (smelter debris)
		114	2-3	Source Area	8799	-	533	Silt - dark brown and abundant brick debris, discontinuous lenses to medium sand (very limited in extent) (Smelter debris)
		115	3-4	Sub-Title C	32918	-	468	Sand - 1-2" of sand underlain by orange to light brown silt and fine sand with trace fine gravel. (fill)
		116	4-5	Source Area	4724	-	30	Transition to light brown/gray, silt and sand, moist becomes drier at 6' (glacial till)
		117	5-6	Residential	1600	-	16	
		121	6-7	Residential	225	-	-	Sandy Silt - Light brown to gray mottled orange, dry, medium dense to loose, trace fine gravel (Glacial till)
		122	8-9	Residential	219	-	-	
		123	10-11	Residential	206	-	-	
LS-54	PTB	50	3.5	Source Area	12360	<5	43	*See Note
		70	4	Source Area	10300	<5	17	
	SMVR3	0-24	0-2	Source Area	8752	-	151	Recovery ~/= 100%; top ~/= 5" AC before 0"; AC/Road fill 0-12"; clear horizon @ 12" - brick, debris, white crystals intermixed to ~/=22"; mottled brown silt at 24", wet (moist)
		24-48	2-4	Residential	225	-	<10	Recovery ~/= 100%; top 4" debris and soil; at 28" clear horizon to 6" layer - tan clay silt; ~/= 34" horizon and grades to silty sand, no debris after 28" BGS. Silty sand to 48" and somewhat moist
		48-60	4-5	Residential	66	-	<10	Recovery ~/= 100%; glacial till - gray silty sand dense, no gravel no debris or

EVERETT SAMPLING EVENTS BY GRID NUMBER

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-55	PTB	80	4	Source Area	4285	<5	78	*See Note
		90	5	Residential	2947	<5	<10	
	TP-6A	106	0-1	Source Area	4373	-	289	Silty Loam - Brown, trace gravel to 1' well rounded brick fragments (Smelter Debris)
		107	1-2	Source Area	12487	-	458	Brick - Brown sandy silt overlying brick layer consisting of three rows of rec mortared brick; approximately two 1/2" gray sand underlying brick (smelter debris)
		108	2-3	Source Area	9726	-	38	Orange/brown silty sand some brown to black mottling; black charcoal fragments, trace gravel (fill)
		109	3-4	Source Area	9252	-	29	
		110	4-5	Source Area	4305	-	10	Light brown silt and sand, trace gravel well rounded (glacial till)
		111	5-6	Source Area	3235	-	10	
		116	6-7	Residential	353	-	10	Sandy Silt - Light brown to gray mottled orange, dry, medium dense, trace fine gravel (glacial till)
		117	8-9	Residential	706	-	-	
		118	10-11	Residential	412	-	-	
		119	12-13	Residential	249	-	-	Silt - light brown to gray, dry, dense, trace fine gravel (glacial till)

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-56	PTB	100	4	Source Area	4918	<5	15	*See Note
		110	4	Source Area	4099	<5	88	
		120	4	Source Area	3749	<5	50	
	SAIC-S14		Surface	Residential	833	2	197	*See Note
			0.5	Residential	2190	5	384	
			1.0	Source Area	3330	4	218	
			2.0	Source Area	6490	6	216	
			3.0	Residential	2410	<0.5	16.9	
	SMV-D2	D2-18	0-1.5	Source Area	5768	7.8	336	~/=20 E of N-S fence on E side of Pilchuck ~/= station PTB+100 - subsoil to 8"; soils and brick/debris intermixed to 18", dry, brown.
		D2-36	1.5-3	Source Area	8132	<5.0	361	>70% recovery, brick and debris and soil mixed - black/brown, clear horizon ~/= 30 with brown weathered till-sill - without debris to 36"
		D2-54	3-4.5	Source Area	5106	<5.0	13	Weathered till (brown) grading to gray mottled till with some gravel, dry, no debris
		D2-72	4.5-6	Residential	1417	<5.0	<10	Recovery ~/=100% - hard, gray glacial till silty with some gravel dry, no debris - some cross-contamination at catcher - discarded
		D2-90	6-7.5	Residential	482	<5.0	<10	Recovery ~/=90% - glacial till-silt with some gravel, gray, dry, hard. No debris or bricks

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-56	TP-6B	100	0-1	Source Area	9388	-	544	Silty Loam - Brown silty loam with trace of fine gravel. Abundant brick fragments (fill)
		101	1-2	Source Area	14223	-	505	Brick - brick floor intact at 1.5'; 0.2' dark brown silty sand over orange brick; 0.2' medium sand under brick underlain by orange/brown silty sand with trace clay, some gravel and cobbles to 2" (Smelter Debris)
		102	2-3	Source Area	13985	-	10	Orange brown silty sand some gravel trace clay; some dark brown to black mottling in soil for 1' below brick layer, wood debris in darker areas (Fill)
		103	3-4	Source Area	13537	-	-	
		104	4-5	Source Area	5497	-	-	Transition to light gray/brown silt to fine sand, trace gravel and cobbles, some orange to gray mottling; very dense (Glacial till)
		105	5-6	Residential	2740	-	-	
LS-57	none		-	-	-	-	-	-
LS-58	SMVR2	0-24	0-2	Residential	1239	-	39	Recovery = 100% +/-; ~/= 6" AC above elevation 0" Top 4" AC and subbase; change to reddish/brown silt with interspersed gravel and sand to 24"; no sign of debris or bricks/fragments
		24-48	2-4	Source Area	3270	-	<10	Recovery ~/= 100%; upper 8" red/brown mottled silt with some gravel/sand; 32"-48" gray clay silt with no gravel - very homogenous, tight and dry to 48"; no debris, brick or fragments.
		48-60	4-5	Residential	1001	-	<10	Recovery ~/= 100%; glacial till - continuation to previous sample; dry, tight, gray clay silt to 60"
LS-59	none		-	-	-	-	-	-
LS-60	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-61	SMVR1	0-24	0-2	Residential	1875	-	447	Recovery ~/= 100%; 4" AC before 0". 0-12" - sand, debris and brick, brown/black and red, some white crystals. 12" - clear horizon - 12"-24" fill-mottled silt red/brown - no fragments below 12". Wet at 24"
		24-48	2-4	Residential	15	-	<10	Recovery ~/= 100%; silty sand 24"-48"; mottled red/orange and gray/brown, little gravel, homogenous throughout core - moist - no debris or bricks/fragments.
		48-60	4-5	Residential	24	-	<10	Recovery ~/= 100%; Sandy with gravel and some cobble, grading to silty sand at bottom; brown/gray with some reddish mottling, wet at 60"; no debris brick or fragments
		60-84	5-7	Residential	<10	-	<10	Recovery ~/=100% - top 8" sandy with gravel and wet; at ~/=68" cross section to silty with little sand, no gravel no debris, gray, dry
LS-62	EV-2	S-1	0-1	Residential	660	10	400	Brown fine-coarse sand, some silt, little gravel, trace clay, contains some brick fragments (damp)
		S-2	1-2	Residential	117	1	50	
		S-3	2-3	Residential	1090	13	430	As above with fragments of brick and slag. Trace white oxidation on sediment (damp)
		S-4	3-4	Residential	1687	15	430	6" as above with increased white and green oxidation 6" light brown/gray silt and fine sand little clay, trace gravel (damp)
		S-5	11-12	Residential	7	<1.0	5.4	as above with intervals fine-coarse sand and silt (dry)
LS-63	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-64	SA-2	369	0-1	Residential	2351	-	1141	0-0.2' Black asphalt (road pavement); 0.2-1' gravelly sand - dark brown slightly moist to dry, fine to medium grained, medium dense with 1" subround to round gravel with trace brick fragments at 1' (road base fill)
		370	1-2	Source Area	4171	-	1128	Sandy Silt - brown, some black staining at 1.5', fine to medium grained, medium dense, slightly moist; trace 1/4" round to subrounded gravel; 1.5" intact red brick chunks; trace wood chunks (Smelter Debris)
		371	2-3	Residential	2014	-	10	Silty Sand - Gray-brown with orange mottling at 2-3', slightly moist to dry, med fine grained, finer with depth, med dense; trace 1/4" subrounded gravel at 2-3' (Glacial till)
		372	3-4	Residential	158	-	-	
		373	5-6	Residential	40	-	-	
		374	6-7	Residential	17	-	-	
LS-65	none		-	-	-	-	-	-
LS-66	SMV-I2	I2-18	0-1.5	Residential	1471	57	1651	100% recovery - topsoil/fill to 12", clear horizon with brick >12"-18"; weathered till at 18", dry
		I2-36	1.5-3	Residential	256	14	16	Recovery ~/=100% - wet at 18" at horizon with brick above; 24-36" weathered till dry/moist grading to till at 36" no debris >18" hard
		I2-54	3-4.5	Residential	<10	12	<10	Recovery ~/=100% - till moist silty stiff to 54", no debris, gray
LS-67	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-68	SMV-J1	J1-18	0-1.5	Source Area	4585	140	5051	Recovery ~/=100% - topsoil to 6"; fill with brick fragments to 18"; black flue dust (?) and debris from 6-18" well mixed with soil, dry
		J1-36	1.5-3	Residential	379	50	54	100% recovery - clear horizon at 18" with debris <18", weathered till mottled brown/gray grading to silty glacial till at 36". No debris >18".
		J1-54	3-4.5	Residential	18	29	12	Recovery ~/=100% - wet with gravel 36-40"; till 40"-54" with gravel to 44" gray moist till 44-54"; no debris
LS-69	SA-1	363	0-1	Residential	1427	-	1038	Black asphalt (road pavement)
		364	1-2	Residential	682	-	387	
		365	2-3	Residential	818	-	89	brick, sand & gravel - red brick fragments getting larger with depth (3" at 3-4'), slightly moist to dry; sand is black/white/gray, medium to fine grained (mortar?); gravel 1" and smaller to 2' (Smelter Debris)
		366	3-4	Residential	320	-	17	
		367	4-5	Source Area	3841	-	1083	Brick - red, dry, intact with 1/4" gray and white sand layers approximately 3" apart. At 4' Sand appears to be yellow stained. (Smelter Debris)
		368	6-6.25	Residential	515	-	-	
LS-70	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-71	S-4	616	Surface	Residential	1340	13	610	Brown to black topsoil, sandy, small gravels
		617	0.5	Residential	2460	27	940	Brown sandy silt
		618	1-2	Source Area	4290	43	2280	brown silty sand (brick chips)
		619	2-3	Residential	1330	14	610	Brown silty sand, small gravel
		620	3-4	Residential	2720	86	1560	Black organic material, silty (brick chips)
		621	4-6	Source Area	4840	65	1850	Dark brown silty, mainly wood fibers
		622	6-7	Residential	270	12	51	Tan Silty sand, small gravels
		700	7-9	Residential	136	4	29	7-7.2' olive gray fill; >7.2' light gray till, sandy silt, angular gravel
		702	9	Residential	11	18	<5.0	Light gray silt, very dense, dry, some gravel
		703	10	Residential	<5.0	<1.0	<5.0	Light gray silt, very dense, dry, angular gravel
		704	11-12	Residential	<5.0	1.5	<5.0	Light gray silt, very dense, dry, some gravel
	SAIC-S4		Surface	Source Area	4860	81	1570	*See Note
			0.5	Residential	2380	35	1690	
			1.0	Residential	2860	37	1610	
			2.0	Source Area	5820	53	2490	
			4.0	Source Area	10500	68	618	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-72	SAI-SS4		Surface	Residential	64	-	-	*See Note
	TB-3	500	0-0.5	Residential	18	-	-	Asphalt - black asphalt & 1/2" angular gravel (road pavement)
		501	2-3.5	Residential	218	-	-	Silty Sand - gray to light brown, slightly moist, loose, trace 1/4" subrounded gravel (road base fill)
		502	5-6.5	Residential	291	-	-	
		503	10-11.5	Residential	20	-	-	Silty sand - light brown, medium to fine grained, slightly moist, 1/4" subrounded gravel, trace wood fragments with purple staining at 10-11.5"
		504	15.16.5	Residential	660	-	-	Silty Sand - light brown some orange mottling at 15', fine grained to silty, slightly moist to dry, medium dense, trace 1/4" subrounded gravel (glacial till)
		505	20-21.5	Residential	194	-	-	
		506	25-26.5	Residential	206	-	-	
		507	30-31.5	Residential	10	-	-	Grayish brown sandy silt, dry, medium to fine grained, medium dense to dense gravel, subrounded to round (glacial till)
		509	35-36.5	Residential	10	-	-	brown, gray and white, coarse to medium grained clean sand, medium dense, slightly moist to moist (advance outwash)
		510	37.5-39	Residential	10	-	-	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-73	TP-3	169	0-1	Residential	1704	-	911	Silty loam - brown, slightly moist to dry (fill)
		170	1-2	Source Area	9043	-	2425	Silty sand - Brown, medium to fine grained, slightly moist to dry, some 1/2" subrounded gravel. Abundant red brick fragments (smelter debris)
		171	2-3	Source Area	21686	-	89	Gravelly sand - yellow to white, medium grained, slightly moist to dry, 20-30% 1" subrounded gravel with abundant red brick debris (smelter debris)
		172	3-4	Source Area	28579	-	51	Gravelly sand - same as above no brick or gravel (smelter debris)
		173	4-5	Residential	1883	-	58	Brick - red, crumbled with white-gray, sandsized particles (mortar), dry (smelter debris)
		174	5-6	Source Area	6902	-	792	
		176	6-7	Source Area	7084	-	275	
		177	7-8	Residential	203	-	13	Silt - Light brown to gray brown, dry, stiff; trace medium to coarse sand with fine subrounded gravel (glacial till)
		178	8-9	Residential	507	-	-	Sand & Silt - 4" of medium grained, gray, slightly moist to dry, very stiff to hard silt; trace gravel (glacial till)
		179	9-10	Residential	655	-	-	Slightly Silty Sand - Brown-gray, moist, medium to fine grained, medium dense, trace gravel (glacial till)
		180	10-11	Residential	744	-	-	
LS-74	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-75	SAIC-S6		Surface	Residential	138	5	284	*See Note
	SMV-H1	H1-18	0-1.5	Residential	111	<5.0	89	50% recovery - topsoil/subsoil to 8" - fill with geofabric at 18", no debris/brick dry, loose
		H1-36	1.5-3	Source Area	3224	20	1314	60-70% recovery - fill with some brick fragments/debris well mixed, dry; grading to weathered till at 36" - brown clear horizon
		H1-54	3-4.5	Residential	486	<5.0	18	Recovery ~/=50% - weathered till brown mottled with red, silty with some gravel, moist no debris
		H1-72	4.5-6	Residential	354	<5.0	<10	100% recovery - wet till with gravel 54-58"; silty till, gray, moist, hard to 72", no debris
LS-76	SAIC-S3		Surface	Residential	286	13	448	*See Note
			0.5	Residential	257	7	240	
			1.0	Residential	915	13	805	
			2.0	Source Area	4700	9	8870	
			3.0	Residential	2340	6.6	8500	
LS-77	SAIC-S5		Surface	Source Area	6890	34	2150	*See Note
LS-78	SA-5	376	0-1	Source Area	4677	-	942	Silty Loam - dark brown, slightly moist, root matter, trace 1/5" subrounded to rounded gravel (fill)
		377	1-2	Residential	808	-	115	Brick - Red, hard, intact with 1/4" layers of white and gray sand 3" apart (Mortar) Smelter Debris
		378	2-3	Residential	47	-	-	
		379	3-4	Residential	60	-	-	
		380	4-5	Residential	11	-	-	
		381	5-6	Residential	35	-	-	
		382	8-9	Residential	317	-	-	Silty Sand - gray to brown, trace dark orange staining, slightly moist to dry, fine grained to silty, medium dense to very dense (becomes more dense with depth) Glacial Till.
		383	11-12	Residential	280	-	-	
		384	14-15	Residential	61	-	-	
LS-79	T-7		Surface	Residential	931	26	461	*See Note
			1.0	Residential	1050	112	130	
			2.0	Residential	468	5	121	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LS-80	EV-13	250	0-0.5	Residential	487	7	121	Silty sand - dark brown, trace gravel, very moist, (road base fill)
		251	2-3.5	Source Area	11810	86	141	Silty Sand - gray to tan, mottled orange, trace gravel, slightly dense, moist
		252	5-5.5	Residential	2785	-	-	Silty Sand - tan to brown, mottled orange. Trace gravel, becoming moist & dense at 6'
		253	5.5-6.5	Residential	1831	-	-	
		253	10-11.5	Residential	2259	-	-	Silty Sand - gray, trace gravel, dense, slightly moist
LS-81	none		-	-	-	-	-	-
LS-82	none		-	-	-	-	-	-
LS-83	none		-	-	-	-	-	-
LS-84	none		-	-	-	-	-	-
LR-01	PTB	0	4.5	Residential	26	<5	<10	*See Note
		10	4.5	Residential	880	<5	18	
	SAIC-S16		Surface	Residential	732	5.5	220	*See Note
LR-02	none		-	-	-	-	-	-
LR-03	SAIC-S12		Surface	Residential	38	2.9	285	*See Note
			0.5	Residential	412	5.8	378	
			1.0	Residential	266	11	635	
			2.0	Residential	255	9.9	266	
			3.0	Residential	758	4.9	303	
	PATB+0		4	Residential	1326	<5	38	*See Note
	P/A+0		2	Residential	1764	13	768	
LR-04	SAIC-S10		Surface	Residential	194	5.5	226	*See Note
			0.5	Residential	32	7.3	195	
			1.0	Residential	34	5	224	
			2.0	Residential	147	5.6	348	
			3.0	Residential	25	1.7	7.2	
	SAIC-S11		Surface	Residential	114	4.8	285	*See Note
			0.5	Residential	130	13	433	
			1.0	Residential	355	13.9	350	
			2.0	Residential	192	12.6	500	
			3.0	Residential	336	7.7	341	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LR-05	SMVR4	0-24	0-2	Residential	82	-	88	0-6" - topsoil/sod. 6-12" fill, silty. 12-24" Clean horizon soil with debris, black and gray with some white crystals, intermixed silt, reddish brown at bottom of SS
		24-48	2-4	Residential	34	-	<10	Recovery ~/=100% - silty, brown/red with some brick fragments 24-30"; fill/till 30-42"; gray/brown with silt some gravel clean horizons; debris and white crystals in bottom 6" and some organic (roots) - dense, silty, gray, dry, some gravel >1"
		48-60	4-5	Residential	38	-	<10	Recovery ~/= 100%; weathered till/fill silty gray/reddish mottling. Some organics in upper 6"; grading to denser silt with depth no sign of debris or bricks/fragments
		60-84	5-7	Residential	64	-	<10	Recovery ~/= 100%; silty sand, moist, gray, dense, uniform throughout profile, little gravel, no sign of debris, bricks or fragments
	SS-8		Surface	Residential	345	-	-	*See Note
LR-06	SAIC-S48		Surface	Residential	791	6.2	492	*See Note
			0.5	Residential	584	9.6	376	
			1.0	Residential	780	9.2	338	
			2.0	Residential	49	<0.5	13.5	
			3.0	Residential	97	<0.5	12	
LR-07	none		-	-	-	-	-	-

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LR-08	SMV-I1	I1-18	0-1.5	Residential	2410	25	1127	60% recovery - 0-8" topsoil; debris and brick well intermixed 8-18" with some white crystals, dry
		I1-36	1.5-3	Source Area	3253	27	1402	80% recovery - fill with some smelter debris and brick to 36", dry
		I1-54	3-4.5	Residential	2224	25	779	Recover ~/=50% - visually distinct horizon at ~/=48", debris with brick well intermixed with soil moist at bottom, some grave ~/=1", fill.
		I1-72	4.5-6	Residential	149	<5.0	31	Recovery ~/=30% - moist sand with some gravel, loose, no debris seen, weathered brown till at bottom
		I1-90	6-7.5	Residential	138	5.5	20	Recovery ~/=75% - wet weathered till at 72-76"; mottled brown grading to silty till at 90". No Debris
		I1-108	7.5-9	Residential	125	6.1	14	Recovery ~/=100% - moist till - gray brown at 90-94"; grading to silty glacial till with some angular gravel from 94-108", hard no debris.
LR-09	SAIC-S2		Surface	Residential	309	5.3	188	*See Note
			0.5	Residential	142	4.6	98.9	
			1.0	Residential	112	52.7	2330	
			2.0	Residential	952	62.1	541	
			3.0	Residential	865	27	68.9	
LR-10	SAIC-S1		Surface	Residential	319	25.1	489	*See Note
			0.5	Residential	215	19.3	657	
			1.0	Residential	438	24.2	1290	
			2.0	Residential	1010	15.8	1470	
			3.0	Residential	333	6.6	494	

Grid Number	Boring	Sample ID	Sampling Depth (feet)	Material	Metals Concentrations			Boring Description
					Arsenic	Cadmium	Lead	
LR-11	SMV-A1	A1-18	0-1.5	Source Area	3263	11	642	Recovery 80% - topsoil subsoil to 6"; fill silty sand with no debris to 18"
		A1-36	1.5-3	Residential	1847	<5.0	46	Recovery ~/= 80% - fill 18-24" brown-sandy silt, grading to weathered till at 36" brown/gray mottled, dry and silt at 36", no debris in core, a few brick fragments in cuttings
		A1-54	3-4.5	Residential	369	<5.0	<10	>80% recovery - weathered till at 54" - brown/reddish/gray - mottled - grading to silty till at 54" - undisturbed - moist but not wet, no debris observed

*Drill Logs not available for this sample.

Appendix F

APPENDIX F

CONSTRUCTION SPECIFICATIONS

CONSTRUCTION SPECIFICATIONS

FENCED AREA CLEANUP

EVERETT SMELTER SITE

CERTIFICATE OF ENGINEER

This Final Design package was prepared in accordance with the requirements of the Enforcement Order No. 02TCPNR-4059, Agreed Judgment No. 03-2-08502-1, Final Cleanup Action Plan, and Interim Action Report. This Final Design package has incorporated comments from the State of Washington Department of Ecology and is consistent with the requirements of WAC 173-340-400, WAC 173-340-430, and WAC 173-340-840.

DAVID K. NATION
STATE OF WASHINGTON
31597
REGISTERED
CIVIL ENGINEER

EXPIRES: 02/28/05

3/29/04

David K. Nation, P.E.
Project Supervisor
ASARCO Consulting, Inc.

Date

DIVISION 1 GENERAL REQUIREMENTS

Section 01000 Summary of Work

Section 01100 Engineering Design Criteria

Section 01200 Construction Drawings

Section 01300 Contract Documents

Section 01400 Supplemental Plans

- Compliance Monitoring Plan – Appendix A
- Site Health and Safety Plan – Appendix B
- Sampling and Analysis Plan – Appendix C
- Transportation Plan – Appendix G

Section 01500 Owner Provided Services

Section 01600 Measurement and Payment

Section 01700 City of Everett – Design and Construction Standards and Specifications for Development

DIVISION 2 SITE WORK

Section 02000 Mobilization/Demobilization

Section 02100 Clear and Grub

Section 02200 Structure Demolition

Section 02300 Utility Abandonment

Section 02400 Excavation

Section 02500 Off-site Disposal

Section 02600 Embankment

DIVISION 8 MISCELLANEOUS CONSTRUCTION

Section 08000 Storm Water Management

Section 08100 Revegetation

SECTION 01000
SUMMARY OF WORK

PART 1 GENERAL

1.1 Scope

The objective of the 2004 Fenced Area Interim Remedial Action is the removal of soil and smelter debris (i.e. source material) with arsenic concentrations greater than 3,000 mg/kg. The tasks necessary to complete the scope of work include: clearing and grubbing; demolition of concrete structures, fencing and asphalt roadways; removal and/or abandonment of buried and overhead utilities; excavation, material segregation, stockpiling and off-site disposal; and associated support tasks for traffic control, storm water management, and verification of source material removal goals.

Removal and off-site disposal activities for the Interim Remedial Action "fenced area" must be completed no later than August 20, 2004. Additional site remediation activities, including soil removal, are anticipated to be completed in a later project phase but are not included in the scope of this project or contract.

1.2 Work Sequence

Source material excavation and site preparation shall be undertaken in the sequence described in *Section 02400 – 1.2 Storyboard Sequence* and as shown on the *Site Layout* Exhibit – ES-SL-01 to allow stockpiling and staging areas for site-wide material management. Subsequent sequencing of construction activities is the responsibility of the Contractor. Concrete footings, slabs, foundations, and retaining walls shall not be destroyed or removed until adjacent source material is excavated and removed.

1.3 Regulatory Requirements

The Contractor shall comply with the requirements of all local, state and federal codes applicable to the completion of the scope of work. The Model Toxics Control Act (MTCA) provides an exemption from the procedural requirements of the following state laws; however the Contractor must meet the substantive requirements:

- RCW 70.94, Washington Clean Air Act

- RCW 70.95, Solid Waste Management Reduction and Recycling
- RCW 70.105, Hazardous Waste Management
- RCW 75.20, Construction Projects in State Waters
- RCW 90.48, Water Pollution Control
- RCW 90.58, Shoreline Management Act of 1971

MTCA also provides an exemption from the procedural requirements of laws authorizing local government permits or approval for remedial actions, but the substantive requirements of local ordinances affecting land use development and construction must be met.

The City of Everett regulates site development and construction activities through the Public Works Permit and the Industrial Waste Discharge permit.

SECTION 01100
ENGINEERING DESIGN CRITERIA

PART 1 GENERAL

1.1 Design Elements

The key components of the design approach consist of the excavation, segregation and disposal for the source material. The *2004 Fenced Area Excavation Flow Charts* (7 Sheets) outline the procedure to categorize refuse generated from the site preparation activities and soil excavated from source areas. The flow charts also include the interim stockpile staging and final disposal locations. Potential soil stabilization treatment options are listed as Alternates A and B of the Soil flow sheets (Sheet 4), but are still in the development phase and are not part of this contract.

The site preparation refuse includes concrete/asphalt and organic soil material. The source material category includes soil and smelter debris/bricks. Segregation of these materials will be required, and in some instances laboratory analysis, for proper disposal

and/or recycling purposes. The four categories of material classification presented in the Flow Charts are listed below:

Organic Soil Material (2" of Surficial Soils)

- Arsenic concentrations less than 150 mg/kg – Recycle
- Arsenic concentrations greater than 150 mg/kg but less than 3,000 mg/kg ("Residential") – Tacoma Residential Cap
- Arsenic concentrations greater than 3,000 mg/kg ("Source") – Off-Site Subtitle C Facility

Concrete/Asphalt

- Asphalt – Recycle for on-site or off-site use. If the asphalt is recycled it will be sampled and analyzed as required by the recycling facility before excavation and shipment.
- Concrete – Reduce to 6-inch maximum dimension and dispose in Tacoma OCF

Soils

- Arsenic concentrations less than 150 mg/kg – On-site Backfill
- Arsenic concentrations greater than 150 mg/kg but less than 3,000 mg/kg ("Residential') – Tacoma Residential Cap
- Arsenic concentrations greater than 3,000 mg/kg but less than 30,000 mg/kg ("Source") – Tacoma OCF
- Arsenic concentrations greater than 30,000 mg/kg ("Subtitle C") – Off-Site Subtitle C Facility OR Tacoma OCF, if approved by regulatory agencies.

Smelter Debris/Bricks

- Bricks – Dispose in Tacoma OCF
- Smelter Debris - Arsenic concentrations less than 3,000 mg/kg – Tacoma OCF or Tacoma Residential Cap
- Smelter Debris - Arsenic concentrations greater than 3,000 mg/kg – Off-Site Subtitle C Facility

NANCY – insert 2004 Fenced Area Excavation Flow Charts here (7-sheets)

SECTION 01200
CONSTRUCTION DRAWINGS

PART 1 GENERAL

1.1 Drawings

Construction drawings (Exhibit Plan Sheets) are attached to these Specifications and are part of the Contract Documents. In the event of a conflict between the Drawings and the Project Specifications, the Specifications shall govern.

SECTION 01300
CONTRACT DOCUMENTS

PART 1 GENERAL

1.1 Contract Components

The Contract Documents consist of the following:

1.) Asarco Agreement Form ("Fixed Price" Construction or Repairs Contract with revised Payment Term Article 4(b)
2.) Bid Proposal
3.) Project Specifications
4.) Construction Drawings
5.) Supplemental Plans (listed in Section 01400)

SECTION 01400
SUPPLEMENTAL PLANS

PART 1 GENERAL

1.1 Additional Plans

In addition to the Project Specifications, the following supplemental plans are incorporated into the Contract Documents. In the event of a conflict between the Project Specifications and the supplemental plan(s), the supplemental plan shall govern.

1.2 Compliance Monitoring Plan - Appendix A

1.3 Site Health and Safety Plan – Appendix B

1.4 Sampling and Analysis Plan – Appendix C

1.5 Transportation Plan – Appendix G

SECTION 01500
OWNER PROVIDED SERVICES

PART 1 GENERAL

1.1 Site Survey Responsibility

Asarco will provide the Contractor with vertical and horizontal survey control and layout for the excavation grid system. However, it is the Contractor's responsibility to perform the source material removal and maintain documentation for excavation grid layout depths and limits.

1.2 Oversight Responsibilities

Asarco will provide personnel and resources for construction oversight responsibilities. As part of the construction management and contract administration tasks, the oversight team will perform confirmation sampling and laboratory analysis for excavation/removal goals, and ambient environmental monitoring.

SECTION 01600
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 Bid Proposal Items

Method of Measurement

No measurement of items listed in the Bid Proposal representing a Lump Sum bid will be measured for payment purposes.

Measurement of items represented by a Unit Price bid will be measured per the unit listed on the Bid Proposal.

Basis of Payment

Payments shall be at the Lump Sum Price or Unit Price bid for each item listed on the Bid Proposal. Payment for the item shall include full compensation for all labor, materials, equipment, supplies and incidentals required to complete the item.

SECTION 01700
CITY OF EVERETT – DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS FOR DEVELOPMENT

PART I GENERAL

1.1 City of Everett Requirements

The following specifications are relevant sub-sections selected from the **City of Everett – Design and Construction Standards and Specifications for Development (Rev. 1-04).** These sections have been modified (including the section numbers) to address the conditions of this site and are incorporated into the Project Specifications as Contractor requirements.

SECTION I GENERAL CONSIDERATIONS

1-5 CONTROL OF NOISE

The city has established regulations for control of noise in residentially zoned property. For the purpose of regulating potentially disruptive or annoying noise, Ordinance No. 1556-89 states that all residentially zoned lands fall within Noise Control District No. 1.

Under the City's Noise Ordinance, construction related noise has limitations during the hours before 7 a.m. and after 10 p.m. on weekdays and before 8 a.m. and after 6 p.m. on weekends and state recognized holidays. Extended work hours may be allowed, including provisions for night and weekend work, as may be needed to accommodate tides, transportation, or other conditions. In general, noise levels associated with crushing or any other on-site activities will be typical of a heavy construction site with large earthwork equipment and haul trucks/trailers.

Construction contractors are responsible for notifying subcontractors of the city's noise regulations.

1-11 PROTECTION OF PROPERTY AND UTILITIES

1-11.1 PROPERTY

Except as shown in the plans, the contractor shall protect and preserve from damage, interference and destruction all private and public property on or in the vicinity of the work. If such property is damaged or destroyed or its use interfered with by the contractor or his agents, it shall be restored immediately to its former condition by the contractor at his expense and such interference terminated.

1-11.2 UTILITIES

The contractor shall protect from damage private and public utilities, including telephone and telegraph lines, power lines, sewer and water lines, railroad tracks and appurtenances, highway lighting and signal systems, and similar facilities. Before beginning any excavation, the contractor shall provide notice of commencement to all owners of

underground facilities through the one number locator service, phone number 1-800-424-5555, if available; if not he shall give notice to all individual utility owners. Such notice shall not be less than 2 nor more than 10 business days before the scheduled date of excavation.

1-12 SITE MAINTENANCE

The owner and contractor shall schedule and control his work so as to prevent all hazards to public safety, health and welfare.

Streets shall be kept free of dirt and debris on a continuous basis.

Pedestrian facilities shall be kept free of obstruction, and continuity shall be maintained at all times unless otherwise approved by the Public Works Department.

On existing streets, two way traffic shall be maintained at all times unless detour plans have been approved in advance by the city traffic engineer.

Pedestrian and vehicular access to occupied buildings shall be maintained at all times except where approval from the building owner has been obtained.

Adherence to the project's erosion and sediment control plan will be required. Features contained therein, such as silt fences, check dams and sedimentation ponds shall be maintained in good working order to the satisfaction of the public works inspector.

1-13 TRAFFIC CONTROL

1-13.1 GENERAL

Traffic control for all projects shall comply with Chapter 6 of MUTCD. The contractor shall be responsible to furnish and maintain all required labor and materials as needed to the satisfaction of the city engineer.

The contractor shall conduct his operations as to offer the least possible obstruction and inconvenience to the public, and he shall have under construction no greater length or amount of work than he can prosecute properly with regard to the rights of the public. He shall not open up sections of the work and leave them unfinished, but he shall finish the work as he goes insofar as practicable.

Unless otherwise approved in writing Asarco and by the city engineer, all public traffic shall be prohibited from passing through the work in the Fenced Area. In other areas, the public may be allowed to pass through with as little inconvenience and delay as possible. With the exception of the interior roads and alley of the Fenced Area, the contractor shall keep existing roads and streets adjacent to or within the limits of the project open to and maintained in a good and safe condition for traffic at all times. The contractor shall remove any deposits or debris and shall repair any damage resulting from his operations. Construction shall be conducted so as to cause as little inconvenience as possible to abutting property owners. Convenient access to driveways, houses and buildings along the line of work shall be maintained.

Construction signs shall not be placed on sidewalks or pedestrian pathways impeding wheelchair or pedestrian traffic. If the work entails removing panels of sidewalk, then place sidewalk closed signs in advance of the work area. This will give warning to the handicapped and pedestrians allowing them to choose an alternate route.

If the road construction activities require advanced warning signs, then signs will be placed in accordance with the MUTCD manual and WORK ZONE TRAFFIC CONTROL book.

Signs and traffic control devices should not be a hazard to pedestrians. Signs located near or adjacent to sidewalk should have a 7-foot clearance. In the event that sidewalks on both sides of the project are closed, then pedestrians should be guided around the construction site.

If your signing crews are in doubt, have them contact the appropriate City of Everett Inspectors.

1-13.2 DETOURS AND ROAD CLOSURES

Approval must be received from the city traffic engineer for all detours and road closures. A formal traffic control plan complying with the MUTCD shall be submitted to public works for review and approval by the traffic engineer prior to any work proceeding.

1-13.3 FLAGGERS, BARRICADES AND SIGNS

Flagger(s), barricades, signs shall conform to the Standards established in the latest edition of the "Manual on Uniform Traffic Control Devices" (MUTCD). Standard Plan No's 701A through 701L show typical traffic control conditions. Standard Plan No. 702 shows typical traffic control devices. Should the contractor deviate from these Standard Plans, he or she should prepare a signing plan showing the necessary construction signing, barricades and flagger(s) required for the project and submit the plan(s) to the public works for approval by the city engineer in advance of the time the signing and barricades will be required. All equipment and materials required for traffic control shall be furnished, installed and maintained by the contractor to the satisfaction of the city engineer.

During construction activity at signalized locations, an off-duty, uniformed police officer shall be required at all times the signal or beacon is turned off or when the traffic signal indicator is countermanded, or if the engineer determines it is necessary for traffic control. Officers are also required for new traffic signal work. The uniformed police officer shall be provided by the contractor. For information on police officer availability, call the City of Everett Police Department at 259-0400.

1-13.4 PLACEMENT OF CONSTRUCTION SIGNS ON SIDEWALKS AND PEDESTRIAN PATHWAYS

Construction signs shall not be placed on sidewalks or pedestrian pathways impeding wheelchair or pedestrian traffic. If the work entails removing panels of sidewalk, then

place sidewalk closed signs in advance of the work area. This will give warning to the handicapped and pedestrians allowing them to choose an alternate route.

If the road construction activities require advanced warning signs, then signs will be placed in accordance with the MUTCD manual and WORK ZONE TRAFFIC CONTROL book.

Signs and traffic control devices should not be a hazard to pedestrians. Signs located near or adjacent to sidewalk should have a 7-foot clearance. In the event that sidewalks on both sides of the project are closed, then pedestrians should be guided around the construction site.

If your signing crews are in doubt, have them contact the appropriate City of Everett inspectors.

1-14 CONTROL AND INSPECTION

1-14.1 GENERAL

Work performed in construction or improvements within the city, whether by a private developer, a city contractor or city forces, shall be done in accordance with the approved plans and specifications and to the satisfaction of the city engineer.

No work may be started until such plans are approved. Any revision to such plans shall be approved by the city engineer prior to performance of the work.

The city engineer will have authority to enforce these Standards as well as other referenced or pertinent specifications and will appoint project engineers, assistants and inspectors as necessary to inspect the work for compliance.

1-14.2(3) NOTIFICATION OF INSPECTION

The owner shall notify the city of inspection needs in a timely manner. In general, a minimum of 24 hours advance notice will be required. Failure to notify in time may

oblige the city to arrange appropriate sampling and testing after-the-fact, with certification by a qualified private testing laboratory. Costs of such testing and certification shall be borne by the developer.

SECTION 02000
MOBILIZATION/DEMOBILIZATION

PART 1 GENERAL

1.1 Description

The scope of work includes the requirements for mobilization, preparatory work temporary facilities, contractor's field office, site security, site access, cleanup, demobilization and associated tasks necessary to complete the contract scope of work.

1.2 Measurement and Payment

This item will not be measured for payment. Payment will be made at the Lump Sum price shown in the Bid Proposal.

SECTION 02100
CLEAR AND GRUB

PART 1 GENERAL

1.1 Description

This work consists of clearing, grubbing and disposing of all vegetation and organic debris within the limits of the excavation boundaries or as necessary to access the site. Organic soil material consisting of the top 2'' of the ground surface shall be stripped and stockpiled for analytical sampling and eventual off-site disposal in either the Tacoma OCF/Residential Cap, or at a Subtitle C facility. Trees, shrubs, bushes and plants shall be cleared and grubbed in a manner to prevent soil material from remaining with the roots

and stumps. The vegetative refuse shall be disposed off-site at a RCRA Subtitle D facility.

1.2 Measurement and Payment

This item will not be measured for payment. Payment will be made at the Lump Sum price shown in the Bid Proposal.

SECTION 02100
STRUCTURE DEMOLITION

PART 1 GENERAL

1.1 Description

Structure demolition consists of the removal and disposal or salvaging of all man-made structures within the fenced area limit boundary, including the public street and alley right-of-ways. Demolition includes, but is not limited to, the following: fences; buildings; concrete/block/brick footings, foundations and walls; asphalt and/or concrete roadways, driveways; and landscaping features.

Electrical utility poles and chain-link fencing materials shall be removed as necessary to complete the scope of work, and salvaged for reinstallation. Following completion of the Interim Remedial Action excavation and back-filling process, the entire fenced area site perimeter shall be secured with the installation of chain-link fence around the perimeter to prevent public access.

1.2 Measurement and Payment

This item will not be measured for payment. Payment will be made at the Lump Sum price shown in the Bid Proposal.

SECTION 02300
UTILITY ABANDONMENT

PART 1 GENERAL

1.1 Public Utilities

The Contractor may utilize existing site utilities for the interim remedial action construction activities, at the Contractor's expense, but all above and below ground public utilities shall be properly decommissioned and abandoned at the boundary of the fenced area site at the completion of the 2004 remedial activities. All costs associated with the installation of temporary facilities and the use of public and/or private utilities shall be the Contractor's responsibility. Removal of utility fixtures shall be completed in compliance with Section 02200 – Structure Demolition.

1.2 Measurement and Payment

This item will not be measured for payment. Payment will be made at the Lump Sum price shown in the Bid Proposal.

SECTION 02400
EXCAVATION

PART 1 GENERAL

1.1 Source Area Excavation

The Contractor is required to excavate and remove all soil with concentrations of arsenic above 3,000 mg/kg (source material), as delineated within the excavation limits shown on the Drawings. Smelter debris, brick and organic surficial soils within the excavation limits shall also be excavated and segregated for sampling and disposal. In order to complete the source material removal, the Contractor will be required to excavate and temporarily stockpile residential soils that prevent access to the source material locations.

In conjunction with the Contractor's excavation process, Asarco will perform confirmation sampling for analytical verification of excavation limits and identification of disposal requirements. The Contractor may be required to stockpile materials prior to disposal to allow for sampling and analytical confirmation results.

1.2 Storyboard Sequence

The overall sequence of excavation, stockpiling, off-site disposal and interim surface restoration shall conform to the disposal classifications listed in the *2004 Fenced Area Excavation Flow Charts* and as outlined in the project storyboard steps listed below. The Contractor may deviate from the proposed plan if it can be demonstrated that the alternative method provides a benefit to the project and is approved by Asarco.

STEP 1

a.) Prepare Stockpile A in Area 1.

b.) Construct stormwater controls.

STEP 2

a.) Excavate truck load-out area in Area 2 adjacent to East Marine View Drive (EMVD). The load-out area shall be 60 (+/-) feet wide, parallel to EMVD, and constructed to allow truck access from and onto EMVD. Place Residential soils/concrete in temporary stockpile near Area 2.

b.) Place Source soils in Stockpile A or containers.

c.) Place Subtitle C soils in containers for direct shipment to off-site disposal.

d.) Construct stormwater sediment detention pond.

e.) Utilize temporarily stockpiled Residential soils and demolition concrete for construction of load-out pad. Grade to drain to detention pond and cover with filter fabric.

f.) Construct load-out area with surface drainage to detention pond; match grade from EMVD. Construct facilities (scale, hopper, screen, etc.).

g.) Establish remaining surface water BMPs in Area 2.

STEP 3

a.) Excavate Subtitle C soils from Area 3. Some Source material removal will be necessary to access Subtitle C soils but contractor can elect to continue excavating remaining Source soils in Area 3 as field conditions and stockpile/container capacity allow.

b.) Place Residential soils in Stockpile B.

c.) Place Source soils in Stockpile A or containers.

d.) Place Subtitle C soils in containers for direct shipment; stage at rail load-out. Begin load-out of Subtitle C soil and export to Subtitle C facility.

STEP 4

a.) Excavate Subtitle C soils in Area 4, placing in containers for direct disposal per Step 3. Some Source material removal will be necessary to access Subtitle C soils, but do not advance excavation below Subtitle C depths.

b.) Place Source soil in Stockpile A.

c.) Place Subtitle C soils in containers for direct shipment off-site.

d.) Subtitle C excavation limits include the removal of Pilchuck Alley.

STEP 5

a.) Excavate Subtitle C soils from Area 5 and place in containers for direct load-out/disposal. Some source material removal will be necessary to access Subtitle C soils, but do not advance excavation below Subtitle C depths. Maintain Pilchuck Path. Complete load-out of Subtitle C soil and export to Subtitle C facility.

b.) Place Residential soils in Stockpile B.

c.) Place Source soils in Stockpile A.

d.) As Subtitle C load-out is completed, begin loading and transporting containers with Source soil to Tacoma, expanding stockpile in Area 6 as needed to accomplish this task.

e.) Excavate Source soil in Area 4 (area east of Pilchuck Path) to final excavation depths, stockpiling/loading containers in Area 6. Remove Pilchuck Path as

required to access Source and/or Subtitle C soils. Remaining Subtitle C soils need to be loaded directly for disposal without stockpiling.

f.) Excavate remaining Source soils in Area 5 and stockpile/load-out for transport.

g.) Excavate Area 1; Residential soils to Stockpile B, Source soils to Stockpile A/load-out as work progresses.

STEP 6

a.) Complete Source soil excavation in Area 6, proceeding south to north. Place soils in Stockpile A as needed, or load to containers for shipment to Tacoma.

b.) Complete excavation of Source soils in Area 6, including the area of Stockpile B. Place in Stockpile A or load-out directly.

c.) Excavate remaining Source material from Pilchuck Path, 5th Street, Area 6 east of the alley, incidental surface material in the load-out area, and sediments from stormwater detention features and export to Tacoma OCF. Export concrete used on-site to Tacoma OCF.

d.) Backfill excavation in Area 5 with stockpiled Residential soils. Slope excavation areas to drain, establish surface water BMPs for winter, hydroseed, and re-establish site-security.

e.) Demobilize from site.

1.3 Excavation Volumes

It is estimated that 51,000 tons of soil will be excavated in the process of removing the material with arsenic concentrations above 3,000 mg/kg.

- 3600 tons (2250 cubic yards) of Subtitle C material – arsenic above 30,000 mg/kg.
- 27,500 tons (17,160 cubic yards) of Source material – arsenic above 3,000 mg/kg.
- 20,000 tons (12,500 cubic yards) of Residential material –arsenic above 150 mg/kg.

The soil excavation volumes do not include any material associated with the Clear & Grub or Structure Demolition work scope items.

1.4 Alternate Disposal Plan for Source Soil Above 30,000 mg/kg Arsenic Concentrations

An alternate disposal plan for source soils with arsenic concentrations above 30,000 mg/kg is being evaluated by Asarco and the regulatory agencies. The plan only includes source soils and doesn't apply to organic, brick or smelter debris material. The proposed plan would allow soil above 30,000 mg/kg to be disposed in the Tacoma OCF. To minimize arsenic mobilization, a soil stabilization treatment may be required prior to transportation or placement in the OCF. This option is presented in the *2004 Fenced Area Excavation Flow Charts* for informational purposes, but is NOT included in the project scope or Bid Schedule.

1.5 Measurement and Payment

Residential soil (material with arsenic concentrations between 150 mg/kg and 3,000 mg/kg) will not be measured for payment, but will be considered incidental to the excavation of the soil with arsenic concentrations above 3,000 mg/kg. Measurement for the Source soil (material with arsenic concentrations between 3,000 and 30,000 mg/kg) and Subtitle C soil (material with arsenic concentrations above 30,000 mg/kg) will be measured by the ton, weighed prior to off-site disposal.

Payment for these items will be made at the Lump Sum price and Unit Price, respectively, shown in the Bid Proposal.

SECTION 02500
OFF-SITE DISPOSAL

PART 1 GENERAL

1.1 Scope

Soil material with arsenic concentrations above 3,000 mg/kg shall be disposed off-site at the locations described in sub-section 1.2, Storyboard Sequence, of Section 02400 and the *2004 Fenced Area Excavation Flow Charts.* In addition, refuse generated from clearing & grubbing, structure demolition, utility abandonment and site preparation shall also be disposed off-site as described in these Specifications.

Soil material designated for off-site disposal, either in Tacoma or in a RCRA Subtitle C facility, shall be transported by inter-modal shipping containers. Asarco will procure the use of a minimum of 200 open-top containers available to the Contractor between May 15th and August 20th, 2004. Asarco will also procure round-trip transportation services for the containers from the container staging yard in Everett to the off-load area in Tacoma. Container transportation for material disposal will utilize the barge system and Asarco will procure the necessary staging areas and wharfage/docking facilities in Everett and Tacoma. The container dimensions are 8 feet high by 8 feet wide by 20 feet long – with an approximate loaded weight limit of 35 tons. There is a gross vehicle weight restriction of 105,500 pounds on a trestle crossing that shall not be exceeded.

It is the Contractor's responsibility to provide the equipment and facilities necessary to load the source material from the site into the inter-modal shipping containers. The Contractor shall provide a certified, digital read-out scale to record the weights of all material removed from the site.

The Contractor shall provide the direction, management, equipment, personnel and resources necessary to complete the loading, transportation and unloading of the off-site disposal containers. The Contractor's responsibilities include providing temporary covers

of the filled containers during staging and transportation, manifest documentation including proper labels and placards for containers, and custody tracking during transportation. The Contractor is responsible for loading/unloading the containers onto the barges, including interim staging and transfer processes. The Contractor will also be required to furnish over-the-road trucks to supplement the barge transportation systems in both Everett and Tacoma. The Contractor will be responsible for the emptying the containers in Tacoma and placing the material in designated stockpile location(s). The Contractor will be required to coordinate the unloading and stockpiling activities in Tacoma with the Tacoma Site Manager. Upon completion of the use of the containers, the Contractor is responsible for container decontamination and damage repair.

For refuse materials prohibited from disposal in Tacoma, Asarco will secure disposal contracts and regulatory permits necessary to dispose off-site. It will be the Contractor's responsibility to secure the transportation services and provide all management and direction of personnel and equipment to complete this item. The Contractor can elect to use the intermodul containers procured by Asarco.

1.2 Measurement and Payment

The method of measurement for Off-Site Disposal shall be determined by the weight in tons, prior to off-site disposal. Payment for these bid items shall be at the Unit Prices, respectively, shown on the Bid Proposal.

SECTION 02600
EMBANKMENT

PART 1 GENERAL

1.1 Work Description

The scope of work consists of the placement and grading of Residential soils stockpiled and/or relocated during the process of excavating the Source and Subtitle C soils. The Contractor shall place the Residential soils back into previous excavated areas,

concurrently with and following excavation activities, to allow equipment mobility on the site. The finished backfill surface shall be graded to prevent off-site soil erosion and to eliminate vertical embankments. Finished grades within backfilled or excavated areas shall not exceed 2:1 slopes.

It is estimated that the Contractor will be required to excavate, replace and grade 12,500 cubic yards to complete this item.

1.2 Measurement and Payment

This item will not be measured for payment. Payment will be made at the Lump Sum price shown in the Bid Proposal.

SECTION 08000
STORM WATER MANAGEMENT

PART 1 GENERAL

1.1 Description

The scope of work for this item includes the implementation of the Large Parcel Sediment and Erosion Control Plan as described in this section and as shown on the applicable plans that complies with the *City of Everett Stormwater Management Manual (January 1997)* The Contractor shall be responsible for the construction, maintenance, and compliance monitoring of the storm water management system throughout the duration of interim remedial activities.

Storm water retention capacities are designed to treat via sedimentation the 10-year/24-hour storm event as shown on the plans. Other plans for *erosion and sediment control (ESC) measures are incorporated by reference and the contractor shall construct necessary ESC structures as required in accordance with the standard drawings (City of Everett Design and Construction Standards and Specifications for Development, Rev. 4/02, Section 7 Standard Drawings, Series 200 – Erosion and Sediment Control).*

The contractor shall also implement as necessary the Source Control Best Management Practices (BMPs) for Construction Sites as specified in the *City of Everett Stormwater Management Manual (Chapter 4, Section 4-1.1 Construction Sites).* General BMPs include, but are not limited to the following items:

a) ESC methods such as sediment detention ponds or traps, filter fabric fences, straw bale barriers, diversion dikes, inlet controls at catch basins, pipe slope drains, terracing, construction entrance rock pads, and hydroseeding.
b) Intercepted groundwater (i.e., groundwater that "daylights") will be routed to the surface water system and handled as surface water from the point of collection on.
c) Excavation, fill, and backfill work areas shall be continually and effectively drained. In particular, water will not be permitted to accumulate in excavations that are receiving material that will be compacted.
d) The contractor shall be required to construct suitable dikes, drainage ways, or provide portable pumping equipment to divert water flows away from work areas.
e) Off-site water shall be routed around the site if possible; if it must flow across the site it will be prevented from contacting disturbed soils.
f) Surface water originating from undisurbed areas will be prevented from contacting disturbed soils insofar as is practical.
g) Existing vegetative cover will remain in each sub-area until active excavation of that area begins.
h) Stockpiles will be covered and ESCs implemented to divert surface water around the stockpile as well as to prevent migration of stockpiled material beyond the stockpile boundary.

1.2 Measurement and Payment

This item will not be measured for payment. Payment will be made at the Lump Sum price shown in the Bid Proposal.

SECTION 08100
REVEGETATION

PART 1 GENERAL

1.1 Description

This scope includes the replacement of salvaged fencing materials, new fence installation and the hydroseeding of all disturbed surface areas. The fencing is intended to secure the site and prevent unauthorized access; and the hydroseeding is intended to minimize the site erosion. The Contractor will likely be required to purchase supplemental fencing materials as necessary to provide a complete site enclosure. The seed, fertilizer and mulch specifications for applications procedures and rates shall be in conformance with the Washington Department of Transportation (WSDOT) Roadside Restoration specifications sections 8-02.3(15) A through H.

1.2 Measurement and Payment

Fence replacement will not be measured for payment but will be considered incidental to the revegetation work scope. The method of measurement for hydroseeding and mulching will be determined by the square foot of area revegetated.

Payment for this item shall be at the Unit Price shown on the Bid Proposal.

Appendix G

APPENDIX G

TRANSPORTATION PLAN

APPENDIX G

TRANSPORTATION PLAN
FINAL DESIGN REPORT
EVERETT SMELTER SITE

DRAFT – JANUARY 2004

Introduction:

This plan addresses the transportation-specific aspects related to the removal and off-site transportation of contaminated soil from Asarco's former Everett Smelter Site to Asarco's former Tacoma smelter or other permitted off-site disposal sites. It is intended to supplement the traffic control provisions of the Construction Specifications (Section 01700, 1-13 Traffic Control) and is included by reference in Division 1, General Provisions, Section 01400 Supplemental Plans.

Summary Description:

The primary transportation method proposed for the transport of excavated material from the Asarco Everett site to the Asarco Ruston site is containerized shipment by barge. This plan describes the operational parameters and logistics for this movement. This transport method has been selected because it is Asarco's belief it provides the highest degree of practical security in transport, it creates the least potential exposure to the public, it has the least impact on the communities involved, utilizes a scant 3 blocks of public roads and is the most economical approach.

Containers:

To provide a secure means of transporting the excavated materials without creating a risk of disbursement Asarco has chosen to use and secured through a sub-lease arrangement at least 200 International Shipping Organization (ISO) 20-foot open-top intermodal containers. These containers are of the exact same specification as are used in the rail transport (and occasional barge transport) of contaminated soils and sediments in this

region to Subtitle D and in some instances Sub-title C landfills. The containers are water-tight. The average carrying capacity of these containers is about 45 cubic yards. Materials which are comprised mostly of soil and rock, like the Everett site, typically run an average of about 3,000 pounds per cubic yard in density. As a consequence the containers, when filled with the excavated material, will have 50-60% of the airspace available as free-board, virtually eliminating any potential for airborne dispersal from the filled containers. Dust control will be further enhanced by tarping in the container or application of a dust palliative which forms a crust on the soil surface, preventing wind blown dispersal.

Container loading:

This aspect of the operation is described more fully in the construction plan. Briefly, excavated materials destined for shipment to Ruston will be amassed in a stockpile adjacent to a loading area. The loading area will be constructed to allow easy access in and out by trucks providing intermediate transport. The containers will be placed on a chassis towed by a standard highway semi-tractor. The truck will pull into the designated loading area. The loading area will be equipped with a scale and a digital readout. An operator using a wheeled loader will remove material from the stockpile and dump it into the container. Loading will continue until a target weight is reached.

The container weight that will likely be used is 35 tons per container. At that weight the equipment used throughout the system is optimized. Due to a variety of factors, containers of the dimension used are typically held to about 28 tons. The primary factors driving this are principally the axle configuration and length of the chassis. In this event, Asarco believes safe transport can be accomplished with the 35 ton load and is pursuing the steps necessary to accomplish that since it minimizes the road use and results in fewer barge movements. Nevertheless, the plan can also work if lower weights are required.

Once loaded the truck will proceed north on Marine View Drive to the entrance of the former Weyerhaeuser Kraft Mill (see Figure G-1). Asarco is finalizing a lease arrangement to use a portion of this site that is contiguous with the historic barge loading

areas. There are numerous configurations available for moving containers on and off a barge here.

Container Handling at Barge Head:

At the commencement of the work on the Everett site Asarco's contracted tug and barge contractor will transport the 200 empty containers to be used on this job to the old Weyerhaeuser site. The barge operator will provide the container handling in this area from the barge to the land and on the land between the trucks and a holding area. The containers will be stacked on the ground up to 4 high.

The barge handler will have an 80,000 pound capacity wheeled fork lift or top-pick staged on the barge. That machine will move containers on the barge and potentially pass them onto a reinforced spot on the ground in a "pass-pass" handling system. On the landward side another wheeled forklift or top-pick or a crane with a "spreader-bar" for lifting containers will be used. The two handling methods are described in the following paragraphs.

One container handling method is the pass-pass. Under this system the loader on the barge lifts a container and places it in a spot adjacent to the barge. The area is reinforced with a shipping module called a flat or steel plating to ensure an even handling surface. The landward loader then lifts the container and places it in a storage area and, when loading is occurring, will place containers on and remove them from the truck chassis. The reverse of this system is used to load the barge. The landward machine places the container onto the spot adjacent to the barge and then the barge machine loads the container onto the barge and places it for shipment.

The other alternative handling method is a crane on the barge or on the land. In this method a spreader-bar, which is standard equipment for moving ISO containers is connected to the crane and affixes itself from the top (using the corner blocks on the containers and a rotating pin) to secure the container. The container is lifted and swung from the first surface over to its desired location. If the crane is on the barge it will swing

further landward placing the area where containers are handled slightly further inland. If a crane is used on the land it will place the container in the center of the barge. A wheeled forklift or top-pick will be used in the opposite location of the crane.

Barge Movement:

Barge movements will be timed in Everett to have the barge arrive and depart on high tides due to depths in the lower Snohomish River. When containers are loaded onto the barge they are lashed into place for shipment by the barge crew. When there are 74 - 100 containers loaded on the barge and the tide is appropriate the tug will tow the barge to Ruston. Barge transport time between Everett and Ruston is estimated at 6 hours. At Ruston the barge will be moved to one of two areas for off-loading.

If analysis determines the dock piers are sufficient, steel plating will be used to reinforce the decking to allow a wheeled forklift or top-pick to move loaded containers across its surface to the land. If the dock cannot be used, a "spud" barge will be used to provide a bridge between the bulkhead and the barge for the landward side loader to operate on.

Containers are passed on and off the barge at Ruston in the same manner as described in Everett. Any empty containers at Ruston will be re-loaded onto the barge for return to Everett. The empty containers are lashed to the barge deck for transport. Loaded containers will be moved into a storage area to await disposal in appropriate locations at Ruston. The landward loader or crane will be used to place containers onto a dumping truck bed and remove the empty containers.

Schedule and Logistics:

Table G-1 illustrates the overall transportation logistics for moving Source material from Everett to Tacoma in a two-week period. This schedule reflects the minimum shipment window that will allow all of the Source material to be removed (about 20,000 CY) from the site and delivered to the Tacoma smelter. While this shipment window may be longer, this plan is based on the two-week scenario shown. Residential soils can be

moved at the same rate if Asarco decides to ship this material to Tacoma in addition to the Source soils.

Transportation to facilities other than the Tacoma Smelter:

There will be shipment of contaminated soil and debris to other permitted off-site disposal facilities that will occur, although the quantity of material will be substantially less than the amount transported by barge. Material that is not transported to Asarco's Tacoma smelter site will be shipped either by over-the-road truck or via rail. Loadout of material from the Everett site will occur in the same manner as container loading described above. Commercial haulers will be required to comply with state and federal regulations applicable to the type of material being transported. Truck routes will be either north from the site to SR 529 or south via East Marine View Drive to the interconnection with Interstate 5.

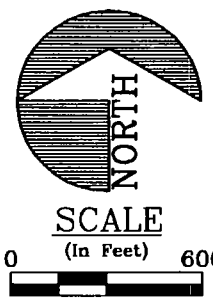
Appedix G
Transportation Plan
Table G-1. Container Logistics for Everett to Tacoma Transfer

29-Jan-04

Day/Day No.	Monday/1	Monday/1	Tuesday/2	Tuesday/2	Wednesday/3	Wednesday/3	Thursday/4	Thursday/4	Friday/5	Friday/5	Saturday/6	Saturday/6	Sunday/7	Sunday/7
Container Status	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day
Unloaded and available at Everett	200	144	144	88	88	32	32	50	50	68	68	86	86	86
Loaded and awaiting transport	0	56	56	38	38	20	20	2	2	58	58	40	40	40
In-transit - Everett to Tacoma	0	0	0	74	0	74	0	74	0	0	0	74	0	0
Unloaded at Tacoma and ready to place in OCF	0	0	0	0	74	0	74	0	74	0	0	0	74	74
Empty at Tacoma and ready for return to Everett	0	0	0	0	0	74	0	74	0	74	0	0	0	0
In-transit - Tacoma to Everett	0	0	0	0	0	0	74	0	74	0	74	0	0	0
Sum of Total Containers Available	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Total Tons Delivered to Tacoma	***0***	***0***	***0***	***2590***	***0***	***2590***	***0***	***2590***	***0***	***0***	***0***	***2590***	***0***	***0***

Day/Day No.	Monday/8	Monday/8	Tuesday/9	Tuesday/9	Wednesday/10	Wednesday/10	Thursday/11	Thursday/11	Friday/12	Friday/12	Saturday/13	Saturday/13	Sunday/14	Sunday/14
Container Status	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day	No. at Beginning of Day	No. at End of Day
Unloaded and available at Everett	86	30	30	48	48	66	66	84	84	28	28	46	46	46
Loaded and awaiting transport	40	22	22	4	4	60	60	42	42	24	24	6	6	6
In-transit - Everett to Tacoma	0	74	0	74	0	0	0	74	0	74	0	74	0	0
Unloaded at Tacoma and ready to place in OCF	74	0	74	0	74	0	0	0	74	0	74	0	74	74
Empty at Tacoma and ready for return to Everett	0	74	0	74	0	74	0	0	0	74	0	74	0	0
In-transit - Tacoma to Everett	0	0	74	0	74	0	74	0	0	0	74	0	74	74
Sum of Total Containers Available	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Total Tons Delivered to Tacoma	***0***	***2590***	***0***	***2590***	***0***	***0***	***0***	***2590***	***0***	***2590***	***0***	***2590***	***0***	***0***

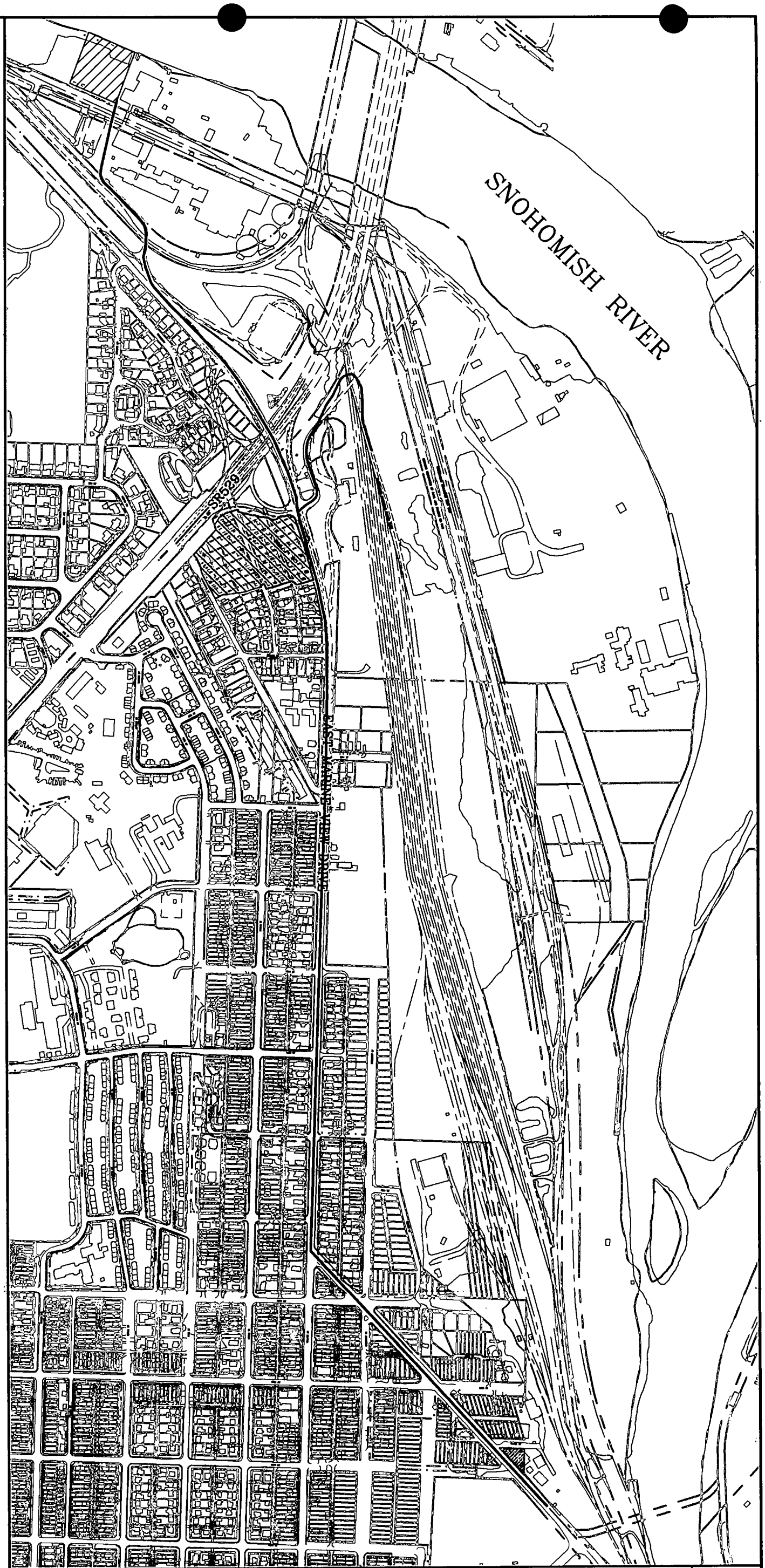
UPDATE TIME: 8pm
PG \TAC\012904\J:\Land Projects\Everett-01-27-04\Everett-01-27-04-T033



SCALE
(In Feet)
0 600

LEGEND

- BARGE LOADING / CONTAINER STORAGE AREA
- REMEDIATION SITE
- ROUTE TO BARGE LOADING AREA
- ROUTE TO I-5
- ROUTE TO RAIL LOADING AREA (IF REQUIRED)



ASARCO Consulting, Inc.

ASARCO INCORPORATED
FINAL DESIGN REPORT
EVERETT SMELTER
APPENDIX G

TRANSPORTATION PLAN

FIGURE
G-1

Appendix H

APPENDIX H

SITE STORMWATER PLAN

APPENDIX H

SITE STORMWATER PLAN
FINAL DESIGN REPORT
EVERETT SMELTER SITE

DRAFT – JANUARY 2004

Overview:

This plan and the applicable Construction Plans and Specifications constitute the Site Stormwater Plan for the remediation of the Fenced Area at Asarco's former Everett Smelter Site. This plan and associated surface water controls are based on the City of Everett Stormwater Management Manual (*Stormwater Management Manual – City of Everett Public Works Department*, Rev. 4/00). For this site, the primary surface water issues are:

- ✓ Minimizing, to the extent practical, the contact of direct precipitation, run-off within the Fenced Area, and run-on from outside the Fenced Area from contacting disturbed or stockpiled soils; and

- ✓ Collecting surface water that has come in contact with disturbed soils and removing suspended sediment before discharge to the City of Everett stormwater system.

Design Approach and Provisions

The surface water and sedimentation pond design was performed using Autodesk Civil Design 3. Hydrology was determined using the TR-55 Tabular Hydrograph Method and storm routing used the Storage Indication Method. Printouts of the computer calculations are attached.

The surface water control measures are in conformance with the Everett Stormwater Management Manual and are included in the Construction Specifications (Appendix F) and Plans (ES-SW series). The Construction Plans and Specifications also include specific provisions to be implemented from the *City of Everett Design and Construction Standards and Specifications for Development,* Rev. 4/02. The design supporting this Site Stormwater Plan is consistent with the Stormwater Management Manual and incorporates both Best Management Practices (BMPs) and Erosion and Sediment Control (ESC) practices.

The remedial excavation is scheduled to be performed from May through August, which is the driest time of the year in Everett. While some rainfall can be expected, the storms are generally of short duration and low to medium intensity. The excavation sequence will allow any surface water that needs to be collected to be routed to the deepest areas excavated or to the on-site stormwater retention basin. Runoff collection, detention, and sediment removal will be needed before discharge. This will be accomplished by constructing a network of diversion dikes or hard-pipelines to route surface water to a detention pond or trap at the lowest portion of the site adjacent to Marine View Drive.

Assuming a worse case for the design storm, in which the entire disturbed area runoff from a 10 year-24 hour event would need to be treated, results in a runoff volume of 0.5258 acre-feet. This estimate also assumes no other BMPs within the disturbed area. Providing that other BMPs will be installed, a sediment pond with dimensions of 30 ft. X 90 ft. X 6 ft. would have sufficient capacity treat the design storm. It is feasible to build a facility with sufficient capacity in this area; the actual configuration and design parameters are included as part of the construction plans and specifications. The pond will treat the entire volume of a 10 year -24 hour storm and discharges storm water via constant flow orifice to the storm sewer system. The BMP's and pond will be constructed at the outset of the work and will remain in service until the remediation work in the Fenced Area, including removal of all Residential soils, is completed.

Attachment H-1

Computer Calculations
Sediment Basin Design Summary

Everett Remedial Design
Sediment Basin Design Summary

Hydrology

Distribution Type	Type IA
Frequency Type	10 years
Precipitation	2.25 in
Drainage Area	5.6195 ac
Runoff	1.1251 in
Runoff Volume	0.5268 acft

Basin Design

Basin Size	30x90x6
Peak Inflow	1.5779 cfs
Peak Outflow	0.3566 cfs
Storage Volume	0.1474 acft
Maximum Storage Elevation	5.0353 ft
Outflow Structure.....	12" Riser with (2) 1" orifices

TR-55 Tabular Hydrograph Method
Input Summary

```
Description ......................
   EVERETT HYDROLOGY - 10YR24HR
Rainfall Distribution ...........  Type IA
Ia/P Interpolation ..............  On
Total Area ......................  5.6195 ac

Peak Time .......................  8.1000 hrs
Peak Flow .......................  1.5779 cfs
```

Given Input Data:

Subarea Description	D/S Subareas	Area (ac)	CN	Tc (hrs)	Tt (hrs)	Rainfall (in)
1	5	0.4761	79	0.0974	0.0146	2.2500
2	5	0.5209	91	0.0933	0.0143	2.2500
3	5	1.2504	79	0.0997	0.0081	2.2500
4	5	0.1396	91	0.0571	0.0330	2.2500
5		3.2325	91	0.0913	0.0000	2.2500

Support Data:

Subarea Name: 1, Row: 1

Sheet Flow

```
Description ......................  AREA 1 SHEET FLOW
Manning's n ......................        0.0500
Flow Length ......................      270.7010 ft
Two Yr, 24 hr Rainfall ..........        1.5500 in
Land Slope .......................        0.1465 ft/ft
Computed Sheet flow time .......................> 0.0974 hrs

****************************
Total Time of Concentration ........................> 0.0974 hrs
```

```
****************************

Shallow Concentrated Flow
-------------------------
   Description ....................  292' SEGMENT
   Surface ........................  Unpaved
   Flow Length ....................      287.5456 ft
   Watercourse Slope ..............        0.1156 ft/ft
   Velocity .......................        5.4857 fps
   Computed Shallow flow time .....................> 0.0146 hrs

********************
Total Time of Travel ...............................> 0.0146 hrs
********************

Subarea Name: 2, Row: 2


Sheet Flow
----------
   Description ....................  AREA 2 SHEET FLOW
   Manning's n ....................        0.0500
   Flow Length ....................      262.3270 ft
   Two Yr, 24 hr Rainfall .........        1.5500 in
   Land Slope .....................        0.1535 ft/ft
   Computed Sheet flow time .......................> 0.0933 hrs

***************************
Total Time of Concentration ........................> 0.0933 hrs
***************************

Shallow Concentrated Flow
-------------------------
   Description ....................  AREA 2 SHALLOW FLOW
   Surface ........................  Unpaved
   Flow Length ....................      296.8893 ft
   Watercourse Slope ..............        0.1275 ft/ft
   Velocity .......................        5.7612 fps
   Computed Shallow flow time .....................> 0.0143 hrs

********************
Total Time of Travel ...............................> 0.0143 hrs
********************

Subarea Name: 3, Row: 3


Sheet Flow
```

```
----------
   Description ....................  AREA 3 SHEET FLOW
   Manning's n ....................        0.0500
   Flow Length ....................      270.6435 ft
   Two Yr, 24 hr Rainfall .........        1.5500 in
   Land Slope .....................        0.1383 ft/ft
   Computed Sheet flow time .......................> 0.0997 hrs

****************************
Total Time of Concentration ........................> 0.0997 hrs
****************************

Shallow Concentrated Flow
-------------------------
   Description ....................  AREA 3 SHALLOW FLOW
   Surface ........................  Unpaved
   Flow Length ....................      275.7411 ft
   Watercourse Slope ..............        0.3412 ft/ft
   Velocity .......................        9.4245 fps
   Computed Shallow flow time .....................> 0.0081 hrs

********************
Total Time of Travel ...............................> 0.0081 hrs
********************

Subarea Name: 4, Row: 4


Sheet Flow
----------
   Description ....................  AREA 4 SHEET FLOW
   Manning's n ....................        0.0500
   Flow Length ....................      108.9436 ft
   Two Yr, 24 hr Rainfall .........        1.5500 in
   Land Slope .....................        0.0903 ft/ft
   Computed Sheet flow time .......................> 0.0571 hrs

****************************
Total Time of Concentration ........................> 0.0571 hrs
****************************

Shallow Concentrated Flow
-------------------------
   Description ....................  AREA 4 SHALLOW FOLLOW
   Surface ........................  Unpaved
   Flow Length ....................      347.5652 ft
   Watercourse Slope ..............        0.1140 ft/ft
   Velocity .......................        5.4476 fps
```

```
   Computed Shallow flow time ....................> 0.0177 hrs

Shallow Concentrated Flow
-------------------------
   Description ....................  LOAD OUT SEGMENT
   Surface ........................  Paved
   Flow Length ....................      266.5962 ft
   Watercourse Slope ..............        0.0566 ft/ft
   Velocity .......................        4.8362 fps
   Computed Shallow flow time ....................> 0.0153 hrs

********************
Total Time of Travel ..............................> 0.0330 hrs
********************

Subarea Name: 5, Row: 5


Sheet Flow
----------
   Description ....................  AREA 5 SHEET FLOW
   Manning's n ....................        0.0500
   Flow Length ....................      300.0000 ft
   Two Yr, 24 hr Rainfall .........        1.5500 in
   Land Slope .....................        0.3105 ft/ft
   Computed Sheet flow time ......................> 0.0783 hrs

Shallow Concentrated Flow
-------------------------
   Description ....................  AREA 5 SHALLOW FLOW
   Surface ........................  Unpaved
   Flow Length ....................      258.8739 ft
   Watercourse Slope ..............        0.1183 ft/ft
   Velocity .......................        5.5494 fps
   Computed Shallow flow time ....................> 0.0130 hrs

***************************
Total Time of Concentration .......................> 0.0913 hrs
***************************
```

Storage Indication Method

File: I:\Land Projects\Everett\Everett-09-23-02\HD\Route-30x90.txt

Given Input Data:
File ..... I:\Land Projects\Everett\Everett-09-23-02\HD\
STORGEINDICATION30x90.sdc.sim

Description 30X9010yr-24HR
Time increment . 0.1000 hrs

Input Files:
Pre-Dev Hydrograph curve ..

Excavated Hydrograph curve .. I:\Land Projects\Everett\Everett-09-23-02\HD\

everetthydgraph10hr.hdc

Stage-Storage curve ... I:\Land Projects\Everett\Everett-09-23-02\HD\30x90.ssc

Stage-Discharge curve ...I:\Land Projects\Everett\Everett-09-23-02\HD\
STAGEDDISCHARGE30x90.sdc

Output Data:
Routed Peak Flow ..... 0.3566 cfs
Routed Peak Time ..... 11.0000 hrs
Excavated Peak Flow . 1.5779 cfs
Excavated Peak Time . 8.1000 hrs

Support Calculations:

Time hrs	Inflow cfs	(I1+I2)/2 acft	H1 ft	S1-(O1/2)T acft	S2+(O2/2)T acft	H2 ft	Outflow cfs
7.0000	0.2521	0.0010	0.0000	0.0000	0.0010	0.0828	0.0000
7.1000	0.2761	0.0022	0.0828	0.0010	0.0032	0.2563	0.0000

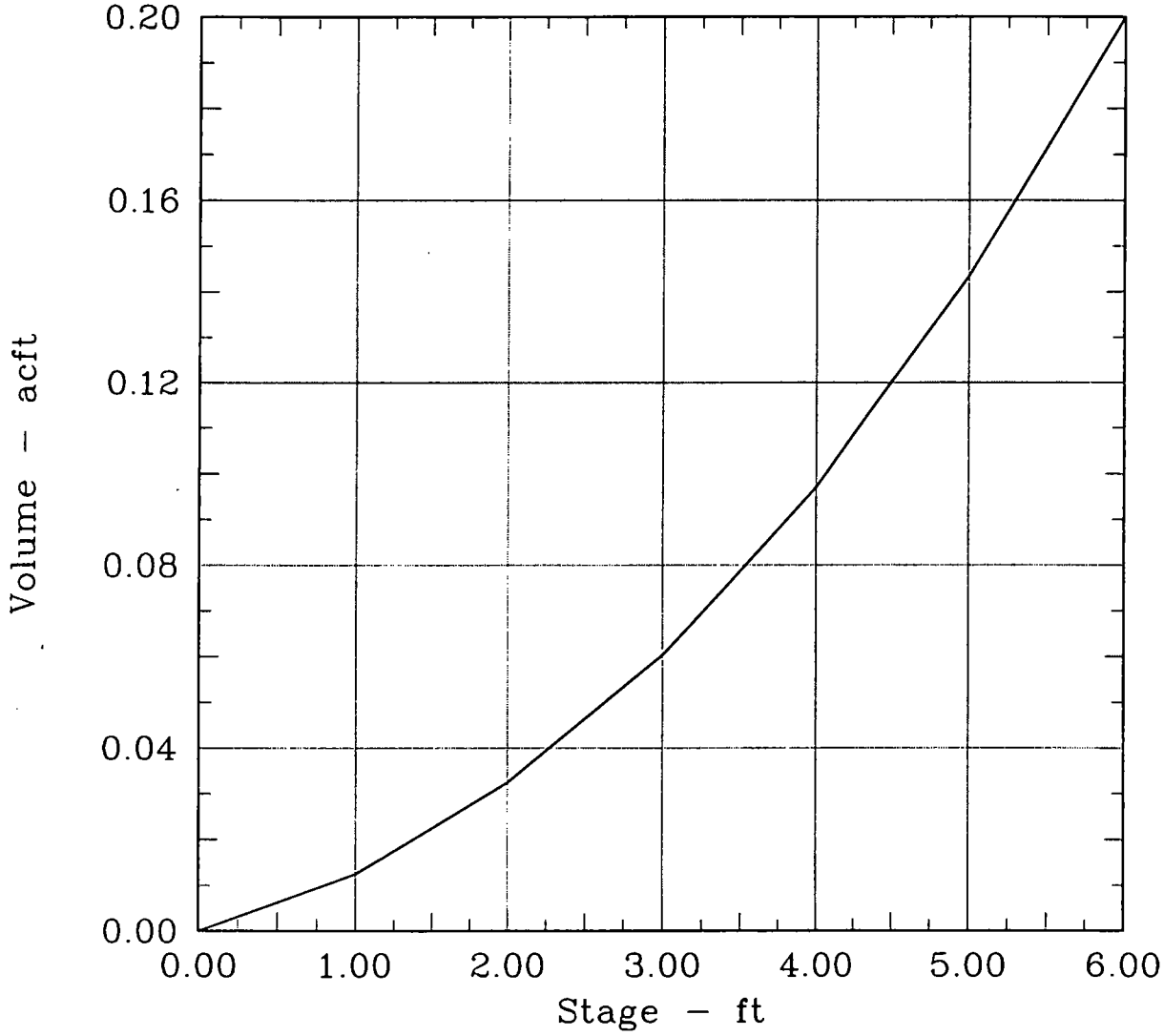
7.2000	0.3001	0.0024	0.2563	0.0032	0.0056	0.4456	0.0000
7.3000	0.3241	0.0026	0.4456	0.0056	0.0082	0.6506	0.0000
7.4000	0.3665	0.0029	0.6506	0.0082	0.0110	0.8775	0.0000
7.5000	0.4090	0.0032	0.8775	0.0110	0.0142	1.0835	0.0000
7.6000	0.4514	0.0036	1.0835	0.0142	0.0178	1.2619	0.0000
7.7000	0.7487	0.0050	1.2619	0.0178	0.0228	1.5108	0.0000
7.8000	1.0460	0.0074	1.5108	0.0228	0.0302	1.8829	0.0000
7.9000	1.3433	0.0099	1.8829	0.0302	0.0400	2.2692	0.0000
8.0000	1.4671	0.0116	2.2692	0.0400	0.0517	2.6839	0.0000
8.1000	1.5779	0.0126	2.6839	0.0517	0.0642	3.1008	0.0000
8.2000	1.3572	0.0121	3.1008	0.0642	0.0763	3.4277	0.0000
8.3000	1.0067	0.0098	3.4277	0.0762	0.0860	3.6878	0.0097
8.4000	0.8565	0.0077	3.6878	0.0857	0.0934	3.8896	0.0321
8.5000	0.7512	0.0066	3.8896	0.0931	0.0998	4.0475	0.0452
8.6000	0.6792	0.0059	4.0475	0.0993	0.1052	4.1624	0.0545
8.7000	0.6690	0.0056	4.1624	0.1045	0.1101	4.2647	0.0611
8.8000	0.6485	0.0054	4.2647	0.1091	0.1146	4.3595	0.0664
8.9000	0.6298	0.0053	4.3595	0.1134	0.1187	4.4463	0.0713
9.0000	0.6112	0.0051	4.4463	0.1174	0.1225	4.5257	0.0754
9.1000	0.5785	0.0049	4.5257	0.1209	0.1259	4.5968	0.0787
9.2000	0.5457	0.0046	4.5968	0.1242	0.1288	4.6589	0.0815
9.3000	0.5213	0.0044	4.6589	0.1270	0.1314	4.7130	0.0839
9.4000	0.4970	0.0042	4.7130	0.1294	0.1336	4.7603	0.0861
9.5000	0.4783	0.0040	4.7603	0.1316	0.1356	4.8016	0.0897
9.6000	0.4597	0.0039	4.8016	0.1334	0.1373	4.8376	0.1308
9.7000	0.4546	0.0038	4.8376	0.1351	0.1388	4.8699	0.1677
9.8000	0.4495	0.0037	4.8699	0.1365	0.1403	4.8998	0.2018
9.9000	0.4495	0.0037	4.8998	0.1379	0.1416	4.9277	0.2337
10.0000	0.4495	0.0037	4.9277	0.1391	0.1428	4.9544	0.2641
10.1000	0.4405	0.0037	4.9544	0.1403	0.1440	4.9789	0.2922
10.2000	0.4315	0.0036	4.9789	0.1414	0.1451	5.0005	0.3169
10.3000	0.4225	0.0035	5.0005	0.1424	0.1460	5.0140	0.3323
10.4000	0.4191	0.0035	5.0140	0.1431	0.1465	5.0226	0.3421
10.5000	0.4156	0.0034	5.0226	0.1435	0.1469	5.0282	0.3484
10.6000	0.4122	0.0034	5.0282	0.1437	0.1471	5.0316	0.3524
10.7000	0.4100	0.0034	5.0316	0.1439	0.1473	5.0336	0.3547
10.8000	0.4077	0.0034	5.0336	0.1440	0.1473	5.0347	0.3559
10.9000	0.4055	0.0034	5.0347	0.1440	0.1474	5.0352	0.3565

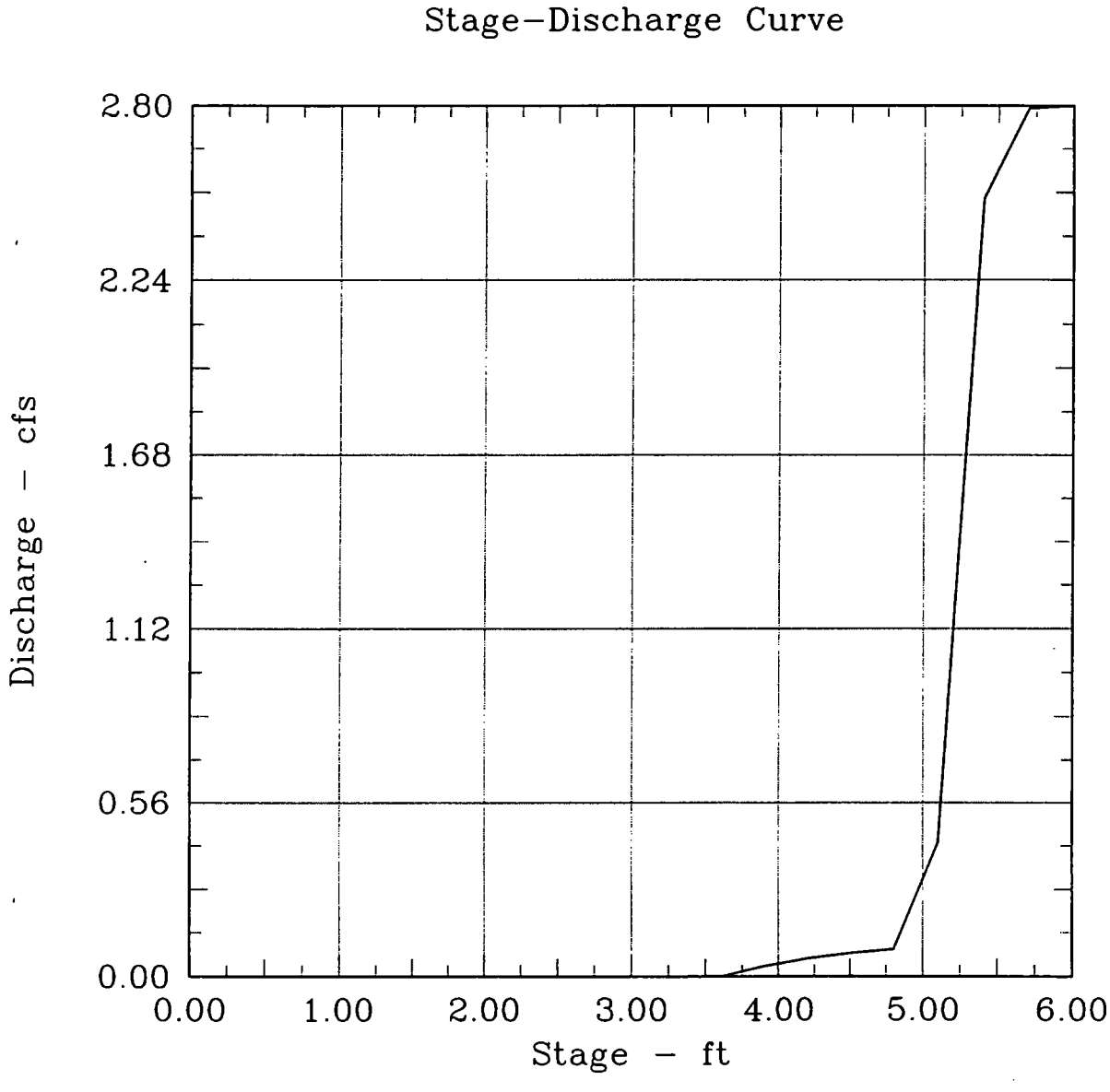
11.0000	0.4032	0.0033	5.0352	0.1440	0.1474	5.0353	0.3566
11.1000	0.3976	0.0033	5.0353	0.1440	0.1474	5.0349	0.3561
11.2000	0.3919	0.0033	5.0349	0.1440	0.1473	5.0339	0.3549
11.3000	0.3863	0.0032	5.0339	0.1440	0.1472	5.0325	0.3534
11.4000	0.3806	0.0032	5.0325	0.1439	0.1471	5.0308	0.3515
11.5000	0.3750	0.0031	5.0308	0.1438	0.1470	5.0290	0.3493
11.6000	0.3693	0.0031	5.0290	0.1437	0.1468	5.0270	0.3471
11.7000	0.3637	0.0030	5.0270	0.1437	0.1467	5.0249	0.3447
11.8000	0.3580	0.0030	5.0249	0.1436	0.1465	5.0228	0.3423
11.9000	0.3524	0.0029	5.0228	0.1435	0.1464	5.0206	0.3398
12.0000	0.3467	0.0029	5.0206	0.1434	0.1462	5.0184	0.3373
12.1000	0.3449	0.0029	5.0184	0.1433	0.1461	5.0164	0.3350
12.2000	0.3431	0.0028	5.0164	0.1432	0.1460	5.0148	0.3332
12.3000	0.3413	0.0028	5.0148	0.1431	0.1459	5.0135	0.3316
12.4000	0.3395	0.0028	5.0135	0.1430	0.1458	5.0123	0.3303
12.5000	0.3377	0.0028	5.0123	0.1430	0.1458	5.0113	0.3292
12.6000	0.3377	0.0028	5.0113	0.1429	0.1457	5.0105	0.3282
12.7000	0.3377	0.0028	5.0105	0.1429	0.1457	5.0099	0.3276
12.8000	0.3377	0.0028	5.0099	0.1429	0.1457	5.0095	0.3271
12.9000	0.3377	0.0028	5.0095	0.1428	0.1456	5.0093	0.3268
13.0000	0.3377	0.0028	5.0093	0.1428	0.1456	5.0091	0.3266
13.1000	0.3359	0.0028	5.0091	0.1428	0.1456	5.0088	0.3263
13.2000	0.3341	0.0028	5.0088	0.1428	0.1456	5.0084	0.3259
13.3000	0.3323	0.0028	5.0084	0.1428	0.1455	5.0079	0.3253
13.4000	0.3305	0.0027	5.0079	0.1428	0.1455	5.0074	0.3247
13.5000	0.3287	0.0027	5.0074	0.1427	0.1455	5.0068	0.3240
13.6000	0.3269	0.0027	5.0068	0.1427	0.1454	5.0061	0.3232
13.7000	0.3251	0.0027	5.0061	0.1427	0.1454	5.0054	0.3225
13.8000	0.3233	0.0027	5.0054	0.1427	0.1453	5.0048	0.3217
13.9000	0.3215	0.0027	5.0048	0.1426	0.1453	5.0041	0.3209
14.0000	0.3197	0.0026	5.0041	0.1426	0.1452	5.0034	0.3201
14.1000	0.3196	0.0026	5.0034	0.1426	0.1452	5.0027	0.3194
14.2000	0.3195	0.0026	5.0027	0.1425	0.1452	5.0023	0.3189
14.3000	0.3193	0.0026	5.0023	0.1425	0.1451	5.0020	0.3185
14.4000	0.3192	0.0026	5.0020	0.1425	0.1451	5.0017	0.3183
14.5000	0.3191	0.0026	5.0017	0.1425	0.1451	5.0016	0.3181
14.6000	0.3190	0.0026	5.0016	0.1425	0.1451	5.0014	0.3179
14.7000	0.3188	0.0026	5.0014	0.1425	0.1451	5.0013	0.3178

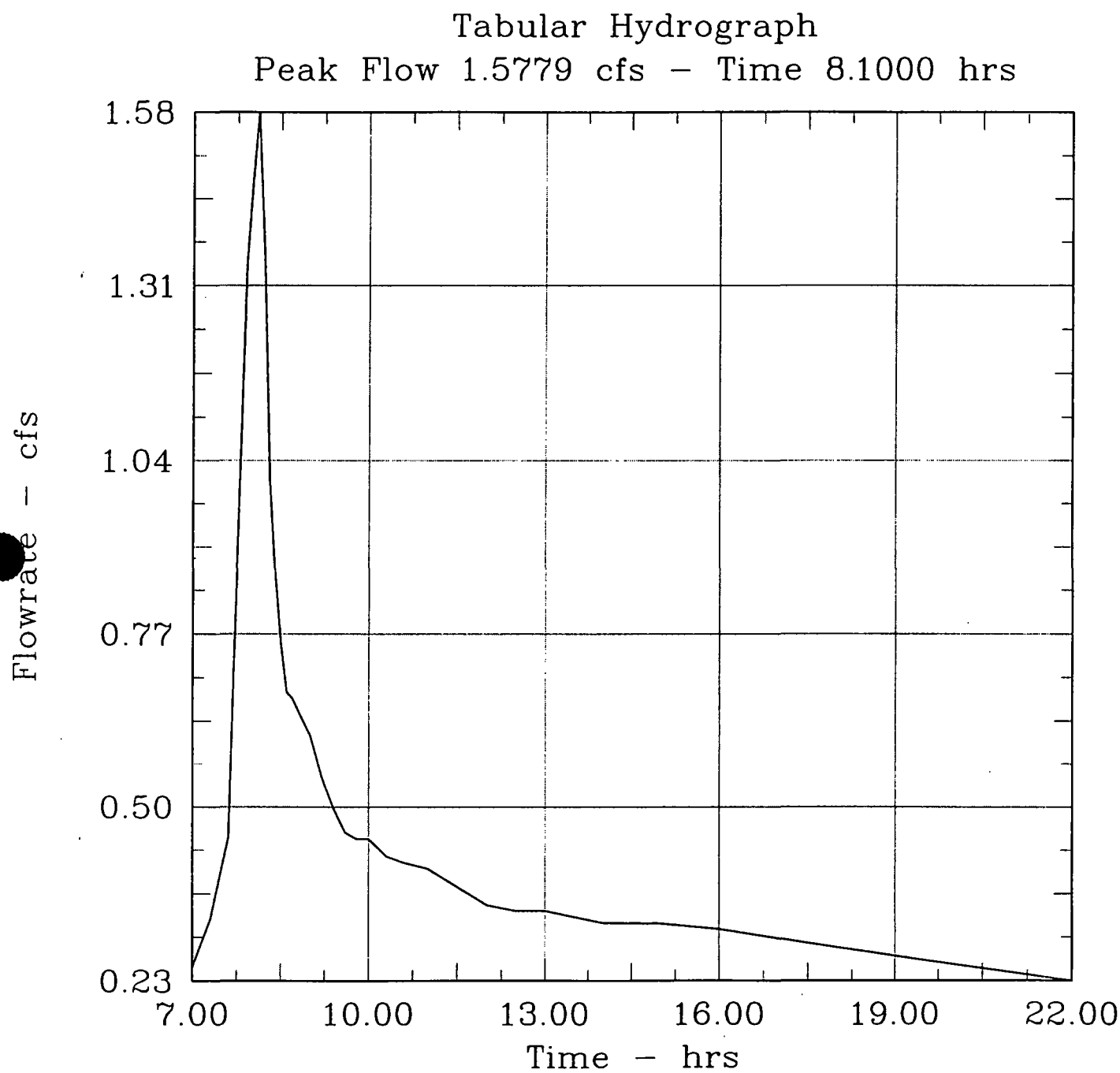
14.8000	0.3187	0.0026	5.0013	0.1425	0.1451	5.0012	0.3177
14.9000	0.3186	0.0026	5.0012	0.1425	0.1451	5.0011	0.3176
15.0000	0.3185	0.0026	5.0011	0.1425	0.1451	5.0011	0.3175
15.1000	0.3176	0.0026	5.0011	0.1425	0.1451	5.0010	0.3174
15.2000	0.3167	0.0026	5.0010	0.1424	0.1451	5.0008	0.3171
15.3000	0.3158	0.0026	5.0008	0.1424	0.1451	5.0005	0.3169
15.4000	0.3149	0.0026	5.0005	0.1424	0.1450	5.0003	0.3165
15.5000	0.3140	0.0026	5.0003	0.1424	0.1450	4.9999	0.3162
15.6000	0.3131	0.0026	4.9999	0.1424	0.1450	4.9995	0.3156
15.7000	0.3122	0.0026	4.9995	0.1424	0.1450	4.9988	0.3149
15.8000	0.3113	0.0026	4.9988	0.1424	0.1449	4.9981	0.3141
15.9000	0.3104	0.0026	4.9981	0.1423	0.1449	4.9973	0.3131
16.0000	0.3095	0.0026	4.9973	0.1423	0.1448	4.9963	0.3120
16.1000	0.3081	0.0026	4.9963	0.1422	0.1448	4.9952	0.3107
16.2000	0.3066	0.0025	4.9952	0.1422	0.1447	4.9938	0.3092
16.3000	0.3052	0.0025	4.9938	0.1421	0.1447	4.9923	0.3075
16.4000	0.3038	0.0025	4.9923	0.1421	0.1446	4.9907	0.3056
16.5000	0.3024	0.0025	4.9907	0.1420	0.1445	4.9888	0.3035
16.6000	0.3010	0.0025	4.9888	0.1419	0.1444	4.9868	0.3012
16.7000	0.2996	0.0025	4.9868	0.1418	0.1443	4.9847	0.2988
16.8000	0.2982	0.0025	4.9847	0.1417	0.1442	4.9824	0.2961
16.9000	0.2968	0.0025	4.9824	0.1416	0.1441	4.9799	0.2934
17.0000	0.2953	0.0024	4.9799	0.1415	0.1439	4.9774	0.2904
17.1000	0.2939	0.0024	4.9774	0.1414	0.1438	4.9747	0.2874
17.2000	0.2925	0.0024	4.9747	0.1413	0.1437	4.9719	0.2842
17.3000	0.2911	0.0024	4.9719	0.1411	0.1435	4.9690	0.2809
17.4000	0.2897	0.0024	4.9690	0.1410	0.1434	4.9660	0.2774
17.5000	0.2883	0.0024	4.9660	0.1409	0.1433	4.9629	0.2739
17.6000	0.2869	0.0024	4.9629	0.1407	0.1431	4.9597	0.2702
17.7000	0.2855	0.0024	4.9597	0.1406	0.1429	4.9563	0.2664
17.8000	0.2840	0.0024	4.9563	0.1404	0.1428	4.9530	0.2625
17.9000	0.2826	0.0023	4.9530	0.1403	0.1426	4.9495	0.2586
18.0000	0.2812	0.0023	4.9495	0.1401	0.1424	4.9459	0.2545
18.1000	0.2799	0.0023	4.9459	0.1400	0.1423	4.9423	0.2504
18.2000	0.2787	0.0023	4.9423	0.1398	0.1421	4.9386	0.2462
18.3000	0.2774	0.0023	4.9386	0.1396	0.1419	4.9349	0.2419
18.4000	0.2761	0.0023	4.9349	0.1395	0.1417	4.9311	0.2376
18.5000	0.2748	0.0023	4.9311	0.1393	0.1416	4.9273	0.2333

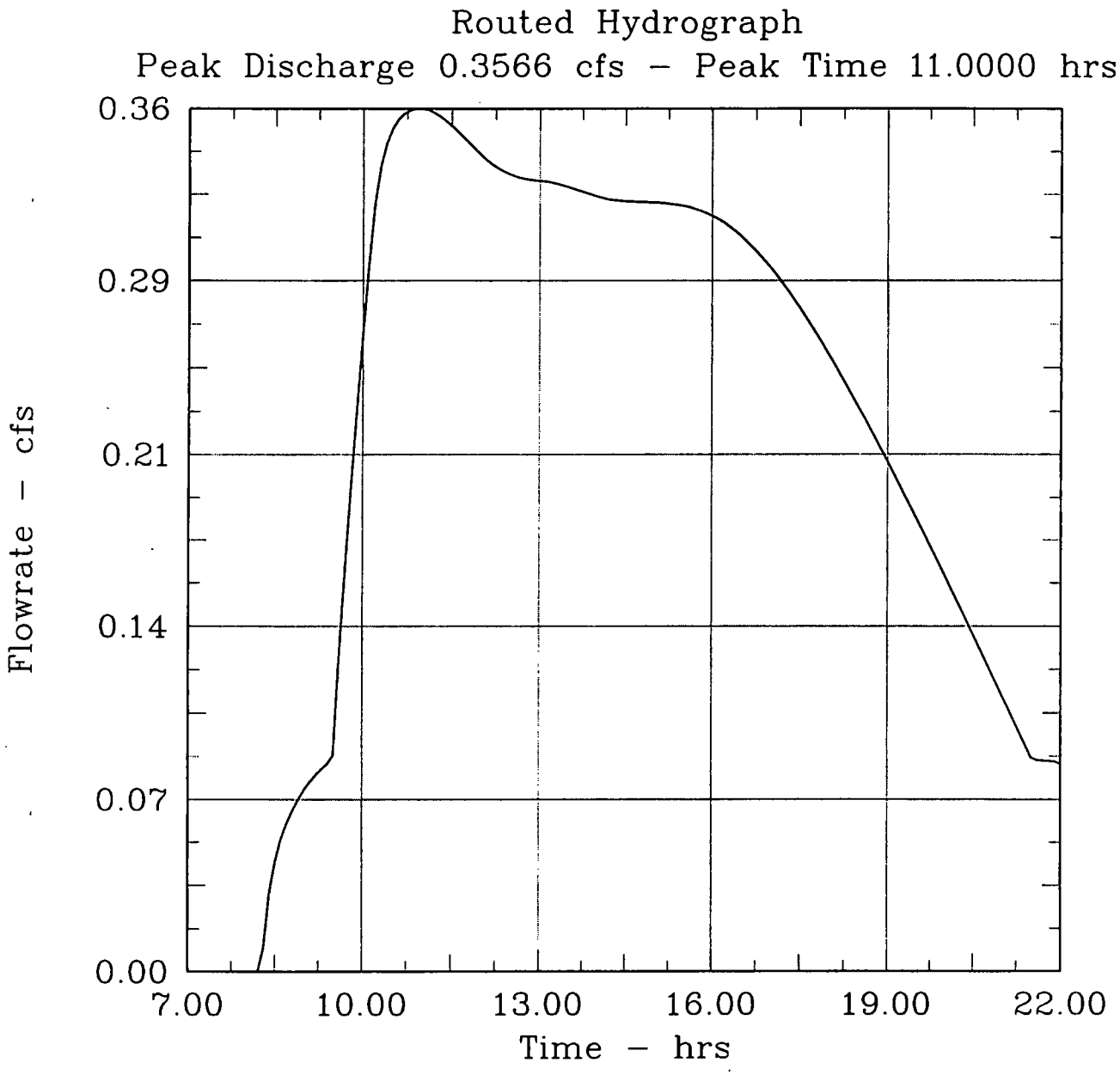
18.6000	0.2735	0.0023	4.9273	0.1391	0.1414	4.9235	0.2289
18.7000	0.2723	0.0023	4.9235	0.1389	0.1412	4.9196	0.2245
18.8000	0.2710	0.0022	4.9196	0.1388	0.1410	4.9157	0.2200
18.9000	0.2697	0.0022	4.9157	0.1386	0.1408	4.9117	0.2155
19.0000	0.2684	0.0022	4.9117	0.1384	0.1406	4.9077	0.2109
19.1000	0.2671	0.0022	4.9077	0.1382	0.1404	4.9037	0.2063
19.2000	0.2659	0.0022	4.9037	0.1380	0.1402	4.8997	0.2017
19.3000	0.2646	0.0022	4.8997	0.1379	0.1401	4.8956	0.1970
19.4000	0.2633	0.0022	4.8956	0.1377	0.1399	4.8915	0.1923
19.5000	0.2620	0.0022	4.8915	0.1375	0.1397	4.8873	0.1876
19.6000	0.2607	0.0022	4.8873	0.1373	0.1395	4.8832	0.1829
19.7000	0.2594	0.0021	4.8832	0.1371	0.1393	4.8790	0.1781
19.8000	0.2582	0.0021	4.8790	0.1369	0.1391	4.8748	0.1733
19.9000	0.2569	0.0021	4.8748	0.1367	0.1389	4.8706	0.1684
20.0000	0.2556	0.0021	4.8706	0.1365	0.1387	4.8663	0.1636
20.1000	0.2543	0.0021	4.8663	0.1364	0.1385	4.8620	0.1587
20.2000	0.2530	0.0021	4.8620	0.1362	0.1383	4.8578	0.1538
20.3000	0.2518	0.0021	4.8578	0.1360	0.1381	4.8535	0.1489
20.4000	0.2505	0.0021	4.8535	0.1358	0.1378	4.8491	0.1440
20.5000	0.2492	0.0021	4.8491	0.1356	0.1376	4.8448	0.1390
20.6000	0.2479	0.0021	4.8448	0.1354	0.1374	4.8404	0.1340
20.7000	0.2466	0.0020	4.8404	0.1352	0.1372	4.8361	0.1291
20.8000	0.2454	0.0020	4.8361	0.1350	0.1370	4.8317	0.1241
20.9000	0.2441	0.0020	4.8317	0.1348	0.1368	4.8273	0.1190
21.0000	0.2428	0.0020	4.8273	0.1346	0.1366	4.8229	0.1140
21.1000	0.2415	0.0020	4.8229	0.1344	0.1364	4.8185	0.1090
21.2000	0.2402	0.0020	4.8185	0.1342	0.1362	4.8140	0.1039
21.3000	0.2390	0.0020	4.8140	0.1340	0.1360	4.8096	0.0988
21.4000	0.2377	0.0020	4.8096	0.1338	0.1358	4.8051	0.0937
21.5000	0.2364	0.0020	4.8051	0.1336	0.1355	4.8007	0.0887
21.6000	0.2351	0.0019	4.8007	0.1334	0.1353	4.7962	0.0877
21.7000	0.2338	0.0019	4.7962	0.1332	0.1351	4.7917	0.0875
21.8000	0.2326	0.0019	4.7917	0.1330	0.1349	4.7872	0.0873
21.9000	0.2313	0.0019	4.7872	0.1328	0.1347	4.7827	0.0871
22.0000	0.0000	0.0010	4.7827	0.1326	0.1335	4.7582	0.0860

Stage–Storage Curve




Stage–Discharge Curve
2.80
2.24
1.68
1.12
0.56
0.00
Discharge – cfs
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Stage – ft


Tabular Hydrograph
Peak Flow 1.5779 cfs - Time 8.1000 hrs
1.58
1.31
1.04
0.77
0.50
0.23
Flowrate - cfs
7.00
10.00
13.00
16.00
19.00
22.00
Time - hrs


Routed Hydrograph
Peak Discharge 0.3566 cfs - Peak Time 11.0000 hrs
0.36
0.29
0.21
0.14
0.07
0.00
Flowrate - cfs
7.00
10.00
13.00
16.00
19.00
22.00
Time - hrs

Appendix I

APPENDIX I

WASTEWATER DISCHARGE PERMIT APPLICATION

City of Everett

Industrial Pretreatment Program

WASTEWATER DISCHARGE PERMIT APPLICATION

3200 Cedar Street
Everett, WA 98201
Phone: (206) 257-8240 Fax: (206) 257-8243

INSTRUCTIONS

GENERAL INFORMATION INSTRUCTIONS

A. INDUSTRIAL USER

1. Give the name of the facility for which information is being provided.

2. If the facility is owned by a person or entity other than the person signing this form, provide the owner's name.

3-6. Provide information as indicated.

7. If you do not know the Standard Industrial Classification (SIC) for your industry, contact the Industrial Pretreatment Section.

8. List all environmental permits, including number; e.g., NPDES, PSAPCA, etc.

B. DOMESTIC OR INDUSTRIAL

1. Sources may include cooling water, boiler blowdown, industrial processes, etc.

2. If you do not know if the activities conducted at your facility are subject to Federal Categorical regulations, contact the Industrial Pretreatment Section for assistance.

C. CERTIFICATION STATEMENT/SIGNATURE

Federal regulation 40 CFR Part 403.12(1) states that the official signing this application must be:

a. A responsible corporate officer (president, vice-president, secretary, or treasurer of the corporation) in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation; or

b. The manager of one or more manufacturing, production, or operation facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million, if authorized by the corporation to sign documents; or

c. A general partner or proprietor, or

d. A duly authorized representative of an individual designated by the regulation, so long as a written authorization is submitted to Industrial Pretreatment which specifies that the authorized person has a position of responsibility for the overall operation of the facility which generates the wastewater discharge, or responsibility for environmental matters for the company.

WASTEWATER DISCHARGE PERMIT APPLICATION

I. GENERAL INFORMATION

A. INDUSTRIAL USER

1. Facility Name: EVERETT SMELTER SITE - FENCED AREA
2. Company Name: ASARCO INCORPORATED
3. Mailing Address: 5219 N. SHIRLEY ST., SUITE 100
   City: RUSTON State: WA Zip: 98407
4. Facility Address: 545 HAWTHORNE ST.
   City: EVERETT State: WA Zip: 98201
5. Local Contact Person: CLINTON S. STANOVSKY Phone: 425 259 0322
6. Primary Business Activity: MTCA CLEANUP SITE 7. SIC: _____
8. Local, State, and/or Federal environmental permits held: CLEANUP PURSUANT TO WASHINGTON DEPT. OF ECOLOGY ENFORCEMENT ORDER NO. 02TCPNR-4059 AND EVERETT SUPERIOR COURT AGREED JUDGEMENT NO. 03-2-08502-1

B. DOMESTIC OR INDUSTRIAL

1. Is wastewater from your facility discharged from any source except kitchens and bathrooms?
   Yes X No _____
2. Are any activities conducted at your facility subject to Federal Categorical regulations?
   Yes _____ No _____

If you answered "no" to both of the questions above, sign the bottom of this page and return this form to the Industrial Pretreatment Section. If either or both questions were answered "yes", complete the Permit Application, sign the bottom of this page, and return the Application to the Industrial Pretreatment Section.

C. CERTIFICATION STATEMENT

I have personally examined and am familiar with the information submitted in this document and attachments. Based upon my inquiry of those individuals immediately responsible for obtaining the information reported herein, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and/or imprisonment.

David K. Nation
Signature

DAVID K. NATION, P.E.
Print Name

SENIOR MANAGER OF PROJECTS AND ANALYTICAL SERVICES
Title

1/30/04
Date

INSTRUCTIONS (CONTINUED)

PLANT/PRODUCTION DATA INSTRUCTIONS

A. PLANT INFORMATION

Provide information as indicated.

B. PRODUCT/SERVICE DESCRIPTION

1. List each separate product or service manufactured or provided by your facility. If you do not know the SIC for your product or service, contact the Industrial Pretreatment Section for assistance.

2. Provide information as indicated.

3. Pretreatment includes any process which modifies the quality or constituents of the wastewater prior to discharge (pH adjustment, solids removal, oil/water separation, etc.)

C. PLANT LAYOUT DIAGRAM

Follow instructions given on sample diagram in Attachment A. The plant layout diagram must include: the facility boundaries (including entrances and exits), the location of municipal sewer lines (including stormwater catch basins), all sewer lines and their points of discharge to the municipal system, location and identification of process discharges, location and labeling of flow metering and/or pretreatment equipment, and location of chemical materials storage.

Processes may be identified by numbers as long as the numbers correspond with those on the Process Schematic Diagrams (see Section IV-C).

WASTEWATER DISCHARGE PERMIT APPLICATION

II. PLANT/PRODUCTION DATA

A. PLANT OPERATION

1. Is business subject to seasonal variation? Yes ✓ No____

If yes, describe: CLEANUP ACTIONS WILL BEGIN IN MAY 2004; BY AUGUST 20, 2004 ALL ~~HIGH~~ SOILS WITH As CONCENTRATIONS GREATER THAN 3000 PPM WILL BE REMOVED FROM SITE, AND SURFACE WATER RUNOFF WILL REVERT TO NON-REGULATE LEVELS.

2. Number of work days per week: N/A (TO BE DETERMINED BY CONTRACTOR)

	1st Shift	2nd Shift	3rd Shift
Start/end time of shifts: N/A			
Number of employees per shift			
Total number of employees (all shifts):			

B. PRODUCT/SERVICE DESCRIPTION

1. List all products manufactured or services provided by your facility:

Product or Service:	SIC:	Description:
MTCA SITE CLEANUP		REMOVAL AND OFFSITE DISPOSAL OF CONTAMINATED SOIL; PLACEMENT AND GRADING OF CLEAN FILL.

2. Are automatic sampling or flow monitoring devices in use? Yes____ No X
If yes, describe the device and its location:
APPLICANT PROPOSES TO DISCHARGE TO COMBINED SEWER FROM AN ONSITE SEDIMENTATION POND AS NECESSARY DUE TO RAINFALL; POLLUTANT DISCHARGE QUANTITIES TO BE CALCULATED BASED ON AVERAGE RAINFALL DATA (III.E., BELOW).

3. Will your facility pretreat any wastewater prior to discharge to the sanitary sewer? Yes X No____

If yes, describe the pretreatment method and equipment and its location(s):

SEDIMENTATION POND AT SOUTHEAST CORNER OF SITE WILL REMOVE SEDIMENTS PRIOR TO DISCHARGE TO COMBINED SEWER AT EAST MARINE VIEW DR site

C. ~~PLANT~~ LAYOUT DIAGRAM

1. Using the instructions and the example provided in Attachment A, provide a ~~plant~~ site layout diagram.

SEE CONSTRUCTION PLAN SHEET SERIES ES-SL.

INSTRUCTIONS (continued)

D. SPILL PREVENTION/WASTE DISPOSAL INFORMATION

Provide information as indicated.

Note: An Accidental Spill Prevention Plan is a document that details how, where, and types of chemicals that are stored, the location of clean- up and safety equipment, spill procedures, employee spill response training, and who to contact in the event of a spill.

III. WATER/WASTEWATER DATA INSTRUCTIONS

A. INFLUENT/EFFLUENT BALANCE SHEET

This is a balance sheet. The Influent total must match the Effluent total and be allocated so water use is accounted for as accurately as possible. If you require assistance, contact the Industrial Pretreatment Section.

WASTEWATER DISCHARGE PERMIT APPLICATION

D. SPILL PREVENTION/WASTE DISPOSAL INFORMATION

1. Does your facility have an Accidental Spill Prevention Plan?
   Yes X No____

2. Do you propose to discharge chemicals, sludges, or hazardous waste to the sanitary or storm sewers?
   Yes X No____

   If yes, please elaborate: TABLE 1 (ATTACHED) SUMMARIZES AVERAGE AND MAXIMUM POLLUTANT CONCENTRATION DATA FROM RUNOFF SAMPLES COLLECTED FROM ~~AREA~~ THE FENCED AREA, AND FROM NEARBY RESIDENTIAL PROPERTIES. SEE SUPPLEMENTAL PARAGRAPH 1, (ATTACHED).

3. Do you dispose of any chemicals, sludges, or hazardous wastes to locations other than municipal sewers or surface waters? Yes X No____

   EPA/State ID No. WAD 988512638

   If yes, Please list: SEE TABLE 2 AND SUPPLEMENTAL PARAGRAPH 2, ATTACHED.

Waste removed by:	Type of Waste:	Waste ID#:	Volume/Frequency [1]

[1] For example, lbs/mo.

III. WATER/WASTEWATER DATA

A. INFLUENT/EFFLUENT BALANCE

Influent (Water In)				Effluent (Water Out)				
Water Use:	Source Code:	Gallon/Day Avg.	Gallon/Day Max.	San. Sewer:	Storm Sewer:	Dischg. Code:	Gallon/Day Avg.	Gallon/Day Max.
Sanitary								
Process								
Boiler								
Irrigation								
Products								
Evaporation								
Cooling								
Other	D	4,300	171,400*	=COMBINED=			3,800	171,400*
Total:								

Source Codes: A. Municipal Supply B. Private Well C. Recycled/Reclaimed
D. Other RAINFALL / STORMWATER

Discharge Codes: A. Recycled B. Waste Hauler C. Other____

* ASSUMES THE 10-YEAR, 24-HR, STORM EVENT (2.25" OF RAINFALL)

B. *CONTINUOUS/BATCH DISCHARGES*

1. If wastewater is discharged continuously, as it is generated, provide the requested information.

2. If process wastewater is held for any reason and discharged as a batch, provide the requested information.

C. *MATERIALS*

Identify the materials and chemicals that you use in your business. Make sure that you include:

- ✓ chemicals used to treat raw water,
- ✓ boiler or cooling tower chemicals,
- ✓ chemicals used for cleaning the plant or equipment, and
- ✓ any chemicals used in your products or processes.

B. *CONTINUOUS/BATCH DISCHARGES*

1. Continuous Discharges:

Hours: From_____ To_____

Days of Week_____

_____

2. Batch Discharge:

Process_____

Vol. (Gal.)_____ Rate (gpm)_____

Hour(s) of Day_____

Day(s) of Week_____

DISCHARGES WILL BE INTERMITTANT (VARYING WITH RAINFALL), FROM STORMWATER COLLECTED ~~FROM THE SITE~~ IN THE SEDIMENTATION POND. THE POND IS SIZED TO TREAT THE 10-YR., 24-HR. RAIN EVENT (2.25").

C. *MATERIALS*

List materials (cleaning agents, solvents, plating solutions, process chemicals, etc.) that are regularly used in your facility that might be present in your wastewater discharge to the sanitary sewer, including accidental spills.

Type of Material	Annual Usage Amount	Estimated Loss To Sewer	Principal Chemical Characteristic
N/A			

INSTRUCTIONS (continued)

IV. PROCESS DETAIL INSTRUCTIONS

A. PROCESS ACTIVITIES

Please list each separate production or process activity that takes place in your facility. Examples include: cooking, equipment washing, painting, sandblasting, etching, plating, etc.

B. WASTEWATER GENERATING PROCESSES

List *all* processes, whether or not they are listed in IV-A. If you do not know which regulated category may be applicable, please contact the Industrial Pretreatment Section for assistance.

Production rates may be stated in lbs/yr, sheets/hr, or other units that are appropriate to your process.

C. PROCESS SCHEMATIC DIAGRAM

Follow the instructions given on the sample process diagram in Attachment B. Provide a separate diagram for each major process conducted in your facility and assign a number to each process. Numbers should correspond with numbers shown on the plant diagram (see Section II-C).

D. ENGINEERING REPORT PLANS AND SPECIFICATIONS AND OPERATION & MAINTENANCE MANUAL

You must submit two copies of the Engineering Report, Plans and Specifications and Operation & Maintenance Manual as required by WAC 173-240. We will forward one copy to Washington State Department of Ecology for approval and retain the other for our files. The permit will not be issued until written approval of the documents is received from the Department of Ecology.

WASTEWATER DISCHARGE PERMIT APPLICATION

IV. PROCESS DETAIL

A. PROCESS ACTIVITIES

1. List all process activities which occur at your facility: (ex: washing, sandblasting, painting, metal forming, electroplating, chemical formulation, etc.) Please indicate by asterisk (*), those processes that *use* water.

SOIL EXCAVATION, SOIL STOCKPILING, LOADING OF TRUCK-MOUNTED SHIPPING CONTAINERS, EXCAVATION EQUIPMENT REFUELING, DUST SUPRESSION*

B. WASTEWATER GENERATING PROCESSES

For each process which *generates wastewater*, please list:

Process:	Regulated Discharge Gal. Per Day: Avg.	Max.	Production Rate: Last Year	Current	40 CFR Category
STORMWATER COLLECTION & TREATMENT	3,800	171,400*	N/A	N/A	
* ASSUMES 10-YR., 24-HR. RAIN EVENT					
DUST SUPRESSION	N/A · SEE SUPPLEMENTAL PARAGRAPH 1.				

C. PROCESS SCHEMATIC DIAGRAM

Using example provided in attachment B., provide a separate process diagram for each major process in your facility.

SEE CONSTRUCTION PLAN SERIES: ES-SW

D. ENGINEERING REPORT PLANS AND SPECIFICATIONS AND OPERATION & MAINTENANCE MANUAL

Refer to WAC 173-240 for required reports.

N/A

WASTEWATER DISCHARGE PERMIT APPLICATION

E. POLLUTANT INFORMATION

Check all that are suspected or known to be present in your manufacturing or service activities or generated as a by-product:

Volatile and semi-volatile compounds often have several synonyms. For those compounds marked by an asterisk(*), please refer to the attached Priority Pollutant Synonym Listing. However, the Chemical Abstract Service (CAS) Registry number is the same, regardless of the name. If you are unsure about the chemical content of any product, refer to the Material Safety and Data Sheet (MSDS) where you should find both names and CAS numbers for chemicals contained in the material.

PRIORITY POLLUTANT INFORMATION

ITEM NO.	CHEMICAL COMPOUND	CAS #	ANNUAL USE (lb) (gal)/ (yr)	ESTIMATED LOSS TO SEWER (lb) (gal)/ (yr)	ITEM NO.	CHEMICAL COMPOUND	CAS #	ANNUAL USE (lb) (gal)/ (yr)	ESTIMATED LOSS TO SEWER (lb) (gal)/ (yr)
1.	asbestos (fibrous)				31.	d-BHC (delta)	319868		
2.	cyanide				32.	g-BHC* (gamma)	608731		
3.	antimony				33.	bis(2-chloroethyl)ether*	111444		
4.	arsenic			4.24 lb	34.	bis(2-chloroethoxy)methane*	111911		
5.	berylium				35.	bis(2-chloroisopropyl)ether*	108601		
6.	cadmium			<0.01 lb	36.	bis(chloromethyl) ether*	542881		
7.	chromium				37.	bis(2-ethylhexyl)phthalate*	117817		
8.	copper				38.	bromodichloro methane*	75274		
9.	lead			1.27 lb	39.	bromoform*	75252		
10.	mercury				40.	bromomethane*	74839		
11.	nickel				41.	4-bromophenylphenyl ether	101553		
12.	selenium				42.	butylbenzyl phthalate	85687		
13.	silver				43.	carbon tetrachloride*	56235		
14.	thallium				44.	chlordane	57749, 12789036		
15.	zinc				45.	4-chloro-3-methylphenol*	59507		
16.	acenaphthene	183329			46.	chlorobenzene	108907		
17.	acenaphthylene	208968			47.	chloroethane*	75003		
18.	acrolein	107028			48.	2-chloroethylvinyl ether	110758		
19.	acrylonitrile	107131			49.	chloroform*	67663		
20.	aldrin	309002			50.	chloromethane*	74873		
21.	anthracene	120127			51.	2-chloronaphthalene	90131		
22.	benzene	71432			52.	chlorophenol (o.m.p)	95578		
23.	benzidine	92875			53.	4-Chlorophenylphenyl ether	7005723		
24.	benzo(a)anthracene*	56553			54.	chrysene*	218019		
25.	benzo(a) pyrene*	50328			55.	4,4' - DDD*	72548		
26.	benzo(b)fluoranthene	205992			56.	4,4; - DDE*	72559		
27.	benzo(g,h,i) perylene*	191242			57.	4,4' - DDT*	50293		
28.	benzo(k) fluoranthene*	207089			58.	dibenzo (a,h)anthracene*	53703		
29.	a-BHC (alpha)	319846			59.	dibromochloro methane*	124481		
30.	b-BHC (beta)	319857							

WASTEWATER DISCHARGE PERMIT APPLICATION

E. POLLUTANT INFORMATION (Continued)

ITEM NO.	CHEMICAL COMPOUND	CAS #	ANNUAL USE (lb) (gal)/ (yr)	ESTIMATED LOSS TO SEWER (lb) (gal)/ (yr)	ITEM NO.	CHEMICAL COMPOUND	CAS #	ANNUAL USE (lb) (gal)/ (yr)	ESTIMATED LOSS TO SEWER (lb) (gal)/ (yr)
60.	1.2-dichlorobenzene*	124481			94.	hexachlorocyclopen tadiene*	77474		
61.	1.3-dichlorobenzene*	541731			95.	hexachloroethane*	67721		
62.	1.4-dichlorobenzene*	106467			96.	indeno-(1,2.3-cd) pyrene*	193395		
63.	3.3'-dichlorobenzidine	91941			97.	isophorone*	78591		
64.	1,1-dichloroethane*	75353			98.	methylene chloride*	75092		
65.	1,2-dichloroethane*	107062			99.	naphthalene	912303		
66.	1,1-dichloroethene*	75354			100.	nitrobenzene	98953		
67.	trans-1,2-dichloroethene*	156605			101.	2-nitrophenol*	88755		
68.	2.4-dichlorophenol	120832			102.	4-nitrophenol*	100027		
69.	1.2-dichloropropane*	78875			103.	n-nitrosodimethy lamine*	62759		
70.	(cis &trans)1.3-dichloropropene*	10061015 10061026			104.	n-nitrosodipropy lamine*	621647		
71.	dieldrin	60571			105.	n-nitrosodipheny lamine*	86306		
72.	diethyl phthalate*	84662			106.	PCB-1016*	12674112		
73.	2.4-dimethylphenol*	105679			107.	PCB-1221*	11104282		
74.	dimethyl phthalate	131113			108.	PCB-1232*	11141165		
75.	di-n-butyl phthalate	84742			109.	PCB-1242*	53469219		
76.	di-n-octyl phthalate*	117840			110.	PCB-1248*	12672296		
77.	4.6-dinitro-2-methylphenol*	534521			111.	PCB-1254*	11097691		
78.	2.4-dinitrophenol	51285			112.	PCB-1260*	11096825		
79.	2,4-dinitrotoluene	121142			113.	pentachlorophenol	87865		
80.	2.6-dinitrotoluene	606202			114.	phenanthrene	85018		
81.	1,2-diphenylhydrazine*	122667			115.	phenol	108952		
82.	endosulfan I*	959988			116.	pyrene	129000		
83.	endosulfan II*	33213659			117.	2.3.7,8-tetrachlorodibenzo-p-dioxin*	1746016		
84.	endosulfan sulfate	1031078			118.	1,1.2.2-tetrachloroethane*	79345		
85.	endrin	72208			119.	tetrachloroethene*	127184		
86.	endrin aldehyde	7421934			120.	toluene*	108883		
87.	ethylbenzene	100414			121.	toxaphene	8001352		
88.	fluoranthene	206440			122.	1,2,4-trichlorobenzene*	87616		
89.	florene*	86737			123.	1,1,1-trichloroethane*	71556		
90.	heptachlor	76448			124.	1.1,2-trichloroethane*	79005		
91.	heptachlor epoxide	1024573			125.	trichloroethene*	79016		
92.	hexachlorobenzene*	118741			126.	2.4.6-trichlorophenol	88062		
93.	hexachlorobutadiene	87683			127.	vinyl chloride*	75014		

WASTEWATER DISCHARGE PERMIT APPLICATION

SYNONYM LISTING FOR PRIORITY POLLUTANTS

CHEMICAL COMPOUND	SYNONYM
benzo(a)anthracene	1,2-benzanthracene 2,3-benzphenanthrene
benzo(a)pyrene	3,4-benzopyrene
benzo(g,h,i)perylene	1,12-benzoperylene
benzo(k)fluoranthene	11,12-benzofluoranthene
g-BHC (gamma)	lindane
bis(2-chloroethyl)ether	2,2'-dichloroethyl ether
bis(2-chloroethoxy)methane	2,2'-dichloroethyoxy methane
bis(2-chloroisopropyl)ether	2,2'-dichloroisopropyl ether
bis(chloromethy)ether	(sym)dichloromethyl ether
bis(2-ethylhexyl)phthalate	2,2'-diethylhexyl phthalate
bromodichloromethane	dichlorobromomethane
bromoform	tribromomethane
bromomethane	methyl bromide
carbon tetrachloride	tetrachloromethane
4-chloro-3-methylphenol	para-chloro-meta-cresol
chloroethane	ethylchloride
chloroform	trichloromethane
chloromethane	methyl chloride
chrysene	1,2-benzphenanthrene
4,4'-DDD	dichlorodiphenyldichloroethane p,p'-TDE tetrachlorodiphenylethane
4,4'-DDE	dichlorodiphenyldichloroethylene p,p'-DDX
4,4'-DDT	dichlorodiphenyltrichloroethane
dibenzo(a,h)anthracene	1,2,5,6-dibenzanthracene
dibromochloromethane	chlorodibromomethane
1,2-dichlorobenzene	ortho-dichlorobenzene
1,3-dichlorobenzene	meta-dichlorobenzene
1,4-dichlorobenzene	para-dichlorobenzene
1,1-dichloroethane	ethylidene chloride
1,2-dichloroethane	ethylene chloride ethylene dichloride
1,1-dichloroethene	1,1-dichloroethylene
(trans)-1,2-dichloroethene	acetylene dichloride 1,2(trans)-dichloroethylene
1,2-dichloropropane	propylene dichloride

CHEMICAL COMPOUND	SYNONYM
(cis & trans) 1,3-dichloropropene	(cis & trans)1,3-dichloropropylene
diethyl phthalate	ethyl phthalate
2,4-dimethylphenol	2,4-xylenol
di-n-octyl phthalate	di(2-ethylhexyl)phthalate
4,6-dinitro-2-methylphenol	4,6-dinitro-ortho-cresol
1,2-diphenylhydrazine	hydrazobenzene
endosulfan I	a-endosulfan-alpha
endosulfan II	b-endosulfan-beta
fluorene	(alpha)-diphenylene methane
hexachlorobenzene	perchlorobenzene
hexachlorocyclopentadiene	perchlorocyclopentadiene
hexachloroethane	perchloroethane
indeno(1,3,3-cd)pyrene	2,3-ortho-phenylene pyrene
isophorone	3,5,5-trimethyl-2-cyclohexen-1-one
methylene chloride	dichloromethane
2-nitrophenol	para-nitrophenol
4-nitrophenol	ortho-nitrophenol
N-nitrosodimethylamine	dimethyl-nitrosoamine
N-nitrosodipropylamine	N-nitroso-di-n-propylamine
N-nitrosodiphenylamine	diphenyl-nitrosoamine
PCB-1016	Arochlor-1016
PCB-1221	Arochlor-1221
PCB-1232	Arochlor-1232
PCB-1242	Arochlor-1242
PCB-1248	Arochlor-1248
PCB-1254	Arochlor-1254
PCB-1260	Arochlor-1260
2,3,7,8-tetrachlorodibenzo-p-dioxin	TCDD
1,1,2,2-tetrachloroethane	acetylene tetrachloride
tetrachloroethene	perchloroethylene tetrachloroethylene
toluene	methylbenzene toluol
1,1,1-trichloroethane	methyl chloroform
1,1,2-trichloroethane	vinyl trichloride
trichloroethene	trichloroethylene
vinyl chloride	chloroethene chloroethylene

ATTACHMENT B

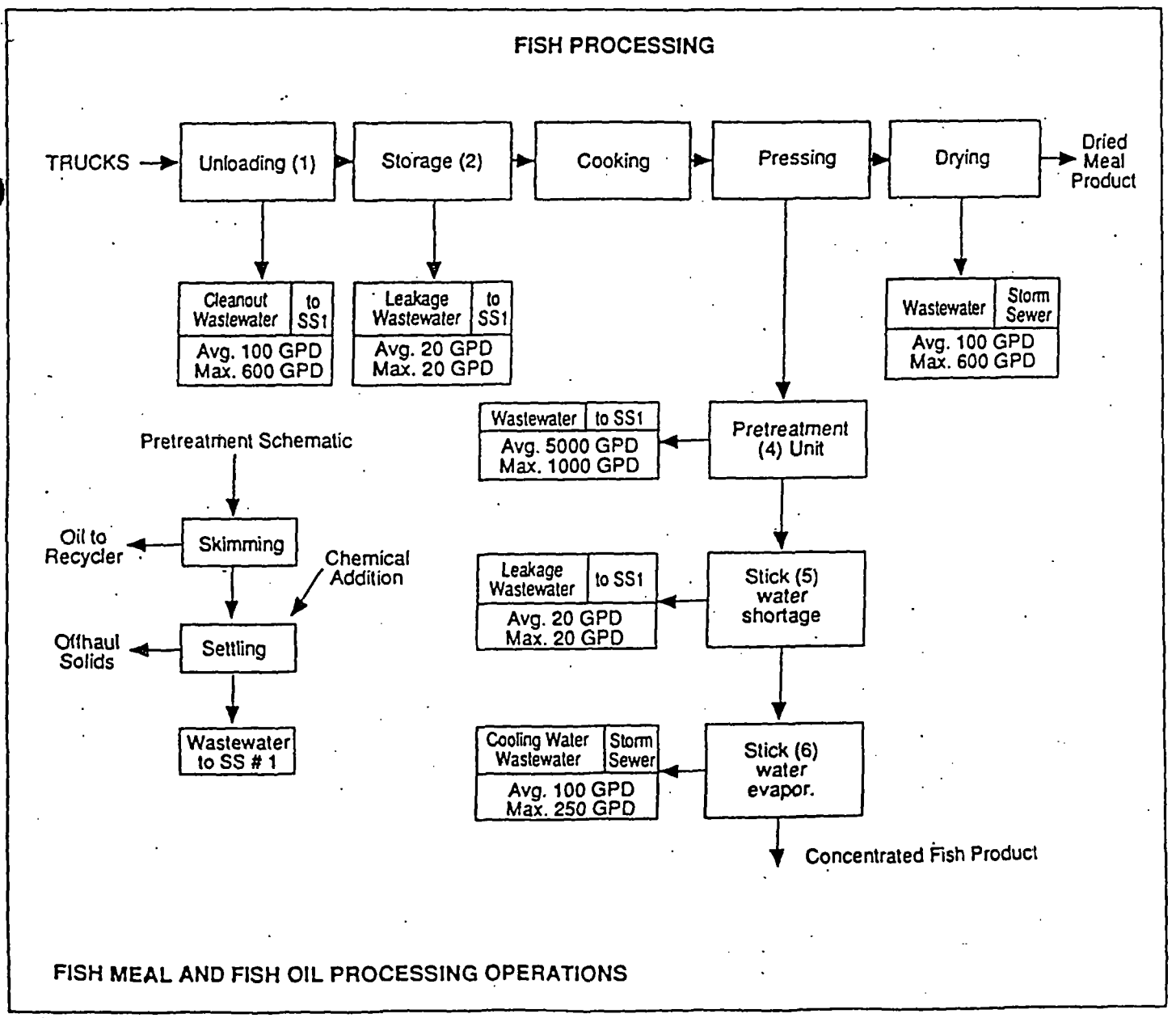
INSTRUCTIONS FOR COMPLETING A SCHEMATIC FLOW DIAGRAM

GENERAL INSTRUCTIONS: Type or print the information on an 8 1/2" x 11" sheet of paper. A larger size or a blueprint may be substituted.

A line drawing of each major activity listed in the "Process Description" must be submitted. Number each process which generates wastewater and use the same number for identification on the building layout. An example schematic flow diagram is shown below.

To determine your average daily volume and maximum daily volume of wastewater flow, you may have to read water meters or make estimates of volumes that are not directly measurable.

SCHEMATIC DIAGRAM - *EXAMPLE*



City of Everett
Industrial Pretreatment Program
Wastewater Discharge Permit Application

Everett Smelter Site
Supplemental Information

Table 1
Summary of Pollutant Limits and Stormwater Sampling Data
(Application, D.2)

	Local Pollutant Limit[1] (mg/L)	Fenced Area Direct Runoff to Catch Basins[2]		Non-Smelter Site (Residential) Runoff to Catch Basins[3]	
		Average (mg/L)	Maximum (mg/L)	Average (mg/L)	Maximum (mg/L)
Total As	0.50	0.218	1.1	0.006	0.014
Total Cd	0.24	<0.003	<0.003	0.002	<0.003
Total Pb	1.89	0.062	0.33	0.020	0.063

Notes:
1. Source: City of Everett Pretreatment Ordinance (#2034-95, as amended), Section 2.4.
2. Source: Comprehensive Lowland Area Remedial Investigation Report: Everett Smelter Site, Everett Washington, January 2000, Table 4-8. (Prepared by Asarco, Inc. for the Washington Department of Ecology.) Results are for 13 samples collected from November 1998 through August 1999.
3. Source: same as 2, above. Results are for 26 samples collected from November 1998 through August 1999.

Table 2
Summary of Non-Sewer/Surface-Water Disposal Locations
(Application, D.3)

Waste Removed By:	Type of Waste:	Waste ID #	Volume/Frequency
soil/debris excavation	Source Materials (contaminated soil, smelter residuals and debris) As > 30,000 ppm	D004 (As) D008 (Pb)	1900 cubic yards (estimated)
soil/debris excavation	Source Materials (contaminated soil and smelter debris) As between 3000 ppm and 30,000 ppm	D004 (As) D008 (Pb)	15,000 cubic yards (est.), removed by August 20, 2004.
soil excavation	Residential materials (contaminated soils) As between 150 ppm and 3,000 ppm	N/A	38,700 cubic yards (est.) removed during 2004 and 2005 construction seasons

Supplemental Paragraph 1. (Application, D.2)

Rainwater runoff will be the principal source of wastewater generated onsite during cleanup operations. All rainwater that does not infiltrate into onsite soils will be collected in a sedimentation pond located at the downhill (southeast) corner of the site. Other potential sources of water are dust control water runoff and (possibly) truck wash runoff. Both of these sources will be minimized or eliminated by standard operating procedures established for the cleanup. Dust suppression sprays will be used in minimal quantities that will be absorbed by onsite soils. All loading (and washing of over-the-road vehicles, if needed) will be accomplished on a paved surface parallel to East Marine View Drive at the north end of the site. This loading area will be sloped to drain directly into the sedimentation pond (see the Site Layout Diagram in Section C of the Application). The surface of the loading area will be swept and/or washed down as necessary to prevent tracking of contaminated soils into the public streets.

Supplemental Paragraph 2. (Application, D.3)

Contaminated soils and smelter residuals with arsenic concentrations greater than 30,000 part per million (ppm) will be disposed at one of the following licensed (RCRA Subtitle C) hazardous waste disposal facilities:

Chemical Waste Management of the Northwest, Inc. (Arlington, OR)
EPA Registry ID: 110013755828

US Ecology Idaho Inc. (Grandview, ID)
EPA Registry ID: 110015630110

Contaminated soils and smelter debris with arsenic concentrations greater than 3,000 ppm but less than 30,000 ppm will be disposed in Asarco's Ruston/Tacoma Site Onsite Containment Facility (OCF), subject to approval by USEPA Region 10.

Contaminated soils with arsenic concentrations greater than 150 ppm but less than 3,000 ppm will be disposed as subgrade backfill at Asarco's Ruston/Tacoma Smelter remediation site, subject to approval by USEPA Region 10.

Exhibits

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

TARGET SHEET

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Site Name: EVSSF

ES-FDR-1
SOURCE MATERIAL
SAMPLE LOCATION MAP

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ES-FDR-2
ARSENIC PROFILE CROSS SECTIONS
A-A', B-B', C-C', D-D'

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ES-FDR-3
ARSENIC PROFILE CROSS SECTIONS
E-E', F-F', G-G', H-H'

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REGION 10
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Site Name: EVSSF

ES-FDR-4
ARSENIC PROFILE CROSS SECTIONS
I-I', J-J', K-K' AND SOURCE MATERIAL
CROSS SECTION LOCATIONS