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URS

SAMPLING AND ANALYSIS PLAN/QUALITY ASSURANCE PROJECT PLAN MARALCO RESTORATION PROJECT
7730 SOUTH 202ND STREET
KENT, WASHINGTON

For

BROWN DOG, LLC
URS JOB NO.: 33757742
September 9, 2005

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SAMPLING AND ANALYSIS PLAN/ QUALITY ASSURANCE PROJECT PLAN

MARALCO RESTORATION PROJECT
KENT, WASHINGTON

	Approval	Date
Project Manager (URS)	James H. Flynn	9/9/05
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ABBREVIATIONS AND ACRONYMS

Brown Dog	Brown Dog LLC
CADD	computer assisted drawing and design
CAP	cleanup action plan
CLP	Contract Laboratory Program
COC	chain of custody
DQO	data quality objective
E & E	Ecology & Environment, Inc.
Ecology	Washington State Department of Ecology
EMR	Environmental Management Resources
EPA	U.S. Environmental Protection Agency
GPS	global positioning system
HASM	Health and Safety Manager
HDPE	high-density polyethylene
HSP	health and safety plan
KBI	Kawecki-Berylco, Inc.
LEL	lower explosive limit
Maralco	Maralco Aluminum Company, Inc.
MKE	Morrison-Knudsen Environmental Services
mg/kg	milligram per kilogram
mg/l	milligrams per liter
mol	mole
MS/MSD	matrix spike/matrix spike duplicate
Nautilus	Nautilus Environmental
NCA	North Creek Analytical
PM	Project Manager
QA	quality assurance
QAM	Quality Assurance Manager
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RPD	relative percent difference
SAP	sampling and analysis plan
SOP	standard operating procedure
SRM	standard reference materials
TCLP	toxicity characteristic leaching procedure
URS	URS Corporation
UST	Underground Storage Tank

1.0 PROJECT MANAGEMENT

1.1 INTRODUCTION

This document constitutes the plan for collecting samples from the aluminum dross stockpile and conducting laboratory analyses for waste determination purposes at the former Maralco Aluminum Company, Inc. site (the "site"), located at 7730 South 202nd Street in Kent, Washington (Figure 1). This plan describes the project team organization, field activities, analytical laboratory tests, data analysis methods, and decision-making process developed to complete the waste determination study. The data developed in this study will be used to help evaluate disposal options and costs for the dross stockpile. URS Corporation (URS) has prepared this Sampling and Analysis Plan (SAP) on behalf of Brown Dog Investments, LLC (Brown Dog). Brown Dog is consulting with the Washington State Department of Ecology (Ecology) to investigate, remediate, and monitor site conditions. This plan has been prepared in accordance with the guidelines described Ecology's *Guidelines for Preparing Quality assurance Project Plans* (Ecology 2004a).

The volume of aluminum dross stockpile is approximately 20,000 cubic yards. This stockpile was left on the site following cessation of plant operations during the bankruptcy proceedings of Maralco Aluminum Company, Inc. which began in 1983. Based on a limited number of analyses of the dross completed in 1987 and 1991 (Ecology & Environment, 1986; MKE, 1991a) on behalf of Ecology, the dross stockpile is considered to be a book-designated, state-only dangerous waste. The sampling and analysis program described in this plan will collect and analyze a more extensive number of samples to determine which portions of the pile, if any, currently exhibit dangerous waste characteristics.

1.2 PROJECT ORGANIZATION

Key URS positions and personnel assigned to this project are described in this section. URS personnel and contractor contact information is presented in Table 1-1.

1.2.1 URS Project Manager

The URS PM has overall responsibility for implementing the project activities and monitoring the project progress. The URS PM is responsible for planning, scheduling, cost control, and completion of project tasks. The URS PM also has overall responsibility for developing and implementing this management plan, monitoring the quality of the technical and managerial aspects of the project, interfacing with Ecology, and ensuring the timeliness of all project deliverables.

1.2.2 URS Quality Assurance Manager

The URS Quality Assurance Manager (QAM) for this project is responsible for the quality of all sampling and analysis activities associated with this investigation. The QAM will oversee all aspects of the sampling and analysis events to ensure that the appropriate procedures and methods are used to meet the quality assurance (QA) objectives of the program.

1.2.3 URS Chemist

The URS Chemist will be responsible for laboratory oversight and will direct the quality review of analytical data. The URS Chemist will work closely with the subcontracted laboratories and will serve as the point of contact for any technical questions from the laboratories.

1.2.4 URS Geologist

The URS Geologist is responsible for the overall performance of field operations, including adherence to this plan, scheduling, liaison with URS subcontractors, and sample logging and custody. The URS Geologist will function as the Site Safety Officer and will be responsible for the safe operation of the field team. The URS Geologist will be responsible for the implementation of the health and safety plan (HSP), review its contents with all personnel, confirm that all personnel have received the required health and safety training, determine personal protection levels, provide necessary personal protective equipment and supplies, and correct any unsafe work practices.

1.2.5 URS Health and Safety Manager

The Health and Safety Manager (HASM) will prepare the HSP for all field activities performed for this limited investigation. The HASM will work directly with the URS PM and will be responsible for monitoring and verifying that the work is performed in accordance with the HSP. The HASM will advise the URS PM regarding health and safety issues but will function independently.

1.2.6 Contractor Services

Laboratory services will be provided under subcontract to URS by North Creek Analytical (NCA) of Bothell, Washington; Nautilus Environmental (Nautilus) of Fife, Washington; and Bio Research of Redmond, Washington. NCA will be performing the chemical analyses of dross samples for total metals, toxicity characteristic leaching procedure (TCLP) metals, ammonia, chloride, ignitability, pH, and total cyanide/total sulfide. Nautilus will be performing fish bioassay testing on selected dross samples and Bio Research will be performing rat bioassay testing on selected dross samples. ESN Northwest of Lacey, Washington will be subcontracted to provide drilling services.

1.3 PROJECT BACKGROUND

Maralco Aluminum Company, Inc. (Maralco) operated an aluminum recycling/refinery facility at the site from 1980 to 1986 (EMR, 2003b). The recycling/refinery operations took place in a concrete building at the site. The recycling process used by Maralco produced aluminum alloy from recycled aluminum cans, Kawecki-Berylco, Inc. (KBI) dross, and scrap metal utilizing the molten salt aluminum smelting process. The wastes created from this process include black dross and particulate matter that was collected in baghouses located in the southwest corner of the warehouse. Black dross is a by-product of the aluminum refining process and is typically a gray fine-grained granular material. During its early operations at the site beginning in 1980, the waste materials were shipped off-site to a landfill. After 1981, the materials were stored east of the smelter building. Maralco attempted a "treatment by generator" process of washing the salt from the dross, resulting in a pile of "washed aluminum oxide" comprising part of the north portion of the pile east of the building. Maralco filed for bankruptcy in 1983 and ceased their operations in November 1986. In February 1986, Ecology received a complaint from the Metro Industrial Wastewater Section concerning leachate from the dross piles that was potentially entering the drainage systems surrounding the site. Ecology began investigations at the site in March 1986; Dangerous Waste and Water Quality enforcement actions including Enforcement Orders and Notices of Penalty were issued, but were never complied with by Maralco at the site due to the bankruptcy. Ecology obtained a secured interest in the property and filed a lien on the property, which was recognized by the Bankruptcy Court in 1988.

Several phases of soil and groundwater investigation have been conducted at the site since 1987 to assess the extent and effects of aluminum black dross, baghouse dust, chromium-containing dross, and a former underground storage tank (UST) at the site. The previous investigations and remedial actions on the property have been summarized in reports prepared by Ecology & Environment (E&E) (1987), MK-Environmental Services (MKE) (1991a, b), Enviros (1995), URS (2000) and EMR (2003a, b). Identified known and potential contaminants include metals, salts, ammonia, and petroleum hydrocarbons.

In the fall of 1988 interim remedial actions were taken at the site including installing a storm drain line to conduct stormwater from the cedar processing facility south of Maralco to a catchbasin on site, and lining the stream channel from the catchbasin to South 202nd Street. Silt fence was also installed between the dross piles and the drainage channel.

In September 1991, a second set of interim remedial activities were performed at the site by Morrison Knudsen on behalf of Ecology in accordance with a work plan prepared for Ecology (Morrison Knudsen, 1991). The interim actions consisted of five activities: fencing the site, improvement of a stormwater collection pond, rerouting of roof drains, grading the area surrounding the warehouse building, and tarping the black dross piles. The dross piles were graded to prevent ponding of stormwater on their surface, and the piles were covered with 5-mil plastic tarpaulins.

The dross stockpile is located east and south of the warehouse building exterior (Figure 1-2). A small pile of dross placed on the northeast quadrant of the property east of the former residence on the property was moved to the area east of the smelter building during the 1988 interim action. Based on prior volume calculations, the dross stockpile is estimated to be approximately 20,000 cubic yards in volume (MKE, 1991b). The stockpile ranges in height from less than 10 feet to up to 25 feet. A portion of the northern end of the stockpile also consists of washed oxides (primarily aluminum oxide), which were produced when water-soluble components of the dross (typically salts) were removed from the dross as part of re-processing.

As part of the proposed property redevelopment, URS completed a draft Cleanup Action Plan (CAP) to address the dross and affected soil, sediment and groundwater at the site (URS, 2004). The CAP presented a summary of investigations and data conducted to date at the site, discussed data gaps with respect to the dross and other wastes at the site, and described the scope of work and rationale for a Supplemental Remedial Investigation (RI) at the site that is focused to address data gaps that relate directly to implementation of the selected remedy.

This SAP provides a scope of work to characterize the dross stockpile at the site for disposal as part of the CAP.

1.4 PROBLEM FORMULATION

Previous characterization sampling at the dross pile has consisted primarily of collection of surface samples and near-surface samples in the pile, as summarized in the draft CAP (URS, 2004). Because of the potential for weathering, leaching and degradation during the years of waste storage at the site and potential variability of waste characteristics due to process variations, variability in waste characteristics such as leaching characteristics, and metals and salt content throughout the pile, representative sampling throughout the pile will be completed to better characterize the pile. This data gap needs to be addressed prior to removal of the dross from the property in order to determine legal and appropriate disposal of the waste, and to receive approval for selected disposal option(s) for the wastes. The dross has been book-designated as a Dangerous Waste by Ecology based on oral rat toxicity (Ecology, 2004b). Based upon this designation and previous characterization sampling, the dross pile will be further characterized by analyses for selected total and leachable metals, ammonia, and rat and fish toxicity, as described in this SAP document. The sampling and analysis objective will be to 1) confirm or refute this book-designation as a Dangerous Waste and 2) provide data needed to receive approval for landfill disposal of the black dross and washed aluminum oxides if appropriate. This SAP details the field and laboratory protocol to be followed to characterize the dross and make a determination regarding the dross waste characterization.

1.5 PROJECT DESCRIPTION AND SCHEDULE

The SAP consists of four tasks, as summarized below

1.5.1 Task 1 – Sampling and Analysis Plan Development

This plan provides the detailed protocols to be followed during Tasks 2, 3, and 4. This plan will provide sufficient detail to the field crew and laboratory to generate data sufficient to characterize the dross pile and make a determination regarding the waste designation.

1.5.2 Task 2 – Sample Collection

The objective of the sample collection will be to collect samples from equivalent volumes (cells/decision units) throughout the stockpile, both laterally and vertically. Prior to sampling, the stockpile will be subdivided into approximately equal volumes and sample locations will be established. Representative samples of the dross decision unit will be collected using direct-push methodology at the established sample locations.

These samples will be collected in general accordance with standard field sampling protocols (Section 2.2). The samples will be submitted to the analytical laboratories for chemical and/or biological analysis.

1.5.3 Task 3 – Laboratory Analysis

Task 3 includes the laboratory analysis of dross samples by chemical and/or biological test methods. Dross samples will be analyzed for chemical characteristics to determine whether constituents are present at sufficient concentrations to support or refute book designation as Dangerous Waste. Samples which have sufficiently elevated concentrations of total metals, salts, or ammonia to trigger book designation may then be tested using fish bioassay and/or rat bioassay test methods necessary to evaluate the characteristic as determined by WAC 173-303 and Ecology. Samples will also be tested for TCLP metals to assess that characterization criterion. In addition to the chemical and biological analyses specified above associated with Dangerous Waste designation, dross samples will be analyzed for the Dangerous Waste characteristics of ignitability, corrosivity, and reactivity for assessment of waste acceptability at the potential disposal facility.

1.5.4 Task 4 – Reporting

The reporting task involves two components: data evaluation and reporting. Data evaluation will include the review (validation) of the initial analytical data, the preparation of summary tables, and calculations associated with Dangerous Waste book designation (e.g., salt content and toxicity equivalent concentrations). After the initial analytical data has been evaluated, a proposal will be made regarding the specific numbers and locations of samples for biological or other testing, if any, or any additional sampling to be performed to further delineate the boundaries of any quantity of waste that designates. This information will be presented to Ecology in an interim report and these decisions will be made with Ecology's approval. Upon completion of all analyses, a final report will be generated documenting site conditions, sample locations, analytical results, and conclusions.

1.6 PROJECT OBJECTIVES AND DECISION CRITERIA

This section establishes the project objectives and performance criteria for this investigation. EPA's Data Quality Objective (DQO) Process (USEPA 2000), a systematic procedure for planning data collection activities, was used to determine type, quality, and quantity of data that will be collected to satisfy the data user's needs. DQOs define quantitative and qualitative criteria for determining when, where, and how many samples (measurements) to collect and a desired level of confidence. The DQO process for this project is presented in this section.

1.6.1 Problem Statement

Current information is insufficient to reliably determine the waste characteristics of the dross stockpile. The results of this investigation will be used to confirm or refute the Dangerous Waste book-designation of the stockpile. The objectives of this investigation are to obtain quantitative information on metals and salt concentrations throughout the stockpile, evaluate the concentrations with respect to Dangerous Waste criteria, and perform a secondary round of bioassay analyses, if necessary, to further evaluate the stockpile. These data will be used to confirm or refute the Dangerous Waste book-designation and evaluate options for disposal of the stockpile.

1.6.2 Investigation Decisions and Needed Input to Those Decisions

The data generated by this investigation will be used to determine which portions (if any) of the dross stockpile require management as Dangerous Waste based on current waste characteristics. This investigation will also provide necessary data to verify that the dross will meet the waste acceptance criteria for the potential disposal facility (Roosevelt Regional Landfill in Klickitat County, Washington). The data necessary to make these determinations include: 1) measured concentrations of total metals (copper, nickel, and zinc), ammonia, and estimated concentrations of salt based on potassium, sodium, and chloride analyses, 2) TCLP concentrations for Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), 3) ignitability, 4) corrosivity (pH), and 5) reactivity (cyanide/ sulfide) characteristics.

Samples collected to meet landfill acceptance criteria are analyzed according to the requirements of the Roosevelt Regional Landfill and are not part of the hazardous waste characterization sampling program subject to Ecology's approval. These include the samples for ignitability, corrosivity, and reactivity.

1.6.3 Study Boundaries

For the purpose of this SAP, the study boundaries of this project will consist of the limits of the aluminum dross stockpile located to the east and south exterior of the smelter (currently being used as a warehouse) building on the site (Figure 1-2). This SAP will not include soil, sediment, or groundwater sampling, or evaluation of the wastes stored within the site warehouse.

1.6.4 Decision Rules

Data generated during this sampling and analysis program will be used to confirm or refute book designation of the dross material as Dangerous Waste on a decision unit basis and determine if the waste designates for TCLP metals or other parameters. The data generated will be sufficient to perform the toxicity equivalence calculations (EC) for book designation based on metals (copper, nickel, and zinc), ammonia, and salt content of the dross and determine if the waste fails the TCLP. If based on the equivalency calculation, a samples does not book-designate then the dross in that decision unit would not be a dangerous waste and no further testing of that decision unit would be needed.

If the dross in one or more decision units book-designates as Dangerous Waste based on the toxicity equivalence calculations, bioassay testing may be performed on dross samples from the decision units that book designate. If the analytical results appear to be homogenous, URS may request the approval from Ecology to composite samples prior to analysis by bioassay testing. A fish bioassay will be performed on the chosen samples if the dross book designated and most or all of the toxicity data used to calculate the EC toxicity came from Fish Toxicity data. A rat bioassay will be performed if the dross book designated and most or all of the toxicity data used to calculate the EC toxicity came from Oral Rat Data. If the sample(s) pass the bioassay testing, the bioassay results would refute the book-designation and the dross within the decision unit would not be considered a dangerous waste and no further testing of that decision unit would be needed. If the sample(s) fail the bioassay testing, then the decision unit would be considered a dangerous waste.

TCLP results will be compared to the toxicity characteristics list (WAC 173-303-090(8)(c)). If the sample contains contaminants at concentrations at or above the dangerous waste threshold, the dross in the decision unit would be considered a dangerous waste.

In the event that dross in an individual decision is designated as a dangerous waste based on the bioassay and/or TCLP results, testing of additional samples from individual decision units could then be performed to determine whether or not the entire decision unit is a dangerous waste, and/or the extent of waste with that/those Dangerous Waste characteristic(s).

In the event that field observations, field screening, or laboratory analyses indicate that the dross may exhibit dangerous waste characteristics based on other parameters (e.g., sulfide gas generation, ignitability), the analytical program may require modification to assess whether those parameters could change the Dangerous Waste determination for the decision unit(s). The Dangerous Waste determination based on unexpected characteristics, if necessary, would be performed consistent with the approach and criteria described in WAC 173-303. If the analytical program needs to be modified, the changes will be discussed with Ecology and agreed to jointly prior to modification of the program.

1.6.5 Limits on Decision Errors

Since analytical data can provide only an estimate of the true mean concentrations in the dross samples, decisions that are based on such data could potentially be in error. Sources of error include sampling error and measurement error. Sampling error occurs because the sampling program is unable to capture the complete extent of natural variability that exists in the stockpile. Measurement error occurs because analytical methods and instruments are not absolutely perfect. Typically, more error is introduced during the planning and sampling stage of an investigation than in the measurement stage of an investigation. The data collection design of this investigation was developed to reduce to a tolerable level the chance of making an incorrect decision.

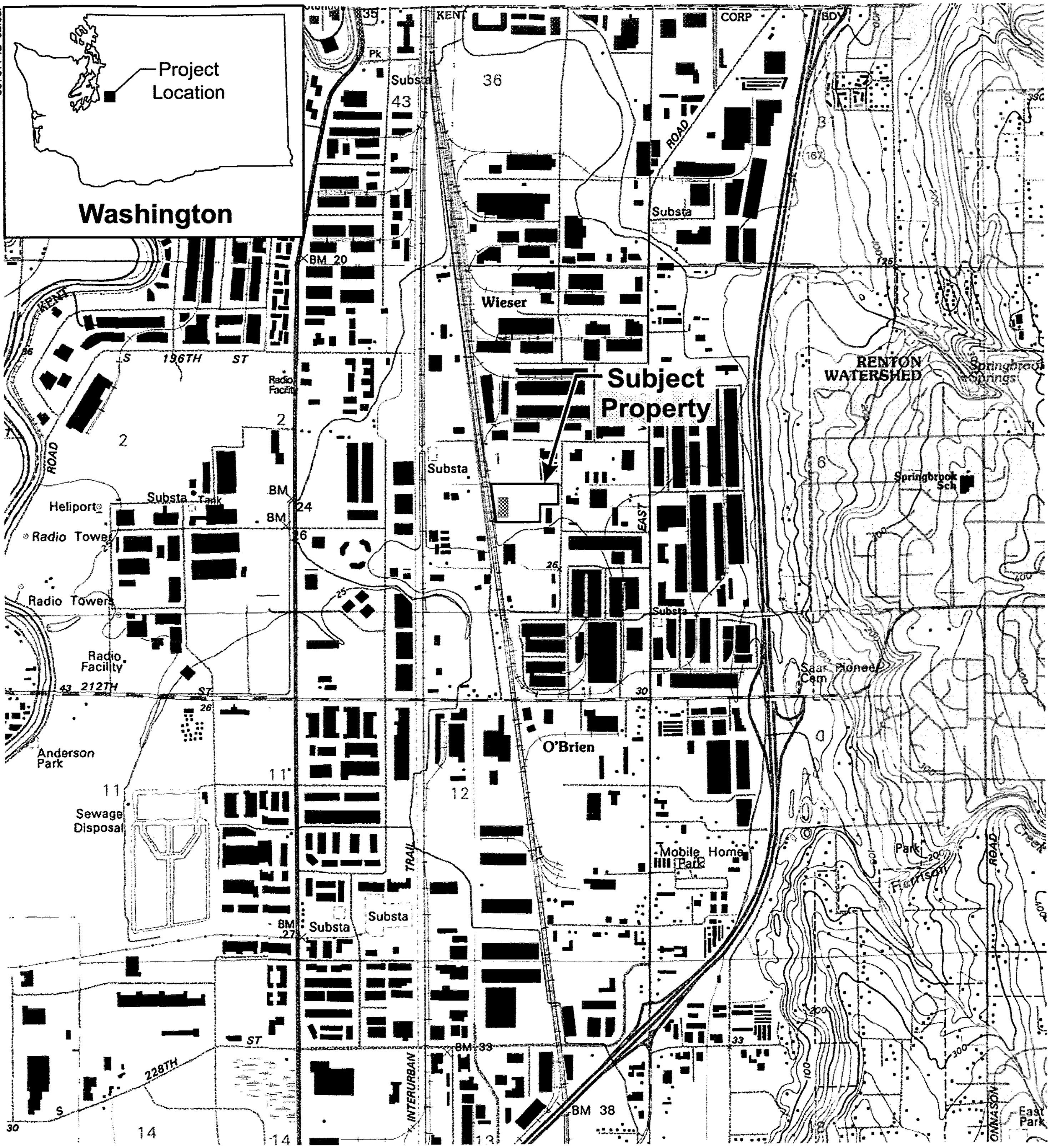
Decisions that will be made based on data collected during this investigation are:

- The portions, if any, of the dross stockpile require management as a Dangerous Waste.
- Whether the dross meet the waste acceptance criteria for the disposal facility.

The number of discrete decision units to be sampled and analyzed is based on standard practice, the sampling guidelines established in Ecology's Guidelines for the Remediation of Petroleum Contaminated Soil (Ecology 1995), and the end use of the data. The number of composite samples for analysis for ignitability, corrosivity, and reactivity was selected based on the waste acceptance criteria for the proposed disposal facility (Roosevelt Regional Landfill in Klickitat County, Washington). Numbers of quality control (QC) samples were selected based on typical QA requirements (e.g. at least one duplicate per each batch or per 20 samples).

1.6.6 Optimization of Sampling Design for Data Collection

During development of the investigation design, different sampling and analysis methods were evaluated and the most resource-effective design that satisfies the project objectives was selected. The idea is to balance costs with an acceptable level of quality at an acceptable potential decision error rate. Based on these criteria, and the existing data at the site, 44 discrete decision units have been established on the stockpile representing approximately equivalent volumes of material. The analytical methods and the selected analytical laboratory are expected to yield high-quality data with adequate documentation to support waste designation and investigation conclusions.



Map created with TOPO!™ © 1997 Wildflower Productions, www.topo.com, based on USGS topographic map

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Figure 1-1
Site Location

URS

Former Maralco Aluminum Site
Kent, Washington

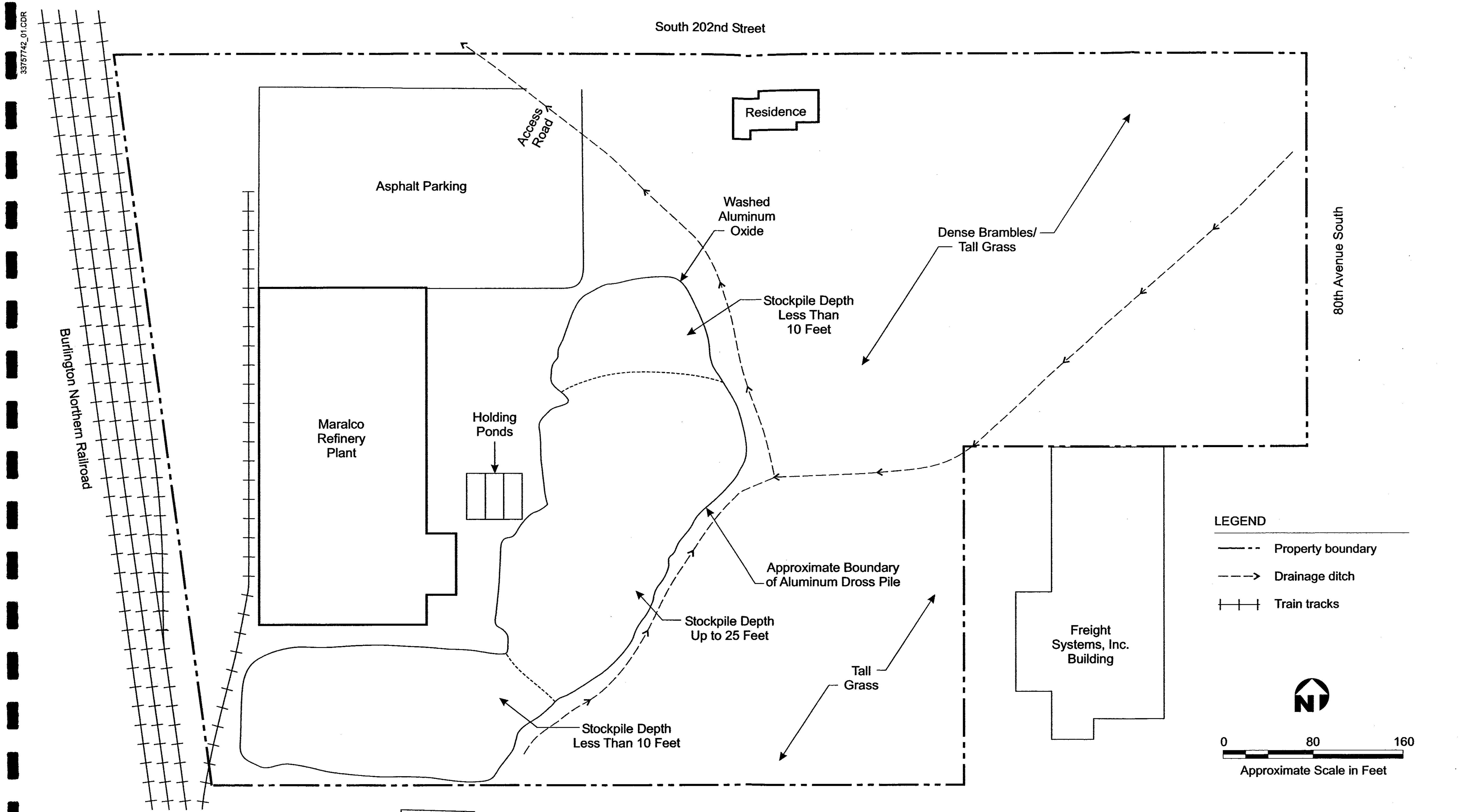

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Figure 1-2
Site Plan

URS

Former Maralco Aluminum Site
Kent, Washington

Table 1-1
Project Contacts

Key Role	Name	Telephone Number
Ecology TCP Case Manager	Norm Peck	(425) 649-7000
Ecology Hazardous Waste Compliance	Victoria Sutton	(425) 649-7000
Brown Dog LLC Project Manager	Dale Frank	(206) 275-4130
URS Project Manager	James Flynn	(206) 438-2113
URS Geologist/Site Safety Officer	Vance Atkins	(206) 438-2012
URS QA Manager	Vance Atkins	(206) 438-2012
URS Chemist	Jennifer Garner	(206) 438-2063
URS H&S Manager	Gail Gislason	(206) 438-2120

2.0 DATA GENERATION AND ACQUISITION

This section describes the field and laboratory activities that will be performed to collect the data necessary to support the project objectives.

2.1 FIELD SAMPLING DESIGN

This sampling and analysis design includes the following components:

- Conduct a survey of the stockpile and prepare a sampling grid to establish sampling locations that will represent equivalent volumes (decision units) throughout the stockpile.
- Collection of representative dross samples from the each of the 44 decision units throughout the stockpile utilizing a direct-push drilling rig (Table 2-1).
- Field screening of dross samples and sampling locations for generation of gasses such as ammonia and methane and potential worker exposure purposes.
- Chemical and bioassay analyses of the dross samples for Dangerous Waste characterization and disposal facility waste acceptance criteria purposes (Table 2-1).

Based on the configuration of the pile and the locations of the previously collected samples, 17 boring locations are proposed throughout the pile as shown on Figure 2-1. URS will collect samples at selected depth intervals throughout the borings for laboratory analyses. Two to three samples will be collected at each boring location (Figure 2-2). At locations where the stockpile is generally less than 15 feet thick, shallow and deep samples will be collected. In the thickest portion of the stockpile, samples will be collected from shallow, intermediate (or middle) and deep intervals. The discrete sample locations and approximate depths are summarized on Table 2-2. During the sampling activities, discrete dross samples will be field screened for reactivity by wetting the dross material and monitoring for generation of ammonia, phosphine, methane, hydrogen sulfide and other gasses using a Draeger tube sampler (or equivalent) and a 4-gas meter.

2.2 FIELD METHODS

Field tasks include the following:

- **Stockpile Survey and Sampling Location Definition**: to be performed prior to field sampling in order to establish boring locations based on stockpile volume and height.

- **Collection of Dross Samples for Laboratory Analysis**: Dross samples will be collected from borings distributed across the stockpile utilizing direct-push methodologies. These samples will be shipped directly to the contracted laboratories for analysis of selected metals (copper, nickel, and zinc), common salt ions (potassium, sodium, and chloride), TCLP metals, ammonia, and/or bioassay analyses. The samples will also be field-screened for the presence of ammonia, phosphine, hydrogen sulfide and methane.

2.2.1 Stockpile Survey and Sampling Location Definition Method

Based on prior volume calculations, the dross stockpile is estimated to be approximately 20,000 cubic yards in volume (MKE, 1991b). The stockpile ranges in height from less than 10 feet to up to 25 feet. In order to evaluate equivalent volumes of the stockpile, the stockpile will be divided into a grid of 17 divisions (Figure 2-1). These divisions are of approximately equal area, and were calculated utilizing a recent 2002 aerial photograph and computer-aided drafting (CAD) methodologies. URS personnel will conduct a site visit and establish the grid locations on the stockpile using global positioning system (GPS), hand level, and other methods.

The grid locations will be subdivided vertically into decision units. The decision units are intended to represent both lateral and vertical distributions within the stockpile (Figure 2-2). The sample locations will be subdivided vertically throughout the sample volumes. Where the stockpile is less than 15 feet in height, samples will be collected from 'shallow' and 'deep' depths, as presented on Table 2-2. Where the stockpile is greater than 15 feet in height, samples will be collected from 'shallow,' 'middle,' and 'deep' depths, as presented on Table 2-2. Samples will be taken as a core through the column of each decision unit at the midpoint. Each sample volume will be representative of a volume of approximately 450 cubic yards. The boring locations for the sample collection will be located within the grid such that a sufficient thickness of dross is available to drive at least a four-foot long sampler and to assure that a representative volume of material is collected (Figure 2-2). The sample locations will be selected to ensure that limited-access (e.g. tractor-mounted) direct-push drilling equipment can safely access the location.

2.2.2 Dross Sample Collection Method

Aluminum dross samples will be collected for two purposes:

- Field screening
- Laboratory analyses

The borings will be completed at the determined boring locations (Figure 2-1) to the base of the dross stockpile (up to 25 feet below the stockpile surface) and into underlying soils to confirm the stockpile thickness and composition using direct-push drilling methods (GeoProbe or equivalent). The borings will be completed by a Washington-licensed driller and will be overseen by a URS Geologist.

The borings will be sampled continuously for lithologic logging. Observations will be recorded on a standardized boring log. Sample observations will include: sampling interval identification, time sample was collected, description of stockpile material, depth, and amount of recovery. Descriptions of the stockpile material will include texture, color, moisture content, and odor. Specific attention will be paid to record variations within the stockpile.

Samples will be collected with a 'macro-core' split-barrel sampler, which is approximately 4 feet long by 1- ½ inches in diameter. The sampler will be lined with a high-density polyethylene (HDPE) or acetate liner. In order to assure that the samples have been collected accurately from each decision unit and thus account for any sloughing of waste between units, a piston-type sampler will be utilized to collect depth-discrete samples. Because of the required sample volume for the multiple analyses at each sampling location (approximately 42 ounces, Table 2-3), multiple borings at each sampling location may be required to be completed in order to collect an adequate sample volume for both scheduled analyses and contingency analyses. If recovery is not sufficient, multiple samples from equivalent depths will be homogenized in a dedicated or lined stainless steel bowl prior to filling laboratory sample jars. The sample volume will be mixed thoroughly, and then the samples collected. Collection of a column sample in this manner will better represent the entire decision unit, rather than sampling a single point. The sample will be transferred from the sampler to laboratory sample containers with a dedicated disposable scoop.

Sample volumes required for composite (disposal facility waste characterization) samples will consist of samples collected from adjacent decision units. A supplemental sample volume will be collected at each discrete sampling location. URS will specify the discrete samples for compositing and direct the analytical laboratory to composite 6 to 7 applicable discrete samples per composite sample prior to analysis as outlined on Table 2-2, unless field observations indicate significant heterogeneity.

A portion of the dross will be field screened for reactivity by wetting the dross material in a 'zip-lock' plastic bag. The bag will be sealed and the sample will be screened using headspace methodology for generation of ammonia and phosphine using a Draeger tube sampler (or equivalent) and for hydrogen sulfide and combustible gasses (methane) using a 4-gas meter. Observations will be recorded on a standardized form, and will include sampling interval identification, time sample was collected and columns for the specific gas readings.

2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

This section describes the procedures to be used during sampling to ensure that dross samples are collected, packaged, shipped, and maintained under proper chain of custody.

2.3.1 Sample Containers, Preservation, and Holding Times

Sample containers, preservation requirements, and holding times are listed in Table 2-3.

2.3.2 Equipment Decontamination

Field decontamination of sampling equipment is not expected to be required because the dedicated, disposable equipment will be used for collecting samples at each sample location and depth. Accordingly, equipment rinsate samples will not be collected. In the event that site conditions require the use of non-dedicated sampling equipment (such as a shovel or a hand auger) the equipment will be thoroughly washed with a solution of phosphate-free, laboratory-grade detergent (Liquinox) and distilled water, and rinsed with distilled water before use at each location. Decontamination water will be accumulated in a 55-gallon drum and stored on site.

2.3.3 Chain of Custody Protocol

Dross samples for chemical analyses will be placed in coolers with blue or water ice for shipment to the analytical laboratories. Individual sample containers will be wrapped with bubble wrap to prevent breakage during transport and a signed chain of custody will accompany each cooler. Coolers will be sealed with signed custody seal.

2.4 ANALYTICAL METHODS

This section describes the analytical procedures to be used for laboratory measurements. The analytical methods and associated QA/quality control (QC) procedures were selected based on consideration of the project objectives. The analytical methods, calibration procedures, and QC measurements and criteria are based on current analytical protocols and/or laboratory-specific SOPs. Laboratory QA will be implemented and maintained as described in this plan and according to the laboratory's QA plans and SOPs. QC samples are described in Section 2.5 of this plan. Analytical method target analytes, routine reporting limits, and quality control criteria are listed in Table 2-5.

The methods selected are sufficient to meet the project objectives. While a best effort will be made to achieve the project objectives, there may be cases in which it is not possible to meet the specified goals. Any limitation in data quality due to analytical problems (e.g., elevated reporting limits) will be identified by the laboratory and brought to the attention of the URS Quality Assurance Manager. In addition, this information will be discussed in the data evaluation report.

Dross samples will be analyzed for purposes of Dangerous Waste designation and disposal facility acceptance criteria. The following analyses may be performed on discrete dross samples for the purpose of Dangerous Waste designation:

- Total metals (sodium, copper, nickel, potassium, zinc) (EPA 6000 series)
- Ammonia (EPA 350.3)
- Chloride (EPA 300.0)
- TCLP metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver) (EPA 1311 & EPA 6000/7000 series)
- Rat bioassay (5,000 mg/kg body weight) (Ecology 80-12) (dependent upon sodium, potassium, and chloride results)
- Fish bioassay (100mg/l 96-hr. static acute fish bioassay test conducted with rainbow trout (*Oncorhynchus mykis)* (Ecology 80-12) (dependent upon copper, nickel, zinc, and ammonia results)

The following analyses will be performed on the composited dross samples for the purpose of satisfying disposal facility waste acceptance criteria:

- Ignitability (EPA 1030)
- Total cyanide (EPA 9010B Mod)
- Total sulfide(EPA 9030B)
- pH (EPA 9045C)

In addition to the laboratory analyses described above, field screening will be performed during the dross sampling activities. The following types of field screening will be performed:

- Ammonia (Draeger tube)
- Phosphine (Draeger tube)
- Hydrogen sulfide (4-gas meter)
- Methane, as lower explosive limit (LEL) (4-gas meter)
- Oxygen (4-gas meter)
- Carbon monoxide (4-gas meter)

2.5 QUALITY CONTROL

This section describes the QC samples (e.g., field duplicates and matrix spikes), data quality indicators, and associated measurement quality objectives (e.g., precision and accuracy goals).

2.5.1 Quality Control Samples

Field QC and laboratory QC samples will be employed to evaluate data quality (data quality indicators). QC samples are controlled samples introduced into the analysis stream whose results are used to review data quality and to calculate the accuracy and precision of the chemical analysis program. The purpose of each type of QC sample, collection and analysis frequency, and evaluation criteria are described in this section. Collection and analysis frequency for field

QC samples are summarized in Table 2-4. Quality control criteria for laboratory analyses (measurement quality objectives) are listed in Table 2-5.

QC procedures for the laboratory analyses will be consistent with the requirements described in the laboratories' protocols and methods. These requirements are defined in SOPs as part of the laboratory's QA program plan. All QC measurements and data assessment for this project will be conducted on samples from and within batches of samples from this project alone; in other words, no "other project" samples will be used with samples from this project for assessment of data quality.

Field Quality Control Samples

Replicate Sample Analysis. Field QC checks are accomplished through the analysis of controlled samples that are introduced to the laboratory from the field. Given that 44 discrete dross samples are being submitted from the field for analysis, 3 field duplicate dross samples will be collected from separate geographic locations and submitted for analysis. The field duplicate sample locations will be field-determined and recorded in the field logbook. Field duplicates will be collected immediately following the collection of primary samples.

Matrix Spike/Matrix Spike Duplicates. MS/MSDs are used to assess sample matrix interferences and analytical errors, as well as to measure the accuracy and precision of the analysis. Three MS/MSD samples will be analyzed for each analytical method associated with the discrete dross sample analysis and one MS will be analyzed, as appropriate, for the analytical methods associated with the composite sample analysis. In the laboratory, known concentrations of analytes are added to environmental samples; the MS or MSD is then processed through the entire analytical procedure and the recovery of the analytes calculated. Results are expressed as percent recovery of the known spiked amount (and relative percent difference [RPD] for MS/MSD pairs).

Laboratory Quality Control Samples

Laboratory QC checks are accomplished by analyzing initial and continuing calibration samples, method blanks, standard reference materials (SRMs), and laboratory duplicate samples. Not all of these QC samples will be required for all methods. Method-specific QC samples are described in the laboratory SOPs.

Initial and Continuing Calibration Samples. Laboratory instrument calibration requirements are summarized in the laboratory SOPs.

Method Blanks. Method blanks are used to check for laboratory contamination and instrument bias. Laboratory method blanks will be analyzed at a minimum of one per analytical batch for all chemical parameter groups.

QC criteria require that no contaminants be detected in the blank(s) above the method quantitation limit. If a chemical is detected, the action taken will follow the laboratory SOPs. Blank samples will be analyzed for the same parameters as the associated field samples.

Standard Reference Materials. SRMs are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects. The SRMs are extracted and analyzed with each batch of samples. Results are compared on a per-batch basis to established control limits and are used to evaluate laboratory performance for precision and accuracy. Laboratory control samples may also be used to identify any background interference or contamination of the analytical system that may lead to the reporting of elevated concentration levels or false-positive measurements.

Laboratory Duplicate Samples. Precision of the analytical system is evaluated by using laboratory duplicates. Laboratory duplicates are two portions of a single homogeneous sample analyzed for the same parameter as applicable per the laboratory SOPs.

2.5.2 Analytical Data Quality Indicators

Project-specific control limits (measurement quality objectives) for these parameters are presented in Table 2-5.

Precision

Precision is defined as the degree of agreement between or among independent, similar, or repeated measures. Precision is expressed in terms of analytical variability. For this project, analytical variability will be measured as the RPD or coefficient of variation between analytical laboratory duplicates and between the MS and MSD analyses. Monitoring variability will be measured by analysis of blind field duplicate samples.

Precision will be calculated as the RPD as follows:

$$\%RPD_i = \frac{2|O_i - D_i|}{(O_i + D_i)} \times 100\%$$

where:

$\%RPD_i$	=	relative percent difference for compound *i*
O_i	=	value of compound *i* in original sample
D_i	=	value of compound *i* in duplicate sample

The resultant RPD will be compared to acceptance criteria, and deviations from specified limits will be reported. If the objective criteria are not met, the laboratory will supply a justification of why the acceptability limits were exceeded and implement the appropriate corrective actions.

The RPD will be reviewed during data quality review, and deviations from the specified limits will be noted and the effect on reported data commented upon by the data reviewer.

Accuracy

Accuracy is the amount of agreement between a measured value and the true value. It will be measured as the percent recovery of MS/MSD, and standard reference samples. Additional potential bias will be quantitated by the analysis of blank samples (e.g., method blanks).

Accuracy will be calculated as percent recovery of analytes as follows:

$$\%R_i = (Y_i \div X_i) \times 100\%$$

where:

$\%R_i$	=	percent recovery for compound *i*
Y_i	=	measured analyte concentration in sample *i* (measured concentration minus original sample concentration)
X_i	=	known analyte concentration in sample *i*

The resultant percent recoveries will be compared to acceptance criteria and deviations from specified limits will be reported. If the objective criteria are not met, the laboratory will supply a justification of why the acceptability limits were exceeded and implement the appropriate corrective actions. Percent recoveries will be reviewed during data quality review, and deviations from the specified limits will be noted and the effect on reported data commented upon by the data reviewer.

Representativeness

Representativeness is the degree to which sample results represent the system under study. This component is generally considered during the design phase of a program. This program will use the results of all analyses to evaluate the data in terms of their intended use.

Comparability

Comparability is the degree to which data from one study can be compared with data from other similar studies, reference values (such as background), reference materials, and screening values. This goal will be achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units.

Completeness

Completeness for usable data is defined as the percentage of usable data obtained from the total amount of data generated. Because the number of samples that will be collected to measure each parameter exceed that required for the analysis, approximately 100 percent completeness is anticipated. When feasible, the amount of sample collected will be sufficient to reanalyze the sample, should the initial results not meet the QC requirements. Less than 100 percent completeness could result if sufficient chemical contamination exists to require sample dilutions, resulting in an increase in the project-required detection/quantitation limits for some parameters. Sample media can also be sufficiently heterogeneous to prevent the achievement of the specified precision and accuracy criteria. The target goal for completeness will be 98 percent for all data. Completeness for quality data will be 95 percent for each individual analytical method. Quality data are data obtained in a sample batch for which all QC criteria were met. Completeness will be calculated as follows:

$$\%C = \frac{A}{I} \times 100\%$$

where:

%C	=	percent completeness (analytical)
A	=	actual number of samples collected/valid analyses obtained
I	=	intended number of samples/analyses requested

Nonvalid data (i.e., data qualified as "R" [rejected]) will be identified during data validation.

Sensitivity

The sensitivity of the analytical methods (i.e., quantitation limits) identified for this project is sufficient to allow comparison of project results to decision criteria. Analytical method quantitation limits for all requested analytes are listed in Table 2-5.

2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Preventive maintenance for field and laboratory equipment will take two forms: (1) implementing a schedule of preventive maintenance activities to minimize downtime and ensure accuracy of measurement systems, and (2) ensuring a stock of critical spare parts and backup systems and equipment. The preventive maintenance approach for specific pieces of equipment used in sampling and analysis will follow manufacturer specifications and method requirements.

2.7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

Field measurement equipment (4-gas meter) will be calibrated daily based on the manufacturer's instructions. Recalibration will be conducted as necessary if conditions occur which might saturate sensors, instrument alarm conditions indicate that recalibration is needed or conditions specified by the manufacturer under which recalibration is recommended occur. Calibration and frequency of calibration of laboratory instruments will be according to the requirements of each method of analysis. These requirements are listed in the laboratory SOP that describes how each target compound will be measured.

2.8 DATA MANAGEMENT

Analytical laboratory data will be maintained in a central electronic project database. Laboratory data will be submitted in electronic format for direct input into the database. Field measurements will be entered into the URS project database directly from field forms. Data will be submitted to the Ecology Environmental Information Management (EIM) database through the online data submission program.

LEGEND

Decision Unit Lateral Boundary

Approximate Boring Location with Samples From 2 Depth Intervals

Approximate Boring Location with Samples From 3 Depth Intervals

N

0 30 60
SCALE IN FEET

Figure 2-1
Dross Stockpile Decision Units

Job No. 33757742

URS

FILENAME: T:\Misc-Jobs\Maralco\FIG 2-2 STOCKPILE.dwg
EDIT DATE: 05/18/05 AT: 14:14

Former Maralco Aluminum Site
Kent, Washington

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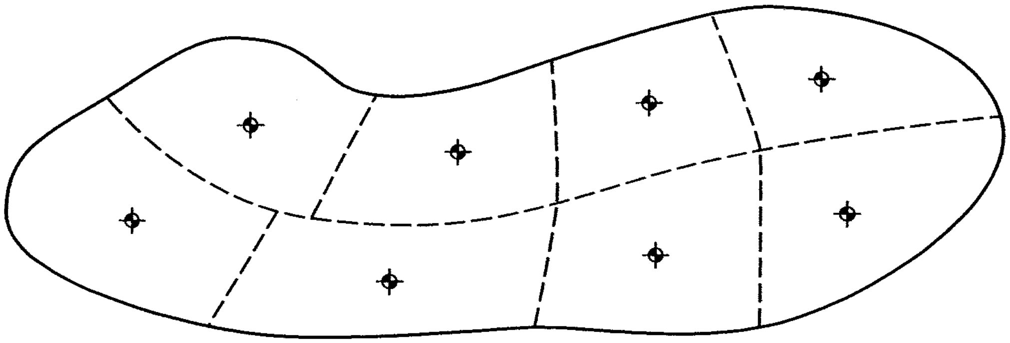
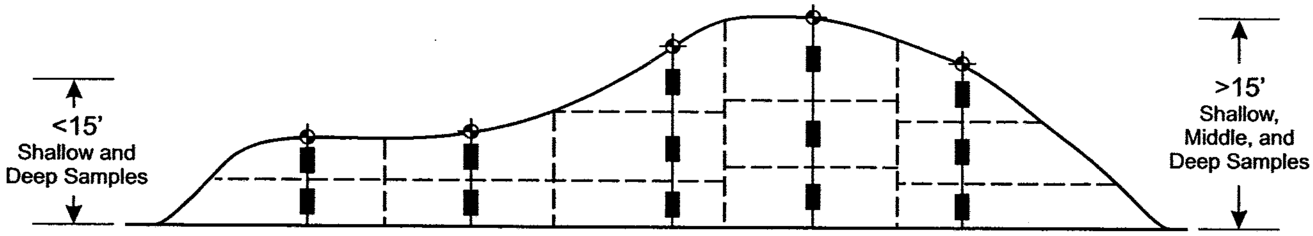


Plan View

Stockpile Subdivided into Equal Areas (Decision Units)



Cross Sectional View

Vertical Sampling Based on Stockpile Thickness Within Individual Decision Units

LEGEND

Decision unit/cell boundary

Boring location

Boring location with sampling intervals

Job No. 33757742

Figure 2-2

Conceptual Decision Unit Sampling Design

URS

Former Maralco Aluminum Site
Kent, Washington

Table 2-1
Sample Types and Rationale

Matrix	Sample Type	Sample Location	Rationale
Dross	Discrete	One discrete sample collected from each of 44 units	Provide supplemental information for determining whether dross designates as a WA State Dangerous Waste due to fish toxicity (metals and ammonia), rat toxicity (salt content) or as a RCRA hazardous waste due to TCLP metals.
Dross	Composite	Seven composite samples collected from the entire dross pile	Provide information for assessing dross' acceptability for disposal per disposal facility's waste acceptance criteria for reactivity, corrosivity and ignitability.

TCLP – Toxicity Characteristic Leaching Procedure
RCRA – Resource Conservation and Recovery Act

Table 2-2
Dross Sample Identification, Depth Intervals, and Analyses

Boring Location	Decision Unit (Sample Designation)	Approximate Sample Depth (feet below surface)[1]	Field Measurements	Total Metals, Salts, TCLP Metals, Ammonia Chloride	Fish Bioassay	Rat Bioassay	pH, Ignitability, Total Cyanide, Total Sulfide
B-1	B-1-S	1-5	X	X	see note [2]	see note [2]	
	B-1-D	6-10	X	X	see note [2]	see note [2]	
B-2	B-2-S	1-5	X	X	see note [2]	see note [2]	
	B-2-D	6-10	X	X	see note [2]	see note [2]	
B-3	B-3-S	2-6	X	X	see note [2]	see note [2]	
	B-3-M	11-15	X	X	see note [2]	see note [2]	
	B-3-D	20-24	X	X	see note [2]	see note [2]	
B-4	B-4-S	2-6	X	X	see note [2]	see note [2]	
	B-4-M	11-15	X	X	see note [2]	see note [2]	
	B-4-D	20-24	X	X	see note [2]	see note [2]	
B-5	B-5-S	2-6	X	X	see note [2]	see note [2]	
	B-5-M	11-15	X	X	see note [2]	see note [2]	
	B-5-D	20-24	X	X	see note [2]	see note [2]	
B-6	B-6-S	2-6	X	X	see note [2]	see note [2]	
	B-6-M	11-15	X	X	see note [2]	see note [2]	
	B-6-D	20-24	X	X	see note [2]	see note [2]	
B-7	B-7-S	2-6	X	X	see note [2]	see note [2]	
	B-7-M	11-15	X	X	see note [2]	see note [2]	
	B-7-D	20-24	X	X	see note [2]	see note [2]	
B-8	B-8-S	2-6	X	X	see note [2]	see note [2]	
	B-8-M	11-15	X	X	see note [2]	see note [2]	
	B-8-D	20-24	X	X	see note [2]	see note [2]	
B-9	B-9-S	2-6	X	X	see note [2]	see note [2]	
	B-9-M	11-15	X	X	see note [2]	see note [2]	
	B-9-D	20-24	X	X	see note [2]	see note [2]	

Table 2-2 (continued)
Dross Sample Identification, Depth Intervals, and Analyses

Boring Location	Decision Unit (Sample Designation)	Approximate Sample Depth (feet below surface)[1]	Field Measurements	Total Metals, Salts, TCLP Metals, Ammonia Chloride	Fish Bioassay	Rat Bioassay	pH, Ignitability, Total Cyanide, Total Sulfide
B-10	B-10-S	2-6	X	X	see note [2]	see note [2]	
	B-10-M	11-15	X	X	see note [2]	see note [2]	
	B-10-D	20-24	X	X	see note [2]	see note [2]	
B-11	B-11-S	2-6	X	X	see note [2]	see note [2]	
	B-11-M	11-15	X	X	see note [2]	see note [2]	
	B-11-D	20-24	X	X	see note [2]	see note [2]	
B-12	B-12-S	2-6	X	X	see note [2]	see note [2]	
	B-12-M	11-15	X	X	see note [2]	see note [2]	
	B-12-D	20-24	X	X	see note [2]	see note [2]	
B-13	B-13-S	0-4	X	X	see note [2]	see note [2]	
	B-13-D	4-8	X	X	see note [2]	see note [2]	
B-14	B-14-S	0-4	X	X	see note [2]	see note [2]	
	B-14-D	4-8	X	X	see note [2]	see note [2]	
B-15	B-15-S	0-4	X	X	see note [2]	see note [2]	
	B-15-D	4-8	X	X	see note [2]	see note [2]	
B-16	B-16-S	0-4	X	X	see note [2]	see note [2]	
	B-16-D	4-8	X	X	see note [2]	see note [2]	
B-17	B-17-S	0-4	X	X	see note [2]	see note [2]	
	B-17-D	4-8	X	X	see note [2]	see note [2]	
Field Duplicate	B-18	B-1-S (2-6)	X	X	see note [2]	see note [2]	
Field Duplicate	B-19	B-7-M (11-15)	X	X	see note [2]	see note [2]	
Field Duplicate	B-20	B-15-D (4-8)	X	X	see note [2]	see note [2]	

Table 2-2 (continued)
Dross Sample Identification, Depth Intervals, and Analyses

Boring Location	Decision Unit (Sample Designation)	Composited Discrete Samples	Field Measurements	Total Metals, Salts, TCLP Metals, Ammonia Chloride	Fish Bioassay	Rat Bioassay	pH, Ignitability, Total Cyanide, Total Sulfide
Composite Sample	COMP-1	B-1, B-2, B-3					X
Composite Sample	COMP-2	B-4, B-6					X
Composite Sample	COMP-3	B-5, B-7					X
Composite Sample	COMP-4	B-8, B-10					X
Composite Sample	COMP-5	B-9, B-11					X
Composite Sample	COMP-6	B-12, B-13, B-14					X
Composite Sample	COMP-7	B-15, B-16, B-17					X

Notes:
[1] – Final sample depths will be based on stockpile thickness at the selected sampling points.
[2] – Samples for fish bioassay and rat bioassay testing will be determined based on total metals and/or salts analytical results.
Field measurements: ammonia (Draeger tube), phosphine (Draeger tube), methane (4-gas meter), and hydrogen sulfide (4-gas meter).
Total metals: copper, nickel, zinc.
Salts: sodium, potassium and chloride.
TCLP metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver.
Sufficient sample quantity will be collected from each decision unit to perform bioassays tests on any decision units that book designate based on metals, salt, or ammonia content.

Table 2-3
Sample Containers and Preservatives

Analyses	Method	Sample Container	Preservation[a]	Holding Time[b]
Dross				
Total Metals [c]	EPA 6000 series	8 ounce glass jar w/ Teflon-lined lid	Cool to 4° C	6 months
TCLP Metals [d]	EPA 1311 & 6000/7000 series			6 months (28 days for mercury)
Ammonia	EPA 350.3			28 days
Chloride	EPA 300.0			28 days
Fish Bioassay	Ecology 80-12	4 ounce glass jar w/ Teflon-lined lid	Cool to 4° C	NA
Rat Bioassay	Ecology 80-12	16 ounce glass jar w/ Teflon-lined lid	Cool to 4° C	NA
pH	EPA 9045C	8 ounce glass jar w/ Teflon-lined lid	Minimize headspace, cool to 4° C	1 day
Ignitability	EPA 1030			28 days
Total Cyanide	EPA 9010			14 days
Total Sulfide [a]	EPA 9030	4 ounce glass jar w/ Teflon-lined lid	ZnOAc on surface, minimize headspace, Cool to 4° C	7 days
Water (Decontamination/Rinsate Blanks, if necessary)				
Total Metals [a]	EPA 6000 series	500 mL polyethylene bottle	HNO_3 to pH < 2, cool to 4° C	6 months
Ammonia	EPA 350.3	250 mL polyethylene bottle	H_2SO_4 to pH <2, Cool to 4° C	28 days
Chloride	EPA 300.0	250 mL polyethylene bottle	Cool to 4° C	28 days

Notes:
[a] Preserve the samples as soon as they are collected
[b] Technical holding time is the time interval from the sample collection until sample analysis (or until sample extraction)
[c] Total metals: copper, nickel, zinc, sodium, potassium
[d] TCLP metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver
ZnOAc = Zinc Acetate
HNO_3 = nitric acid
H_2SO_4 = sulphuric acid
NA = not applicable

Table 2-4
Estimated Number of Samples To Be Analyzed

Analyses	Method	Primary Dross Samples	Field Duplicates	MS/MSD	Total Sample Count[a]
Total Metals [b]	EPA 6000 series	44	3	3	50
TCLP Metals [c]	EPA 1311 & 6000/7000 series	44	3	3	50
Ammonia	EPA 350.3	44	3	3	50
Sodium and Potassium	EPA 6000 series	44	3	3	50
Chloride	EPA 300.0	44	3	3	50
Fish Bioassay	Ecology 80-12	TBD [d]	0	na	TBD [d]
Rat Bioassay	Ecology 80-12	TBD [d]	0	na	TBD [d]
pH	EPA 9045C	7	1	na	8
Ignitability	EPA 1030	7	1	na	8
Total Cyanide	EPA 9010	7	1	1	9
Total Sulfide	EPA 9030	7	1	1	9
	Totals	**248 [e]**	**19**	**17**	**284 [e]**

Notes:
[a] Total number of samples assume that equipment rinsate blank samples will not be collected or analyzed
[b] Total metals: copper, nickel, and zinc.
[c] TCLP metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver
[d] To be determined based on total metals, salt, and ammonia results.
[e] Totals do not include potential bioassay analysis
MS/MSD – matrix spike/matrix spike duplicate
na – not applicable

Table 2-5
Laboratory Requirements For Requested Analyses

Analyses	Method	Quantitation Limits [a]	Accuracy (%)	Precision (RPD)	Completeness
Soil Analyses					
Total copper	EPA 6020	0.50	80 - 120	20%	95%
Total nickel	EPA 6020	0.50	80 - 120	20%	95%
Total zinc	EPA 6020	5.0	80 - 120	20%	95%
Total potassium	EPA 6010B	15.0	80 - 120	20%	95%
Total sodium	EPA 6010B	15.0	80 - 120	20%	95%
TCLP Silver	EPA 1311/6010B	0.050	40-140	50%	95%
TCLP Arsenic	EPA 1311/6010B	0.050	80 – 120	20%	95%
TCLP Barium	EPA 1311/6010B	1.0	80 – 120	20%	95%
TCLP Cadmium	EPA 1311/6010B	0.050	80 – 120	20%	95%
TCLP Chromium	EPA 1311/6010B	0.050	80 – 120	20%	95%
TCLP Lead	EPA 1311/6010B	0.050	80 – 120	20%	95%
TCLP Selenium	EPA 1311/6010B	0.050	80 – 120	20%	95%
TCLP Mercury	EPA 1311/7470	0.0010	80 - 120	20%	95%
Ammonia	EPA 350.3	25.0	90 – 110	30%	95%
Chloride	EPA 300.0	4.0	90 – 110	25%	95%
Fish Bioassay	Ecology 80-12	NA	NA	NA	NA
Rat Bioassay	Ecology 80-12	NA	NA	NA	NA
pH	EPA 9045C	NA	NA	10%	95%
Ignitability	EPA 1030	NA	NA	20%	95%
Total Cyanide	EPA 9010	0.500	27-138	46%	95%
Total Sulfide	EPA 9030	40.0	20-120	30%	95%
Water Analyses (Decontamination/Rinsate Blanks, if necessary)					
Total copper	EPA 6020	0.0010	80 - 120	20%	95%
Total nickel	EPA 6020	0.0010	80 - 120	20%	95%
Total zinc	EPA 6020	0.010	80 - 120	20%	95%
Total potassium	EPA 6010B	2.0	80 - 120	20%	95%
Total sodium	EPA 6010B	0.250	80 - 120	20%	95%
Ammonia	EPA 350.3	0.10	75-125	30%	95%
Chloride	EPA 300.0	0.40	52-134	25%	95%

Notes:

[a] – Soil Analyses units = mg/kg, water analyses units = mg/l

3.0 ASSESSMENT AND OVERSIGHT

3.1 ASSESSMENT AND RESPONSE ACTIONS

This section identifies the number, frequency, schedule, and type of assessment activities that will be involved in this project. Field systems audit, laboratory and field performance audits, and data reduction assessment are not planned for this project. This project includes independent technical reviews, a field-readiness review, and data quality assessments.

Independent technical reviews, the field-readiness review, and data quality verification assessments will be conducted by senior URS staff with technical expertise applicable to the task. Assignments will be coordinated with the URS QAM. The QAM will ensure that issues identified by the independent technical reviews, field readiness review, and data quality assessments are incorporated into the project as appropriate, and confirm the implementation and effectiveness of the response action.

3.1.1 Independent Technical Reviews

Independent technical reviews will be performed on all deliverable documents, including this plan and the interim and final reports. These reviews will be conducted by experienced and qualified personnel to ensure the quality and integrity of tasks and products by allowing the work and/or deliverable to undergo objective, critical scrutiny. The QAM is responsible for ensuring that reviewers are independent from actual work or decision-making on the tasks or activities being reviewed and that they possess technical qualifications sufficient for conducting the in-depth review. A written record of the review and resolution of the review findings by the QAM and PM will be incorporated into the project files.

3.1.2 Data Quality Assessments

Data quality assessments will be prepared under the direction of the QAM to document the overall quality of data collected in terms of the established quality criteria/indicators. The data assessment parameters calculated from the results of the field measurements and laboratory analyses will be reviewed to ensure that all data used in subsequent evaluations are scientifically valid, of known and documented quality, and, where appropriate, legally defensible. In addition, the performance of the overall measurement system will be evaluated in terms of the completeness of the project plans, effectiveness of field measurement and data collection procedures, and relevance of laboratory analytical methods used to generate data as planned. Finally, the goal of the data quality assessment will be to present the findings in terms of data usability.

The major components of a data quality assessment are presented below and show the logical progression of the assessment leading to a determination of data usability:

- Summary of the problems, data generation trends, general conditions of the data, and reasons for data qualification as presented in the laboratory data narrative.
- Evaluation of QC samples, such as blanks, field duplicates, laboratory duplicates and LCSs to assess the quality of the field activities and laboratory procedures.
- Assessment of the quality of data measured and generated in terms of accuracy, precision, and completeness.
- Summary of data usability. Sample results for each analytical method are qualified as acceptable, rejected, estimated, biased high, or biased low.

3.1.3 Field Readiness Review

The field readiness review is a systematic, documented review of the readiness for the startup of the field effort described in this study plan. The readiness review will be conducted before proceeding with the field effort. The field readiness review will be attended by the PM, QAM, URS Geologist, field crew, and any other appropriate personnel.

3.2 NONCONFORMANCE AND CORRECTIVE ACTION

The project plans, supplementary procedures, SOPs, and training establish the baseline for assessing the quality system. Management and technical staff will follow these plans and procedures during the course of any project activity. However, on occasion, nonconformances do occur. Each nonconformance will be documented by project personnel or a subcontractor employee observing the nonconformance. Examples of nonconforming work include the following:

- Subcontractor-supplied items that do not meet the contractual requirements
- Errors made in following work instruction or improper work instruction
- Unforeseen or unplanned circumstances that result in services that do not meet quality/contractual/technical requirements
- Unapproved or unwarranted deviations from established procedures
- Sample chain-of-custody documentation missing or deficient
- Data falling outside established DQO criteria

Results of QA reviews typically identify the requirement for a corrective action. Nonconformances will be communicated to the PM by the QAM. The PM is responsible for evaluating all reported nonconformances, determining the root cause, conferring with the QAM on the steps to be taken for correction, and executing the corrective action as developed and scheduled. Corrective action measures will be selected to prevent or reduce the likelihood of future occurrences and to address the root causes to the extent identifiable. Quality assurance nonconformances and selected measures for corrective action will be appropriate and realistic and will be documented in the interim report for Ecology's approval and in the final report.

4.0 DATA REVIEW AND DATA ASSESSMENT PROCEDURES

This section describes the procedures which will be used for data review, data assessment, and data reporting. Data generated by this project will be reviewed (validated) to determine whether data qualifiers are necessary. Data assessment includes verifying that the data meet the project objectives and performing calculations associated with Dangerous Waste characterization. Data reporting will include interim and final reports. Data review, data assessment and reporting are described in detail below.

4.1 DATA REVIEW

Data review is the process of technically reviewing analytical data using written data validation protocols, and qualifying measurement results using data qualifiers. The primary objective of data review is to determine if project data are of sufficient quality to support the project objectives. After the data review process is completed, data qualifiers are appended to measurement values by the data reviewer. Final usability of qualified data will be determined by the project team.

A summary data quality review will be performed in accordance with standard laboratory data validation, based on method performance criteria and QC criteria documented in the study plan. The summary data quality review will be included as an appendix to the final report. Hold times, blanks, matrix spike/matrix spike duplicate recoveries, laboratory duplicate results, blank spike recoveries (laboratory control samples) and reporting limits will be reviewed to assess compliance with applicable methods. If data qualification is required, data will be qualified based on the definitions and use of qualifying flags outlined in *EPA Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review* (USEPA, 2002). The data will be reviewed by a qualified URS chemist.

The project team will provide an assessment and evaluation of the summary data review reports. Data outliers such as data qualified with "J" and "R" flags will be documented in data validation reports to the Project Manager. Data validation guidelines require that measurement values below the quantitation limit be qualified as an estimated value. The project team will determine the usability of such estimated values. If resources are available, the Project Manager may elect to have "R" qualified samples reanalyzed using archived samples.

4.2 DATA ASSESSMENT PROCEDURES

Following the data review process, validated data will be assessed by the Project Manager to determine if the data meet the project objectives. This assessment of validated data will be reported in the final report for the project. Validated data will be summarized on tables and then used in the book designation procedure. Dross analytical results will be used to calculate toxicity equivalent concentrations based on the measured metals (copper, nickel, and zinc) and ammonia concentrations and salt content estimated from the measured chloride, sodium, and potassium concentrations. The following subsections describe the methodologies to be used for estimating salt content and for performing the toxicity equivalent calculations.

4.2.1 Salt Content Estimation

Salt content will be estimated based on the measured concentrations of sodium, potassium, and chloride in the discrete dross samples. For each discrete dross sample, the salt content will be estimated stoichiometrically using the following process:

1) Determine the molar concentration of chloride (mol_{Cl^-}/kg_{Dross}) by dividing the measured chloride content (mg_{Cl^-}/kg_{Dross}) by the atomic weight of chloride ($0.0355\ kg_{Cl^-}/mol_{Cl^-}$).

$$mol_{Cl^-}/kg_{Dross} = (mg_{Cl^-}/kg_{Dross})*(1\ kg_{Cl^-}/1\text{x}10^6\ mg_{Cl^-}) / (0.0355\ kg_{Cl^-}/mol_{Cl^-})$$

2) Determine the molar concentrations of sodium (mol_{Na^+}/kg_{Dross}) and potassium (mol_{K^+}/kg_{Dross}) by dividing the measured concentrations by the respective atomic weights ($0.023\ kg_{Na^+}/mol_{Na^+}$ and $0.039\ kg_{K^+}/mol_{K^+}$).

$$mol_{Na^+}/kg_{Dross} = (mg_{Na^+}/kg_{Dross})*(1\ kg_{Na^+}/1\text{x}10^6\ mg_{Na^+}) / (0.023\ kg_{Na^+}/mol_{Na^+})$$

$$mol_{K^+}/kg_{Dross} = (mg_{K^+}/kg_{Dross})*(1\ kg_{K^+}/1\text{x}10^6\ mg_{K^+}) / (0.039\ kg_{K^+}/mol_{K^+})$$

3) If the molar potassium concentration is greater than the molar chloride concentration ($mol_{K^+}/kg_{Dross} > mol_{Cl^-}/kg_{Dross}$), then the dross salt content will conservatively be assumed to be composed entirely of potassium chloride and the salt content (mg_{Salt}/kg_{Dross}) will be estimated by multiplying the molar chloride concentration (mol_{Cl^-}/kg_{Dross}) by the molecular weight of potassium chloride ($0.0745\ kg_{KCl}/mol_{KCl}$).

if: $mol_{K^+}/kg_{Dross} > mol_{Cl^-}/kg_{Dross}$,

then assume: $mol_{Salt}/kg_{Dross} = mol_{KCl}/kg_{Dross} = mol_{Cl^-}/kg_{Dross}$

salt content: $mg_{Salt}/kg_{Dross} = (mol_{Cl^-}/kg_{Dross})*(0.0745\ kg_{KCl}/mol_{KCl})*(1\text{x}10^6\ mg_{KCl}/kg_{KCl})$

This assumption is conservative due to the greater atomic weight of potassium than sodium and the consequential greater molecular weight of potassium chloride than sodium chloride.

4) If the molar potassium concentration is less than the molar chloride concentration ($mol_{K^+}/kg_{Dross} < mol_{Cl^-}/kg_{Dross}$), then the dross salt content will be assumed to be composed of a mixture of sodium chloride and potassium chloride. To be conservative, it will be assumed that the molar potassium chloride concentration equals the molar potassium concentration and the molar sodium chloride concentration is equal to the difference between the molar chloride

concentration and the molar potassium concentration. The salt content will be estimated by multiplying the assumed molar sodium chloride and potassium chloride concentrations by the respective molecular weights of sodium chloride and potassium chloride.

if: $mol_{K+}/kg_{Dross} < mol_{Cl-}/kg_{Dross}$,

then assume: $mol_{KCl}/kg_{Dross} = mol_{K+}/kg_{Dross}$, and

$mol_{NaCl}/kg_{Dross} = mol_{Cl-}/kg_{Dross} - mol_{K+}/kg_{Dross}$

salt content: $mg_{Salt}/kg_{Dross} = (1x106\ mg_{Salt}/kg_{Salt})*[(mol_{K+}/kg_{Dross})*(0.0745\ kg_{KCl}/mol_{KCl}) + (mol_{Cl-}/kg_{Dross} - mol_{K+}/kg_{Dross})*(\ 0.0585\ kg_{NaCl}/mol_{NaCl})]$

Based on available chloride, sodium, and potassium data for the dross (MKE, 1991a), the above equations should adequately address the potential relative abundances of chloride, sodium, and potassium in the dross. In the unlikely event that the measured chloride, sodium, and potassium concentrations do not empirically satisfy the above equations, an alternate approach for estimating the salt content will be determined by the project team (including Ecology consultation and approval by Ecology, Table 1-1) and documented in the final report.

4.2.2 Dangerous Waste Book Designation

Book designation calculations will be performed for each discrete dross sample by calculating a toxicity equivalent concentration according to the procedure described in WAC 173-303-100(5)(b). The toxicity equivalent concentration calculation will be performed using the measured concentrations of copper, nickel, zinc, and ammonia for fish toxicity and the estimated salt concentration for oral rat toxicity. The following toxic categories will be assumed for each constituent:

Ammonia: Toxic Category B

Copper: Toxic Category A

Nickel: Toxic Category C

Zinc: Toxic Category B

Salt: Toxic Category D

Table 4-1 summarizes the available toxicity data used to determine these toxic categories, as well as the toxicity equivalent factors associated with each of the toxic categories. The equivalent concentrations for fish toxicity and for oral rat toxicity will be calculated using the following equations:

$$\text{Toxicity Equivalent Concentration (\%)} = \frac{\Sigma X\%}{1} + \frac{\Sigma A\%}{10} + \frac{\Sigma B\%}{100} + \frac{\Sigma C\%}{1000} + \frac{\Sigma D\%}{10{,}000}$$

where: $\Sigma X\%$ = percent concentration X toxicity constituent

$\Sigma A\%$ = percent concentration of copper

$\Sigma B\%$ = sum of percent concentrations of ammonia and zinc

$\Sigma C\%$ = percent concentration of nickel

$\Sigma D\%$ = percent salts

Discrete dross samples will book-designate as Dangerous Waste for toxicity if the calculated toxicity equivalent concentration -is equal to or greater than 0.001% and less than 1%. If the equivalent concentration is equal to or greater than 1%, the waste will be designated as Extremely Hazardous Waste.

4.3 REPORTING

Reporting will be performed twice: first after evaluation is completed for analytical results from discrete samples (book designation) and other waste characterization analyses, and second after receipt of any bioassay tests performed.

Interim reporting will summarize analytical results, book designation results, and any recommendations for bioassay testing. If bioassay testing is recommended, then the appropriateness of compositing apparently similar discrete dross samples would be addressed at this time.

Final reporting will provide the results of all analytical testing performed and recommendations for disposal of the dross. The final report will also include laboratory data, data review (validation) reports, and boring logs.

Table 4-1
Toxicity Criteria for Book Designation Calculations

Constituent	Toxicity Criteria	Literature Toxicity Data [a]	Toxic Category [b]	Equivalent Concentration Factor [b]
Ammonia	Fish	$LC_{50} = 0.45$ mg/L	B	100
Copper	Fish	$LC_{50} \geq 0.02$ mg/L	A	10
Nickel	Fish	$LC_{50} \geq 2$ mg/L	C	1,000
Zinc	Fish	$LC_{50} \geq 0.59$ mg/L	B	100
Salt (sodium chloride / potassium chloride)	Oral (rat)	$LD_{50} = 3{,}000$ mg/kg (sodium chloride), 2,600 mg/kg (potassium chloride)	D	10,000

Notes:
[a] Toxicity data for ammonia, copper, nickel, and zinc were queried from the Pesticides Action Network (PAN) database, available on-line at http://pesticideinfo.org/. Salt toxicity data are from the Registry of Toxic Effects of Chemical Substances (RTECS).
[b] Toxic categories and equivalent concentration factors are as determined by book designation criteria in WAC 173-303-100.

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