

**Halaco Engineering Co
Oxnard, Ventura County, California
Integrated Assessment
Sampling and Analysis Plan**

**GSA Contract Number: W91238-05-F-0052
Document Control Number: 12767.060.317.0001**

May 2006

**Prepared for:
U.S. Environmental Protection Agency
Region 9**

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**Halaco Engineering Co.
Oxnard, Ventura County, California
Integrated Assessment
Draft Sampling and Analysis Plan**

EPA ID: CAD009688052

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LIST OF ACRONYMS

AOC	Analyte of Concern
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CDO	Cease and Desist Order
CLP	Contract Laboratory Program
CLPAS	Contract Laboratory Program Analytical Services
DFG	California Department of Fish and Game
DHS	California Department of Health Services
DQO	Data Quality Objective
DQI	Data Quality Indicator
DTSC	Department of Toxic Substances Control
EPA	United States Environmental Protection Agency
ERS	Emergency Response Section
HCl	Hydrochloric Acid
HNO ₃	Nitric Acid
HRS	Hazard Ranking System
IDW	Investigation-Derived Wastes
IA	Integrated Assessment
LARWQCB	Los Angeles Regional Water Quality Control Board
LCS	Laboratory Control Samples
LSI	Listing Site Inspection
MARSSIM	Multi-Agency Radiation Site Survey and Investigation Manual
MCL	Maximum Contaminant Levels
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
µg/kg	micrograms per kilogram
µg/l	micrograms per liter
MERL	Mobile Environmental Radiological Laboratory
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NCP	National Contingency Plan
NPL	National Priorities List
OID	Oxnard Industrial Drain
OSC	EPA Federal On-Scene Coordinator
OSWER	Office of Solid Waste and Emergency Response
pCi/g	picoCuries per gram
pCi/kg	picoCuries per kilogram
pCi/l	picoCuries per liter
PM	Project Manager
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
PRG _r	Residential Preliminary Remediation Goal
QA	Quality Assurance

QAO	Quality Assurance Office
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SAM	Site Assessment Manager
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
STLC	Soluble Threshold Limit Concentration
SWRCB	California State Water Resources Board
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TTLC	Total Threshold Limit Concentration
USACE	United States Army Corps of Engineers
VOC	Volatile Organic Compound
WMU	Waste Management Unit
XRF	X-Ray Fluorescence Spectrometer
⁴⁰ K	Potassium-40
¹³⁷ Cs	Cesium-137
²³² Th	Thorium-232
²³⁰ Th	Thorium-230
²²⁸ Th	Thorium-228

1.0 INTRODUCTION

Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), Weston Solutions, Inc. (WESTON®) has been tasked to conduct a Hazard Ranking System (HRS) Integrated Assessment (IA) of the Halaco Engineering Co. (Halaco) site, located at 6200 Perkins, Ventura County, Oxnard, California. The IA incorporates elements of the HRS Assessment as well as Removal Assessment goals in support of the U. S. Environmental Protection Agency (EPA) Superfund Division, Emergency Response Section (ERS) for potential time-critical removal efforts. The HRS assesses the relative threat associated with actual or potential releases of hazardous substances to the environment, and has been adopted by the EPA to assist in setting priorities for further site evaluation and eventual remedial action. The HRS is the primary method for determining a site's eligibility for placement on the National Priorities List (NPL). The NPL identifies sites where the EPA may conduct remedial actions.

This Sampling and Analysis Plan (SAP) describes the project and data use objectives, data collection rationale, quality assurance goals, and requirements for sampling and analysis activities. The SAP also defines the sampling and data collection methods that will be used for this project. The SAP is intended to accurately reflect the planned data-gathering activities for this site investigation; however, site conditions and additional EPA direction may warrant modifications. All significant changes will be documented in the final report.

WESTON® has been tasked to gather and review existing available information regarding site conditions, identify and fill data gaps, and prepare HRS scoresheets and rationale for the site.

The specific field sampling and chemical analysis information pertaining to the site is addressed in this SAP, in accordance with the EPA documents *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations* (QA/R-5), October 1997, *Guidance for the Data Quality Objectives Process* (QA/G-4), September 1994 and *Data Quality Objective Process for Superfund* (EPA 540/G-93/71), August 1993.

1.1 Project Organization

The following is a list of project personnel and their responsibilities:

EPA Site Assessment Manager (SAM) - The EPA SAM is Matt Mitguard. Mr. Mitguard is the primary decision maker for the HRS portions of this investigation, and is one of the primary contacts for the WESTON Project Manager.

EPA On-Scene Coordinator (OSC) - The EPA OSC is Rob Wise. Mr. Wise is the primary decision maker for the Removal portions of this investigation, and is one of the primary contacts for the WESTON Project Manager.

WESTON Project Manager (PM) and Field Sampling Quality Control (QC) Coordinator - The WESTON PM and Field Sampling QC Coordinator is Ben Castellana. Dr. Castellana is responsible for the overall performance of all tasks assigned to WESTON by the EPA and working with the EPA Quality Assurance Office (QAO) to ensure project quality assurance goals are met.

WESTON Quality Assurance (QA) Manager - The WESTON QA Manager is Joe DeFao. Mr. DeFao is responsible for working with the United States Army Corps of Engineers (USACE) and EPA QAO to ensure project quality assurance goals are met.

Table 1-1: Organizational Chart

Title/Responsibility	Name	Phone Number
EPA Site Assessment Manager	Matt Mitguard	(415) 972-3096
EPA On-Scene Coordinator	Rob Wise	(562) 986-6180
EPA Quality Assurance Manager	Eugenia McNaughton, Ph.D.	(415) 972-3411
USACE Project Manager	Dan McMIndes	(916) 557-7399
WESTON Project Manager and Field Sampling QC Coordinator	Ben Castellana	(818) 371-5388
WESTON QA Manager	Joe DeFao	(925) 948-2657
EPA Region 9 Sample Control Coordinator	Mary O'Donnell	(510) 412-2389

1.2 Distribution List

Copies of the final SAP will be distributed to the following persons and organizations:

- Matt Mitguard, EPA Region 9
- Rob Wise, EPA Region 9
- EPA Region 9 Quality Assurance Office
- Dan McMIndes, EPA Region 9, USACE
- Marilyn Levine, State of California, Attorney General's Office
- Paula Rausmuesen, State of California, LARWQCB
- Glen Foreman, State of California, Department of Toxic Substances Control
- Jeff Phillips, US Department of Fish and Wildlife
- Mitch Disney, Ventura County District Attorney's Office
- David Musick, EPA Office of Radiation and Indoor Air
- Roger Shura, EPA Office of Radiation and Indoor Air
- Weston Solutions, Inc. files

1.3 Statement of the Specific Problem

The EPA has determined that the presence of potentially hazardous materials and wastes at the Site may pose an immanent and substantial threat to human health and the environment. The EPA Superfund Division is conducting an IA at the Site to address these concerns from a time-critical removal standpoint on behalf of the Emergency Response Section, and from an HRS standpoint on behalf of the Site Assessment Section. A detailed review of existing documents indicates significant data gaps needing reconciliation to fully address the IA goals. The data gaps include the determination of whether wastes at the Site may be considered Hazardous Waste under Resource Conservation and Recovery Act (RCRA) or California State Law, and whether contaminants have been released from the Site, threatening human health and the environment. The data gaps should be addressed by collecting samples of waste, soils, sediments, surface water, groundwater, and airborne particulates to be analyzed, and the results validated, under Data Quality Objectives (DQOs) that are defensible under HRS and ERS programs.

2.0 BACKGROUND

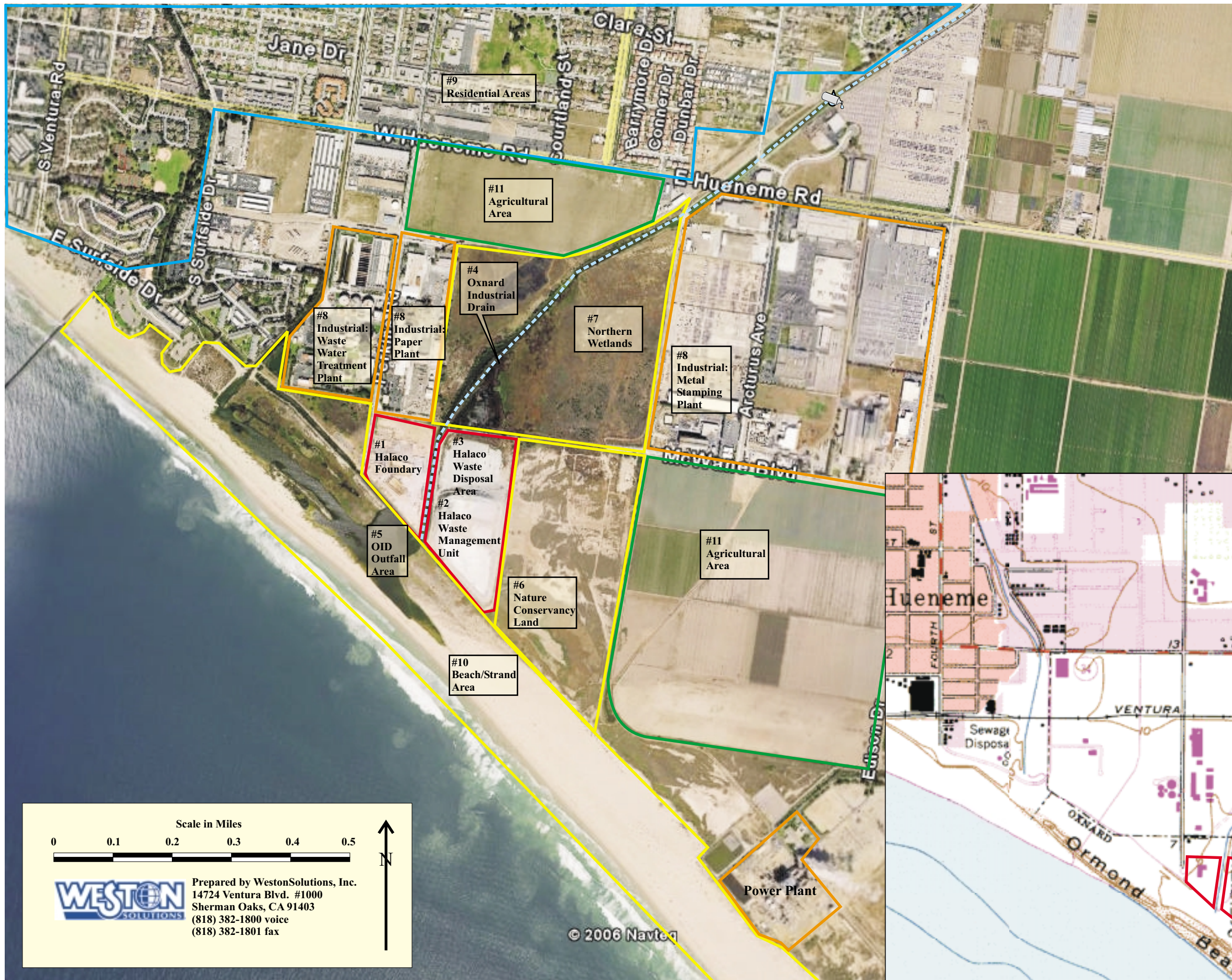
2.1 Location and Description

The site is located at 6200 Perkins Road, Oxnard, Ventura County, California, 93033. The site lies in Section 27, Township 1 North, Range 22 West, San Bernardino Baseline and Meridian, within the Oxnard Hydrogeologic Subarea. The coordinates of the site are 34° 8' 20" North latitude, 119° 10' 55" West longitude.

The Halaco facility consists of two separate parcels on either side of the Oxnard Industrial Drain (OID). The Smelter is located on approximately 11 acres owned by Clarence, John, and Robert Haack and leased to Halaco, situated on the west side of the OID. The waste disposal area including the waste management unit (WMU) is located on approximately 26 acres owned by Halaco, situated on the east side of the OID.

For discussion purposes, the site is divided into the following areas (Figure 2-1):

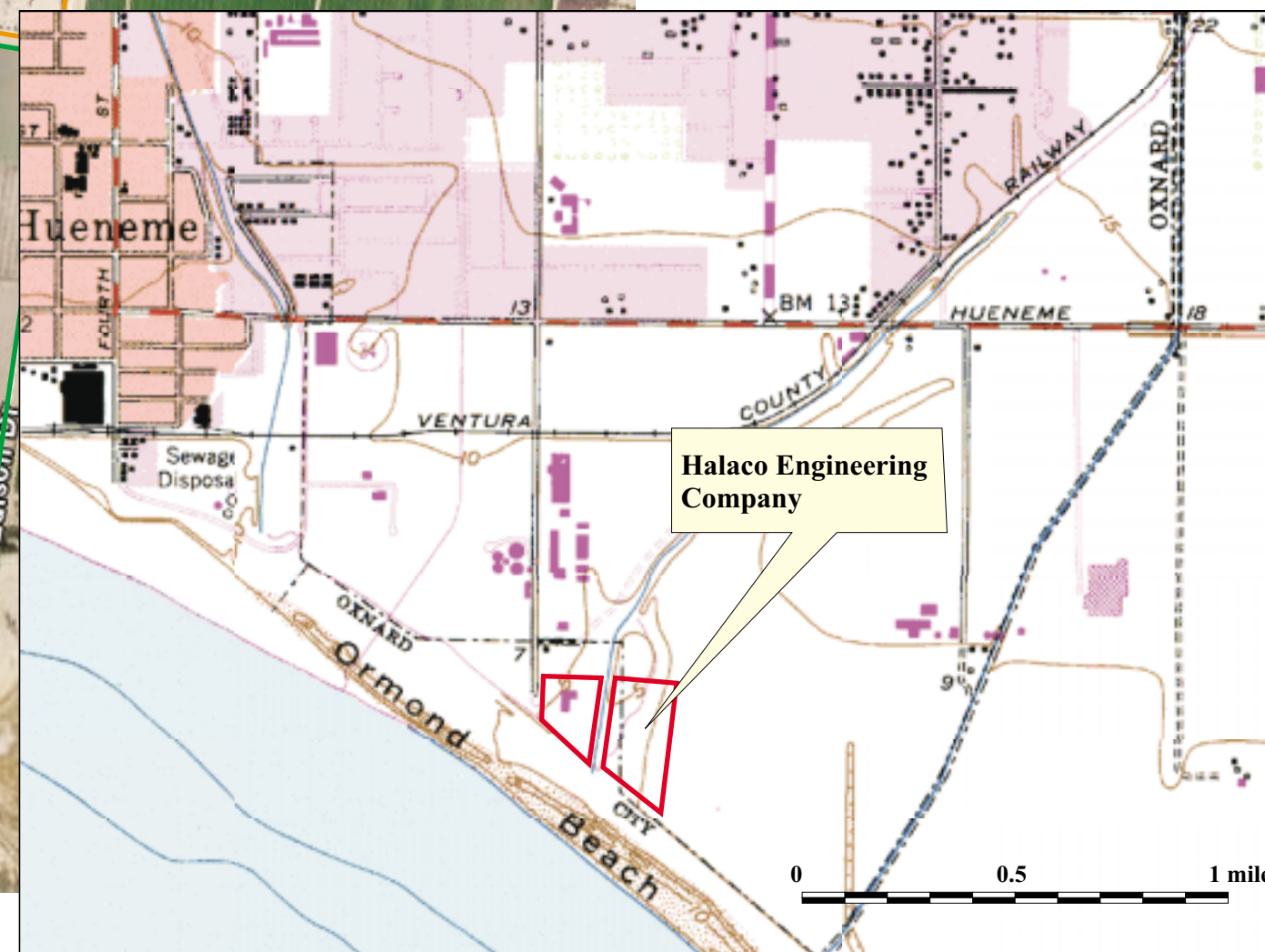
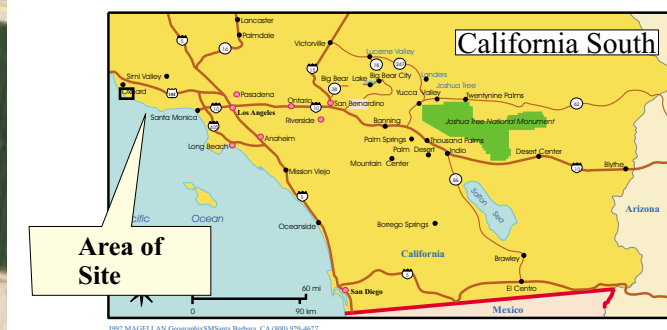
- #1 Smelter – where recycling operations commenced, on the west side of the OID.
- #2 WMU – waste pile located east of the Smelter and comprised of slag from the Smelter operations with three settling ponds constructed into the surface.
- #3 Waste Disposal Area, north of the WMU – disputed wetlands area north of the WMU where dried material from the WMU was historically spread.
- #4 OID – bisects the site.
- #5 OID outfall - where the OID meets the Pacific Ocean.
- #6 The following additional area is not owned by Halaco or the Haacks, but has historically been included during discussions of Halaco due to off-site migration of contamination: *East of the WMU* - a debated wetlands area not owned/leased by Halaco.



**Figure 2-1: Site Location
and Site Areas Map**

**Halaco Engineering Company
Integrated Assessment**

May 2006



2.2 Topographic and Geologic Information

The site is found on the Oxnard USGS 7.5-minute Topographic Map Series, 1967. The site is situated at the shoreline of the Rio De Santa Clara Plain on Ormond Beach. The facility rests on Pleistocene to Quaternary beach and fluvial deposits composed of sands and silts with moderate permeability. Groundwater beneath the site is believed to be dominated by fresh water from the nearby OID. Groundwater depth is estimated at 3 to 5 feet below ground surface.

2.3 Operational History

Between 1950 and 1955, Halaco operated at 11920 S. Alameda in Los Angeles, California. Between 1955 and 1965, Halaco operated at 18601 S. Main Street in Los Angeles, California (DHS 1984). In 1965, Halaco operations moved to the 6200 Perkins Street, Oxnard location. The smelter portion of the Halaco site was built upon a former open dump for the City of Oxnard. This dump was phased out after the Wagon Wheel Landfill opened in August 1962. It is believed that the dump accepted lumber, sewer sludges and grits, hospital wastes and general household refuse. Extensive burning was carried out the last year the dump operated. The dump is believed to have received a final cover of beach sand (DHS, 1979b).

In 1979, Halaco only recycled aluminum and magnesium. Some time prior to 1979, Halaco also recycled zinc. The aluminum scrap metal recycled by Halaco came from shredded cans, machine shop borings, aluminum-copper radiators, and blocks of partially processed scrap aluminum from other countries. This scrap aluminum contained an estimated 1 to 3 percent copper plus silver, zinc, lead, chromium, titanium, tin and minute quantities of other impurities. The magnesium scrap metal came from Volkswagen motor parts and aircraft wheels (DHS, 1979a).

Feed stock such as scrap metal was fed into vats for melting. These vats also contained flux composed of salts that helped to effect the separation of impurities in the metal. Fluxes were potassium chloride, magnesium chloride, and sodium chloride. When the feed stock was molten, the impurities in the feed stock, such as dirt and metal oxides, rose to the top of the vat of molten material. These impurities (slag) were skimmed off the top of the molten metal and washed. Slag that was dense settled to the bottom of these vats and was also removed and washed. The dense slag was often ferrous metals which do not melt at these temperatures. Molten material in the middle (horizontally stratified) portion of the vat was considered metal suitable for sale as recycled material. This metal was decanted and poured into casts and sold as ingots.

The two slags (top and bottom layers) were removed by heavy equipment and placed in a large horizontal rotating drum adjacent to the OID. The slag material was sprayed forcefully with surface water that was pumped from the OID. In theory, the water dissolved away soluble salts used in the flux, leaving the metals behind. Small amounts of metals (mostly aluminum and magnesium) and oxides may also have been washed away and deposited as waste material. The rotating drums had various perturbations and screens in which they broke up the slag material. The water used to spray the slag material exited the drum as a slurry made up of suspended solids, salts, and ferrous and non-ferrous metals.

As the slurry exited the rotating drums, it was poured into a shaker that was in a sump-like depression. Here the slurry drained away from the shaker and was pumped out and into the settling ponds on the east side of the OID. The solids left over from the shaker were moved upward with a conveyor belt and separated into magnetic and non-magnetic materials, dumped into bins, then trucked back to the Smelter for either feedstock (non-ferrous), or disposal (ferrous). The ferrous metals were sold or disposed of, but not recycled on site.

Between approximately 1965 and 1971, Halaco discharged their industrial waste water into the OID under permit with the Oxnard Sanitation District. This practice was discontinued and the WMU was created in approximately 1971, when the Los Angeles Regional Water Quality Control Board (LARWQCB) began monitoring Halaco's discharge (DHS, 1979a). After 1971, industrial waste from the smelter was piped across the OID to the WMU. Discharged waste included washer-tumbler water and the water from the furnace stack scrubbers. Solids settled out into the pond and the clarified water was pumped back to the plant for reuse.

Historically, after the liquid portion of the waste slurry dried, solids from the WMU were dredged up and deposited on the WMU berms. After 1965 and prior to 1977, Halaco began depositing waste solids on the disputed 15-acre wetlands area to the north of the WMU.

In July 1969, Halaco obtained a Radioactive Materials License to handle magnesium-thorium alloy in the form of scrap metal. The possession limit was reported as 5,000 pounds of alloy, not to exceed 4% thorium. Authorized use included melting of scrap alloy and dilution to 0.05% thorium. The permit expired in August 1974 (DPHRML, 1969). Between 1965 and 1977, it was estimated that Halaco received and processed 500 to 600 pounds of magnesium-thorium scrap per year. Thorium, Potassium-40, and Cesium-137 have been detected in solid and/or leachate waste at the Halaco facility.

In June 2000, the LARWQCB estimated that 430,000 cubic yards of waste material were present in the WMU at thicknesses varying between 20 and 40 feet. In June 2000, USACE staff informed the LARWQCB that the area east of Halaco's surface impoundment was comprised of a substantial area of wetlands subject to USACE jurisdiction.

In response to LARWQCB's March 2002 Cease and Desist Order (CDO) No. R4-2002-0064, Halaco ceased discharge of wastes to the WMU in September 2002 and began operating a filter press to process the waste slurry. The filter press generated a filtrate wastewater with reduced solids content and a semi-solid "filter cake" consisting of the solids removed from the slurry. The wastewater generated in the filtration process was discharged into the City of Oxnard sanitary sewer system or re-circulated at the site. Sewer discharge ceased in June 2003 when the permit to discharge terminated and was not renewed. In July 2003, the LARWQCB issued a Notice of Violation for piles of filter cake improperly stored on the smelter side of the property (RWQCB, 2005).

Pursuant to the March 2002 CDO, Halaco characterized site wastes to determine whether the solid waste was inert. Based on Halaco's report, the LARWQCB determined that the solid waste was not

inert due to elevated levels of ammonia that could be released to ground and surface waters (RWQCB, 2003a).

In late 2004, all Halaco process operations ceased. Employees were terminated and filter cake and baghouse dust was sent to La Paz Landfill in Arizona for disposal. In a letter dated June 6, 2005, Halaco informed the LARWQCB that they did not have the funds to complete the required site characterization. In a subsequent letter from Halaco to the LARWQCB, Halaco reported that they had ceased operations at the site (RWQCB, 2005).

2.4 Previous Investigations

2.4.1 Metals

This section of the historical sampling summary discusses soil and waste material sampling and metals analysis activities between 1979 and 2004. The investigations that generated the data described below were performed by regulatory agencies and Halaco's consultants. Extensive data were available for areas east of the OID representing Halaco waste material. Limited data have been collected on areas west of the OID representing smelter operations. Soil and waste material concentrations are compared to appropriate hazardous waste determining and health-based action levels, which are described in section 3.0.

2.4.1.1 Soluble Threshold Limit Concentration (STLC) Metals

In October 1985, a total of 23 soil samples were collected by the Department of Toxic Substances Control (DTSC) from background, smelter, north of the WMU and WMU locations. Samples were analyzed for STLC aluminum, cadmium, chromium, copper, lead, magnesium, and zinc. There are no STLC criteria for aluminum and magnesium. Aluminum STLC concentrations ranged from less than 10 to 3,900 mg/l. Magnesium concentrations ranged from 27 to 3,900 mg/l. Chromium, lead, and zinc did not exceed the STLC criteria (DHS, 1985).

- Cadmium concentrations exceeded the STLC of 1 mg/l in one sample collected from powder found in the smelter area at a concentration of 1.1 mg/l.
- Copper concentrations exceeded the STLC of 25 mg/l in two samples, both collected from the WMU, at concentrations of 30 and 650 mg/l.

In August 2002, Padre Associates, Inc., on behalf of Halaco, collected 73 samples from 28 borings within the WMU at depths varying from 2 to 30 feet below ground surface (bgs). Select samples were analyzed for STLC barium, copper, lead and zinc. Barium and zinc concentrations were reported for 20 of the samples and did not exceed STLC criteria of 100 and 250 mg/l, respectively.

- Copper concentrations, ranging from 3.8 to 480 mg/l, exceeded the STLC limit of 25 mg/l in 44 of the 73 samples analyzed. The highest concentration was detected at 12 feet bgs in the WMU. Seven of the 28 boring locations had copper concentrations that exceed STLC

in the top ten feet. The average STLC copper concentration for the WMU during this investigation was 45.5 mg/l, which is nearly twice the STLC for copper.

- Lead exceeded the STLC limit of 5 mg/l in 3 of the 73 samples analyzed, at 56, 6.3 and 5.2 mg/l. All three samples were collected between 12 and 14 feet bgs.

In October 2004, the DTSC collected five samples related to filter press operations from the smelter area. Samples were analyzed for STLC arsenic, barium, beryllium, cadmium, chromium, copper, lead, nickel, and zinc. Only beryllium concentrations exceeded the STLC criteria of 0.75 mg/l. Sample location maps were not provided for this data set. Filter cake has reportedly been shipped off-site to a waste facility in Arizona, but no manifests or bills of lading have been made available to confirm the waste disposition.

- Beryllium concentrations exceeded STLC criteria of 0.75 mg/l in 3 filter cake related samples at concentrations of 0.92, 1.4 and 2.2 mg/l.

2.4.1.2 Total Threshold Limit Concentration (TTLC) Metals

In December 1979, the California Department of Fish and Game (DFG) collected seven soil samples from the WMU, OID, and north of the WMU. Soil samples were analyzed for arsenic, chromium, copper, iron, lead, manganese, mercury, nickel, and zinc. Only copper and zinc exceeded TTLC criteria (DFG, 1980).

In December 1979, 18 soil samples were collected by the California Department of Health Services (DHS) and analyzed for TTLC metals. Samples were collected from in and around the WMU. Barium, chromium, lead, nickel and zinc concentrations were below TTLC criteria. Copper exceeded the TTLC criteria of 2,500 milligrams per kilogram (mg/kg) in four of the five samples analyzed, ranging in concentration from 3,000 to 7,440 mg/kg. The highest copper concentration was located in the WMU, on the north side.

Twelve soil samples were collected in and around the WMU by the National Enforcement Information Center for the EPA in December 1980 and were analyzed for total metals. Only copper and zinc exceeded TTLC criteria (EPA 1981).

In August 1985, the DFG collected five soil samples from the WMU for heavy metals analysis. Only chromium, copper and zinc exceeded TTLC criteria. (DFG, 1985).

In October 1985, the DHS collected and analyzed 38 soil samples from background, inside and north of WMU, Ormond Beach, and smelter locations. Only copper and zinc exceeded TTLC criteria (DHS, 1985).

In September 1991, Ecology and Environment, Inc., while performing a Listing Site Inspection (LSI) for the EPA, collected 30 soil samples east of the WMU, 49 soil samples north of the WMU using a 50 by 100 foot grid, and 7 background samples. Barium, beryllium and copper exceeded TTLC criteria. The LSI report concluded that hazardous substances, pollutants and contaminants exist

within Halaco wastes and appear to have migrated off-site, to the area east of the WMU (EPA, 1992).

- Barium exceeded TTLC criteria of 10,000 mg/kg in one soil sample collected east of the WMU at a concentration of 21,800 mg/kg.
- Beryllium exceeded TTLC criteria of 75 mg/kg in one sample collected east of the WMU at 202 mg/kg and one soil sample from north of the WMU at 92.4 mg/kg.
- Copper exceeded TTLC criteria of 2,500 mg/kg with concentrations ranging from 2,880 to 5,050 mg/kg in five soil samples collected east of the WMU. Eleven soil samples from north of the WMU exceeded copper TTLC criteria with concentrations ranging from 2,630 to 8,740 mg/kg.

In October 2004, the DTSC collected five samples related to filter press operations from the smelter area. Samples were analyzed for select total metals. Only beryllium exceeded TTLC criteria. Sample location maps were not provided for this data set (Interagency 2004). The filter cake has reportedly been shipped off-site to a waste facility in Arizona, but no manifests or bills of lading have been made available to confirm the waste disposition.

2.4.1.3 Toxicity Characteristic Leaching Procedure (TCLP) Metals

In December 1980 and September 1991, a total of fourteen samples were collected from the WMU, OID, north and east of the WMU and analyzed for TCLP metals. None of the samples analyzed exceeded the TCLP criteria

2.4.1.4 Preliminary Remediation Goals

Many metals, including some of those discussed in the paragraphs above, exceed the EPA Residential Preliminary Remediation Goals (PRG_s).

From the over 190 samples collected between 1979 and 2004, described in the TTLC section above, metals data indicate that aluminum, arsenic, chromium, barium, cadmium, copper, lead, iron, manganese and vanadium exceeded their PRG_s for one or more samples.

2.4.2 Radionuclides

In December 1979, Halaco collected and analyzed one composite sample from the WMU for radioactivity; no measurable radioactivity was detected (Trusesdail, 1980). During the September 1991 E&E LSI, one sample was collected from east of the WMU and analyzed for alpha and beta radiation. Analytical results were less than 10 picoCuries per gram (pCi/g) for both samples (EPA 1992). In December 1991, the DHS Radiological Health Branch performed a walk through survey for radiation with handheld instruments. The survey did not detect any radiation, however, it was noted that if radiation was present, it would be buried under 20 years of slag material (E & E, 1991).

In August 1999, LARWQCB staff inspected the site and collected environmental samples. Leachate was observed seeping out of the east side of Halaco's waste pile and flowing into the wetland area east of the WMU. A sample was collected in the immediate vicinity of a leachate seep and analyzed

for thorium. This sample contained Thorium 232 (^{232}Th) and Thorium 228 (^{228}Th) at concentrations approximately 20 times that of background. A sediment sample was also collected from the bank surface of the OID and contained ^{232}Th and ^{228}Th at approximately 100 times that of background. Background was approximately 1.0 pCi/g for both ^{232}Th and ^{228}Th (RWQCB 2000a).

In March 2000, LARWQCB participated in a joint sampling event with Halaco. Results indicated Halaco's leachate was being discharged to groundwater as evidenced by the presence of Potassium 40 (^{40}K) in groundwater adjacent to the WMU. The groundwater sample collected from adjacent to the WMU contained 15,190 picoCuries per liter (pCi/l) of ^{40}K . The background concentration in the OID was 44.7 pCi/l of ^{40}K . Halaco's effluent concentration was 10,610 pCi/l of ^{40}K . Results also indicated that leachate was being discharged to surface water as evidenced by the presence of ^{40}K at concentrations ranging from 739 to 780 pCi/l of ^{40}K . Halaco's leachate, effluent, surface water and OID sample concentrations of ^{40}K exceeded the Rad-PRG for tap water of 1.93 pCi/l (E & E, 2006).

In October 2000, TetraTech reported the results of a limited Multi-Agency Radiation Site Survey and Investigation Manual (MARSSIM) survey for Halaco. The highest reading encountered was 15,000 counts per minute and located along the bank of the OID near the northeast bridge. This level was approximately five times background radiation levels. In a March 29, 2001 letter to Halaco regarding this report, the DHS indicated that the type of MARSSIM survey was not adequate to characterize radioactive contamination at the Halaco site. This letter references a sample collected by DHS from Halaco in August 1999 which contained source material in excess of 0.05% by weight and therefore Halaco is a user as defined by California Code of Regulations Title 17 Section 30100 (E & E, 2006).

In August 2002, Padre Associates collected 20 waste samples from the WMU from depths ranging from 3 to 28 feet bgs. Samples were analyzed for ^{228}Th , ^{230}Th , and ^{232}Th . ^{228}Th concentrations ranged from 0.235 to 9.17 pCi/g, and exceeded the Rad-PRG for residential soil. ^{228}Th concentrations were less than the Rad-PRG for outdoor worker soil. ^{230}Th concentrations ranged from 0.358 to 9.52 pCi/g, and exceeded the Rad-PRG for residential soil. ^{230}Th concentrations were less than the Rad-PRG for outdoor worker soil. ^{232}Th concentrations ranged from 0.19 to 6.92 pCi/g, and exceeded the Rad-PRG for residential soil. ^{232}Th concentrations were less than the Rad-PRG for outdoor worker soil. The highest concentrations were detected at 25 feet bgs and elevated concentrations were also detected at the maximum explored depth of 28 feet bgs (E & E, 2006).

Previous industrial process wastewater sampling indicated detectable levels of Cesium-137 (^{137}Cs) at Halaco. A follow-up screening survey was performed by DHS staff to identify a source. Only elevated levels of ^{40}K were identified in areas where potash was used or stored. A subsequent wastewater sample was collected in June 2003 and indicated ^{40}K at 21,970 pCi/l and ^{137}Cs at 13.4 pCi/l. Both the ^{40}K and ^{137}Cs concentrations exceeded the Rad-PRGs for tap water. The levels of ^{137}Cs were approximately the same as earlier results indicating that there may be a source of ^{137}Cs in Halaco's water system which is slowly being leached out during routine operations (E & E, 2006).

The Brash Industries Halaco Engineering WMU Data Analysis document reported that the highest thorium concentrations detected in well water was ^{230}Th at 12 +/- 8.49 pCi/l collected in November 2003 (R3). This concentration exceeds the Rad-PRG for ^{230}Th at 0.52 pCi/l.

Alpha and beta radiation particles have been detected in surface and ground water collected at the site between June 2003 and November 2004. Alpha particles exceed the EPA Maximum Contaminant Level (MCL) of 15 pCi/l in multiple groundwater and one surface water location. Beta particles did not have a comparable MCL or other water quality comparison criteria.

2.5 Hazard Ranking System (HRS) Considerations

The HRS is a scoring system used to assess the relative threat associated with actual or potential releases of hazardous substances from sites. It is the principal mechanism the EPA has to place sites on the NPL. The relevant data necessary to evaluate a site includes releases to groundwater, surface water, soil and air, toxicity and quantity of substances released and receptors potentially impacted/affected by the substances. Field sampling is often required to verify a release. The quality of the data must be sufficient to meet the criteria for usage in the HRS, in accordance with the data quality objectives documented in the *Guidance for Data Usability in Site Assessment*, Interim Final, January 1993.

2.5.1 Waste Characteristics

For HRS purposes, a source is defined as an area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance.

Potential hazardous substance sources associated with the Halaco site include, but may not be limited to:

- Remaining process materials in the smelter portion of the site, including soils contaminated by site operations.
- Contaminated soils/wastes in the WMU.

2.5.2 HRS Pathways

2.5.2.1 Groundwater Pathway

In determining a score for the groundwater migration pathway, the HRS evaluates: 1) the likelihood that sources at a site actually have released, or potentially could release, hazardous substances to groundwater; 2) the characteristics of the hazardous substances that are available for a release (i.e., toxicity, mobility, and quantity); and 3) the people (targets) who actually have been, or potentially could be, impacted by the release. For the targets component of the evaluation, the HRS focuses on the number of people who regularly obtain their drinking water from wells that are located within

4 miles of the site. The HRS emphasizes drinking water usage over other uses of groundwater (e.g., food crop irrigation and livestock watering), because, as a screening tool, it is designed to give the greatest weight to the most direct and extensively studied exposure routes.

In February 1972, a California State Water Resources Board (SWRCB) Geologist, G. Torres, reviewed hydrogeologic conditions in the vicinity of the WMU. Torres also reviewed data generated during installation of 4 exploratory borings by Buena Engineers in September 1970, in the vicinity of the WMU, to a maximum depth of 18 feet bgs. Torres concluded that this work provided insufficient information to demonstrate that hydraulic continuity did not exist between the evaporation pond, underlying aquifers, the OID or the surrounding marshland. Studies conducted in a nearby area indicated that significant amounts of fluid can be transmitted through underlying soils. Since there is hydraulic continuity between surface water and water within the semi-perched zone, groundwater and surface water quality impairment can occur from a surficial source (SWRCB, 1972; RWQCB, 1972).

Based on groundwater isopleths measured by Padres and Associates in 2003, Groundwater in the site vicinity flows inland from the site toward local residential, industrial, and agricultural areas. Groundwater near the site is encountered at depths ranging from 3 to 5 feet below ground surface. A number of drinking water wells are located within four miles of the site, serving the residential neighborhood located approximately ½ mile north of the site. Information regarding the well locations and population served will be collected during this IA. In addition, groundwater within four miles of the site is used for agricultural purposes, to water crops intended for human consumption.

A release of hazardous substances from the Halaco site to groundwater is suspected based on the use of settling ponds in the WMU for waste disposal for over 30 years, and based on historical practices in the smelter portion of the site. Therefore, groundwater samples will be collected upgradient of, beneath, and downgradient of the site to determine whether an observed release can be established.

2.5.2.2 Surface Water Pathway

In determining the score for the surface water pathway, the HRS evaluates: 1) the likelihood that sources at a site actually have released, or potentially could release, hazardous substances to surface water (e.g., streams, rivers, lakes, and oceans); 2) the characteristics of the hazardous substances that are available for a release (i.e., toxicity, persistence, bioaccumulation potential, and quantity); and 3) the people or sensitive environments (targets) who actually have been, or potentially could be, impacted by the release. For the targets component of the evaluation, the HRS focuses on drinking water intakes, fisheries, and sensitive environments associated with surface water bodies within 15 miles downstream of the site.

The area to the north, east, and south of the WMU may be classified as wetlands. In addition, information regarding the location of habitats for endangered and threatened species will be obtained. The Pacific Ocean fishery is located immediately downstream of the wetlands area located

to the south of the site. Detailed information regarding fishery yield, and human consumption of the fish will be obtained during the IA for HRS scoring purposes.

The OID flows north to south through the site, between the smelter and WMU, and discharges to the wetlands area immediately south of the site, and to the Pacific Ocean. From 1965 through 1971, Halaco discharged their waste water to the OID.

Based on the proximity of the WMU and smelter areas to the OID, a release of hazardous substances to the OID is suspected. Because the WMU is bermed with materials dredged from the settling ponds, a release of hazardous substances to the wetlands areas east and south of the site is suspected. A release of hazardous substances from the site to the Pacific Ocean fishery is also suspected. Therefore, surface water and sediment samples will be collected from the OID upstream, within, and downstream of the site. Samples will also be collected from the wetlands soils surrounding the site, and from the Pacific Ocean fishery sediments.

2.5.2.3 Soil Exposure Pathway

In determining the score for the soil exposure pathway, the HRS evaluates: 1) the likelihood that there is surficial contamination associated with the site (e.g., contaminated soil that is not covered by pavement or at least 2 feet of clean soil); 2) the characteristics of the hazardous substances in the surficial contamination (i.e., toxicity and quantity); and 3) the people or sensitive environments (targets) who actually have been, or potentially could be, exposed to the contamination. For the targets component of the evaluation, the HRS focuses on populations that are regularly and currently present on or within 200 feet of surficial contamination. The four populations that receive the most weight are residents, students, daycare attendees, and terrestrial sensitive environments.

In 2004, all site operations ceased, and employees were terminated. There do appear to be people living in trailers at the site, and there is at least one employee still working at the site. In addition, the site is accessible to joggers and off-road vehicles; evidence of this was observed by EPA during a March 2006 site visit. Because the site is adjacent to nearby wetlands and critical habitat for several endangered species, it is likely that endangered wildlife could migrate onto the site and/or contaminants could migrate to critical habitats.

2.5.2.4 Air Pathway

In determining the score for the air migration pathway, the HRS evaluates: 1) the likelihood that sources at a site actually have released, or potentially could release, hazardous substances to ambient outdoor air; 2) the characteristics of the hazardous substances that area available for a release (i.e., toxicity, mobility, and quantity); and 3) the people or sensitive environments (targets) who actually have been, or potentially could be, impacted by the release. For the targets component of the evaluation, the HRS focuses on regularly occupied residences, schools, and workplaces within 4 miles of the site. Transient populations, such as customers and travelers passing through the area, are not counted.

General wind direction is inland from the site toward residential and industrial areas. There are approximately 133,771 residents living within four miles of the site. In addition, a wastewater treatment plant, paper plant, and metal stamping plant are located downwind within 1/4 mile of the site. Information regarding the number of workers at these plants will be obtained during the IA for HRS scoring purposes.

A release of hazardous substances from the site to air is suspected based on complaints from nearby workers and residents regarding deposition of WMU materials off-site. In addition, the ambient wind direction from the Pacific Ocean, and the large amount of fine-grained materials at the WMU suggests that a release to air is likely. Therefore, air samples will be collected both upwind and downwind of the site. Air samples will also be collected at locations 1/4, and 1/2 mile from the site to determine actual contamination of local workers and residents.

2.6 Removal Considerations

The sampling strategy outlined in this SAP has also been designed so that, wherever possible, samples are collected at locations, and the analyte suite is chosen, to fulfill both the HRS and Removal Assessment considerations.

2.6.1 Waste Characteristics

For Removal Assessment purposes, the wastes include all abandoned waste materials from the recycling operations, as well as chemicals used in the operations of the facility that are now abandoned on site. The waste materials from the recycling operations include slag in both the WMU and the Smelter areas. These wastes have accumulated throughout the 40-year operational history of the Site. The primary Removal Assessment goal is to establish the nature of the waste to determine how best to proceed with stabilization, remediation and/or disposal options.

The relevant analyses and data treatment are defined under 40 CFR Part 261.4 for characteristic hazardous waste determination. The waste is not a Listed Hazardous Waste. Previous data indicate that Corrosiveness, Flammability, and Reactivity are not concerns with the slag/dross waste, but may be issues with some of the abandoned chemicals. The two primary removal concerns with the slag/dross waste at the site are: 1) Do the concentrations of toxic metals and radionuclides in the waste exceed health-based guidance and/or regulatory threshold values? and 2) Are the metals present sufficiently leachable as to cause the waste to be classified as either a RCRA or California Hazardous Waste? In order to determine whether the concentrations of metals and radionuclides exceed health-based guidance and/or regulatory threshold values, samples will be collected from wastes in both the Smelter and the WMU.

2.6.2 Threat of Release To Human Health and the Environment

2.6.2.1 Wetland Soils

In order to determine whether contaminants from the Site have migrated to nearby ecologically sensitive areas, soil samples will be collected in the wetlands areas adjacent to the Site. The wetlands will be delineated before sampling commences.

2.6.2.2 Beach, Marine, and OID Sediments

In order to determine whether contaminants from the Site have migrated to adjacent areas with recreational use and or Clean Water Act considerations, sediment samples will be collected in the beach areas adjacent to the Site, the OID, and nearshore marine sediments in the outfall area of the OID. Because longshore currents move beach sediments from the Northwest to the Southeast, downgradient samples will be collected to the Southeast of the OID outfall, and background beach sediments will be collected to the Northwest of the OID outfall. In addition, data collected from beach and OID sediments may be used to fulfill the HRS Surface Water Exposure Pathway, as described in Section 2.6.2.2.

2.6.2.3 Non-Wetland Soils

In order to determine whether contaminants from the Site have migrated to adjacent areas where human health issues may be a concern, soil samples will be collected from non-wetlands areas. Non-wetlands soils are distinguished from wetlands soils because the primary action level for non-wetlands soils is health-based, rather than ecology-based. Soils will be collected from areas directly adjacent to the Site, from residential yards and agricultural fields downwind/downgradient of the Site, and background locations upwind/upgradient of the Site.

2.6.2.4 Air Samples

In order to determine whether contaminants from the Site are present as particulates in ambient air, air filter samples will be collected at six locations around the Site. These locations will be chosen based on predominant wind conditions in order to determine the presence of metals and radionuclides in ambient air upgradient and downgradient from the Site. In addition, air sample data may be used to fulfill the HRS Air Exposure Pathway, as described in Section 2.6.2.4.

3.0 PROJECT OBJECTIVES

3.1 Project Task and Problem Definition

WESTON has been tasked to conduct sampling of waste, soil, groundwater, surface water, sediment, and air to assess potential contamination as defined in Sections 2.6 and 2.7. To document the presence of hazardous substances in the source, site soils and smelter waste materials will be sampled. To establish an observed release to groundwater, groundwater samples will be collected upgradient and downgradient of the site. To establish an observed release to surface water, surface

water and sediment samples will be collected upstream and downstream of the site. In addition, sediment samples will be collected from the Pacific Ocean fishery immediately downstream of the site to determine whether actual contamination in the fishery can be documented. To establish an observed release to air, air samples will be collected upwind and downwind of the site. To establish a release, threat of release, and/or threat to human health and the environment, soil and sediment samples will be collected in adjacent areas where contaminants may have migrated, including adjacent wetland, agricultural, residential, and soils and sediments where recreational activities take place, such as the beach and adjacent parcels.

To characterize the wastes in the Smelter and WMU, samples will be collected from the waste materials in a statistically defensible manner, as described in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (OSWER SW-846 see Chapter 9, Random Sampling Section). To establish whether the waste materials and/or contaminants from the waste materials have released to the environment, soil, air, and sediment samples will be collected from adjacent areas adjacent to, and in background areas of, the site. The choice of sample locations has, wherever possible, been chosen to fulfill both the HRS and ERS goals of this investigation.

All solid-matrix (including waste, soil and sediment) and air samples will be submitted for field laboratory analysis of metals using a field XRF unit, as well as gamma spectroscopy for radionuclides. At least 20% of the solid-matrix samples will be submitted to a EPA Contract Laboratory Program (CLP) laboratory for definitive metals analysis. At least 20% of the air samples will be submitted to a laboratory to be determined for metals analysis. Subsurface soil and waste samples will be screened for volatile organic compounds (VOCs) using a photon ionization detector instrument. A minimum of ten percent of the samples, preferentially those samples yielding PID readings greater than 5 ppm, will be submitted for analysis of VOCs at a CLP laboratory. Groundwater and surface water samples will be submitted to a laboratory for metals and radionuclide analyses. In addition, groundwater samples will be analyzed for VOCs at a CLP laboratory.

3.2 Data Use Objectives

Data collected during this site investigation will be used to:

- Determine the concentrations of VOCs, metals, and radionuclides in site soils and other source materials to document the presence of hazardous substances in the source.
- Determine whether the waste materials at the site may be classified as Hazardous Wastes under RCRA and/or California law.
- Document the concentrations of VOCs, metals, and radionuclides in groundwater to evaluate whether an observed release to groundwater has occurred and can be attributed to the site.
- Document the concentrations of metals and radionuclides in surface water and sediments to evaluate whether an observed release to surface water has occurred and can be attributed to the site.
- Document the concentrations of metals and radionuclides in air to evaluate whether an observed release to air has occurred and can be attributed to the site.

- Determine whether the waste pile poses a threat to human health and/or the environment for Removal Assessment purposes.
- Evaluate whether further characterization of the site is necessary.

3.3 Action Levels

3.3.1 Action Levels for HRS Objectives

As discussed in the HRS, the action levels for source areas are concentrations elevated above the background levels from a comparable background location located outside of the area potentially influenced by the site. The action levels for groundwater, surface water, sediment, and air are, as dictated by the HRS, concentrations significantly above background levels, and concentrations above health based benchmarks as published in the Superfund Chemical Data Matrix. For VOCs and metals, significantly above background is defined as three times above the background concentration. If the background concentration is below detection, then the action level is the Quantitation Limit (QL). For radionuclides, significantly above background is defined as 2 standard deviations above the mean activity level in background samples. If the background concentration is below detection, then the action level is the QL. To determine action levels, sufficient background samples will be collected during this sampling event to ensure comparable results. HRS action levels are presented in Tables 3-1 through 3-3.

Based on a review of the historical data, the constituents deemed most likely to be elevated above background levels throughout the site are metals and the radionuclides thorium 232 (^{232}Th), thorium 228 (^{228}Th), potassium 40 (^{40}K) and cesium 137 (^{137}Cs). In addition, chlorinated solvents and hydrocarbons, including benzene, toluene, ethylbenzene, xylenes (BTEX), and trichloroethene (TCE), may be elevated in subsurface soils beneath the Smelter. Therefore, these are the main analytes of concern (AOCs) for this investigation. However, if any other VOCs or metals are detected during analysis, they will also be evaluated as potential AOCs by comparison with their action levels as described above.

3.3.2 Action Levels for Removal Objectives

3.3.2.1 Risk to Human Health and Threat of Release

The action levels for non-wetland soils and wastes are the Region 9 (or Cal-Modified, if applicable) PRG_s. The PRG_s are risk-based guidelines that take into account human exposure pathways. Because of the proximity of the site to recreational areas and the likelihood that such a site may be developed for residential use, the PRG_s are the most useful reference to establish detection limits and cleanup goals for the site. In the event that background concentration for a given analyte exceeds the PRG_r, the background concentration becomes the default action level. The PRG_s for arsenic, antimony, cadmium, and thallium are lower than the detection limit for the XRF screening level; the project will use definitive data only for the determination of attribution of these metals to the site.

Table 3-1: Data Quality Indicator Goals - Soil/Sediment/Waste

Method Analytes	Site Assessment Action Level (sediment)	Site Assessment Action Level (soil)*	Removal Action Level (PRGr)	Removal Action Level (SQuiRT)	CRQL	Accuracy (% Recovery for MS/MSD)	Precision (RPD for MS/MSD and duplicates)	Percent Complete
CLPAS ILM05.2 for metals, mg/kg								
Aluminum	3xbkg	---	76,000	25,000	20	65-135	≤50	≥90
Antimony	3xbkg	31	31	---	6	65-135	≤50	≥90
Arsenic	3xbkg	22	22	5.9	1	65-135	≤50	≥90
Barium	3xbkg	5,400	5,400	---	20	65-135	≤50	≥90
Beryllium	3xbkg	150	1560	---	0.5	65-135	≤50	≥90
Cadmium	3xbkg	37	37	0.58	0.5	65-135	≤50	≥90
Calcium	3xbkg	---	---	---	500	65-135	≤50	≥90
Chromium	3xbkg	210	210	36.2	1	65-135	≤50	≥90
Cobalt	3xbkg	---	900	10	5	65-135	≤50	≥90
Copper	3xbkg	---	3,100	35.7	2.5	65-135	≤50	≥90
Iron	3xbkg	---	23,000	188,400	10	65-135	≤50	≥90
Lead	3xbkg	---	150	35	1	65-135	≤50	≥90
Magnesium	3xbkg	---	---	---	500	65-135	≤50	≥90
Manganese	3xbkg	11,000	1,800	630	1.5	65-135	≤50	≥90
Mercury	3xbkg	23	23	174	0.1	65-135	≤50	≥90
Nickel	3xbkg	1,600	1,600	18,000	4	65-135	≤50	≥90
Potassium	3xbkg	---	---	---	500	65-135	≤50	≥90
Selenium	3xbkg	390	390	---	3.5	65-135	≤50	≥90
Silver	3xbkg	390	390	---	1	65-135	≤50	≥90
Sodium	3xbkg	---	---	---	500	65-135	≤50	≥90
Thallium	3xbkg	---	5	---	2.5	65-135	≤50	≥90
Vanadium	3xbkg	550	550	---	5	65-135	≤50	≥90
Zinc	3xbkg	23,000	23,000	98	6	65-135	≤50	≥90

Method Analytes	Site Assessment Action Level (sediment)	Site Assessment Action Level (soil)*	Removal Action Level (PRGr)	Removal Action Level (SQuiRT)	CRQL	Accuracy (% Recovery for MS/MSD)	Precision (RPD for MS/MSD and duplicates)	Percent Complete
CLPAS SOM01.1 for VOCs, µg/kg								
Dichlorodifluoromethane	3xbkg	---	94,000	11,000	5	65-135	≤50	≥90
Chloromethane	3xbkg	---	47,000	---	5	65-135	≤50	≥90
Vinyl Chloride	3xbkg	430	79	11,600	5	65-135	≤50	≥90
Bromomethane	3xbkg	---	3,900	---	5	65-135	≤50	≥90
Chloroethane	3xbkg	---	3,000	---	5	65-135	≤50	≥90
Trichlorofluoromethane	3xbkg	23	390,000	11,000	5	65-135	≤50	≥90
1,1-Dichloroethene	3xbkg	3,900,000	510,000	---	5	65-135	≤50	≥90
1,1,2-Trichloro-1,2,2-	3xbkg	---	---	---	5	65-135	≤50	≥90
Acetone	3xbkg	70,000,000	14,000,000	---	10	65-135	≤50	≥90
Carbon Disulfide	3xbkg	7,800,000	360,000	---	5	65-135	≤50	≥90
Methyl acetate	3xbkg	---	22,000,000	---	5	65-135	≤50	≥90
Methylene chloride	3xbkg	85,000	9,100	11,000	5	65-135	≤50	≥90
trans-1,2-Dichloroethene	3xbkg	1,600,000	---	---	5	65-135	≤50	≥90
Methyl tert-butyl ether	3xbkg	---	32,000	---	5	65-135	≤50	≥90
1,1-Dichloroethane	3xbkg	7,800,000	510,000	---	5	65-135	≤50	≥90
cis-1,2-Dichloroethene	3xbkg	780,000	---	---	5	65-135	≤50	≥90
2-Butanone	3xbkg	47,000,000	22,000,000	---	10	65-135	≤50	≥90
Bromochloromethane	3xbkg	---	820	---	5	65-135	≤50	≥90
Chloroform	3xbkg	780,000	220	28,900	5	65-135	≤50	≥90
1,1,1-Trichloroethane	3xbkg	---	1,200,000	18,000	5	65-135	≤50	≥90
Cyclohexane	3xbkg	---	140,000	---	5	65-135	≤50	≥90
Carbon tetrachloride	3xbkg	4,900	250	35,200	5	65-135	≤50	≥90
Benzene	3xbkg	12,000	640	5,300	5	65-135	≤50	≥90
1,2-Dichloroethane	3xbkg	7,000	280	118,000	5	65-135	≤50	≥90

Method Analytes	Site Assessment Action Level (sediment)	Site Assessment Action Level (soil)*	Removal Action Level (PRGr)	Removal Action Level (SQuiRT)	CRQL	Accuracy (% Recovery for MS/MSD)	Precision (RPD for MS/MSD and duplicates)	Percent Complete
1,4-Dioxane	3xbkg	---	44,000	---	100	65-135	≤50	≥90
Trichloroethene	3xbkg	58,000	53	45,000	5	65-135	≤50	≥90
Methylcyclohexane	3xbkg	---	2,600,000	---	5	65-135	≤50	≥90
1,2-Dichloropropane	3xbkg	9,400	100,000	---	5	65-135	≤50	≥90
Bromodichloromethane	3xbkg	10,000	820	---	5	65-135	≤50	≥90
cis-1,3-Dichloropropene	3xbkg	6,400	780	6,060	5	65-135	≤50	≥90
4-Methyl-2-pentanone	3xbkg	---	---	---	10	65-135	≤50	≥90
Toluene	3xbkg	16,000,000	520,000	17,500	5	65-135	≤50	≥90
trans-1,3-Dichloropropene	3xbkg	6,400	780	---	5	65-135	≤50	≥90
1,1,2-Trichloroethane	3xbkg	11,000	730	18,000	5	65-135	≤50	≥90
Tetrachloroethene	3xbkg	12,000	480	9,320	5	65-135	≤50	≥90
2-Hexanone	3xbkg	---	---	---	10	65-135	≤50	≥90
Dibromochloromethane	3xbkg	---	1,100	11,000	5	65-135	≤50	≥90
1,2-Dibromoethane	3xbkg	7.5	32	---	5	65-135	≤50	≥90
Chlorobenzene	3xbkg	1,600,000	150,000	250	5	65-135	≤50	≥90
Ethylbenzene	3xbkg	7,800,000	400,000	32,000	5	65-135	≤50	≥90
o-Xylene	3xbkg	160,000,000	270,000	---	5	65-135	≤50	≥90
m,p-Xylene	3xbkg	160,000,000	270,000	---	5	65-135	≤50	≥90
Styrene	3xbkg	16,000,000	1,700,000	---	5	65-135	≤50	≥90
Bromoform	3xbkg	---	62,000	---	5	65-135	≤50	≥90
Isopropylbenzene	3xbkg	---	---	---	5	65-135	≤50	≥90
1,1,2,2-Tetrachloroethane	3xbkg	3,200	410	9,320	5	65-135	≤50	≥90
1,3-Dichlorobenzene	3xbkg	---	530,000	1,120	5	65-135	≤50	≥90

Method Analytes	Site Assessment Action Level (sediment)	Site Assessment Action Level (soil)*	Removal Action Level (PRGr)	Removal Action Level (SQuiRT)	CRQL	Accuracy (% Recovery for MS/MSD)	Precision (RPD for MS/MSD and duplicates)	Percent Complete
1,4-Dichlorobenzene	3xbkg	27,000	3,400	1,120	5	65-135	≤50	≥90
1,2-Dichlorobenzene	3xbkg	---	600,000	1,120	5	65-135	≤50	≥90
1,2-Dibromo-3-chloropropane	3xbkg	460	460	---	5	65-135	≤50	≥90
1,2,4-Trichlorobenzene	3xbkg	780,000	62,000	250	5	65-135	≤50	≥90
1,2,3-Trichlorobenzene	3xbkg	---	---	---	5	65-135	≤50	≥90
EPA Method 900 Radionuclides by Gamma Spectroscopy, pCi/kg								
Cesium 137	**	18,000	3.88	---	0.3	65-135	≤50	≥90
Potassium 40	**	---	0.108	---	0.01	65-135	≤50	≥90
Thorium 228	**	---	24.2	---	0.3	65-135	≤50	≥90
Thorium 230	**	---	3.4	---	0.3	65-135	≤50	≥90
Thorium 232	**	3,400	3.1	---	0.3	65-135	≤50	≥90

mg/kg milligrams analyte per kilogram soil

µg/kg: micrograms analyte per kilogram soil

pCi/kg: picoCuries analyte per kilogram soil

PRGr: EPA Region 9 Preliminary Remediation Goals for residential soil

SQuiRT: NOAA Screening Quick Reference Table Values for freshwater sediments - the lowest of Probable or Threshold Effects Level was chosen as the Action Level.

CRDL CLP Contract Required Detection Limits

MS/MSD Matrix Spike/Matrix Spike Duplicate

RPD Relative Percent Difference

CLPAS: EPA Contract Laboratory Program Analytical Services

*: Lower of Reference Dose Screening Concentration or Cancer Risk Screening Concentration from SCDM. Soil concentrations will also be compared to background.

**: 2 standard deviations above the mean background concentration

Table 3-2: Data Quality Indicator Goals - Groundwater & Surface Water

Method Analytes	Site Assessment Action Level (surface water, food chain)	Site Assessment Action Level (surface water, environmental)	Site Assessment Action Level (groundwater)*	CRQL	Accuracy (% Recovery for MS/MSD)	Precision (RPD for MS/MSD and duplicates)	Percent Complete
CLPAS ILM05.2 for metals, µg/l							
Aluminum	3xbkg	---	---	200	65-135	≤50	≥90
Antimony	3xbkg	---	6	60	65-135	≤50	≥90
Arsenic	3xbkg	36	10	10	65-135	≤50	≥90
Barium	3xbkg	---	2,000	200	65-135	≤50	≥90
Beryllium	3xbkg	---	4	5	65-135	≤50	≥90
Cadmium	3xbkg	8.8	5	5	65-135	≤50	≥90
Calcium	3xbkg	---	---	5,000	65-135	≤50	≥90
Chromium	3xbkg	---	100	10	65-135	≤50	≥90
Cobalt	3xbkg	---	---	50	65-135	≤50	≥90
Copper	3xbkg	3.1	1,300	25	65-135	≤50	≥90
Iron	3xbkg	---	---	100	65-135	≤50	≥90
Lead	3xbkg	8.1	15	10	65-135	≤50	≥90
Magnesium	3xbkg	---	---	5,000	65-135	≤50	≥90
Manganese	3xbkg	---	5,100	15	65-135	≤50	≥90
Mercury	3xbkg	0.94	2	0.2	65-135	≤50	≥90
Nickel	3xbkg	8.2	730	40	65-135	≤50	≥90
Potassium	3xbkg	---	---	5,000	65-135	≤50	≥90
Selenium	3xbkg	71	50	35	65-135	≤50	≥90
Silver	3xbkg	1.9	180	10	65-135	≤50	≥90
Sodium	3xbkg	---	---	5,000	65-135	≤50	≥90
Thallium	3xbkg	---	0.5	25	65-135	≤50	≥90
Vanadium	3xbkg	---	260	50	65-135	≤50	≥90
Zinc	3xbkg	81	11,000	60	65-135	≤50	≥90

Method Analytes	Site Assessment Action Level (surface water, food chain)	Site Assessment Action Level (surface water, environmental)	Site Assessment Action Level (groundwater)*	CRQL	Accuracy (% Recovery for MS/MSD)	Precision (RPD for MS/MSD and duplicates)	Percent Complete
CLPAS OLC03.2 for VOCs, µg/l							
Dichlorodifluoromethane	3xbkg	---	---	0.5	65-135	≤50	≥90
Chloromethane	3xbkg	---	---	0.5	65-135	≤50	≥90
Vinyl Chloride	3xbkg	---	0.057	0.5	65-135	≤50	≥90
Bromomethane	3xbkg	---	---	0.5	65-135	≤50	≥90
Chloroethane	3xbkg	---	---	0.5	65-135	≤50	≥90
Trichlorofluoromethane	3xbkg	---	11,000	0.5	65-135	≤50	≥90
1,1-Dichloroethene	3xbkg	---	7	0.5	65-135	≤50	≥90
1,1,2-Trichloro-1,2,2-	3xbkg	---	---	0.5	65-135	≤50	≥90
Acetone	3xbkg	---	33,000	5	65-135	≤50	≥90
Carbon Disulfide	3xbkg	---	3,700	0.5	65-135	≤50	≥90
Methyl acetate	3xbkg	---	---	0.5	65-135	≤50	≥90
Methylene chloride	3xbkg	---	5	0.5	65-135	≤50	≥90
trans-1,2-Dichloroethene	3xbkg	---	100	0.5	65-135	≤50	≥90
Methyl tert-butyl ether	3xbkg	---	---	0.5	65-135	≤50	≥90
1,1-Dichloroethane	3xbkg	---	3,700	0.5	65-135	≤50	≥90
cis-1,2-Dichloroethene	3xbkg	---	70	0.5	65-135	≤50	≥90
2-Butanone	3xbkg	---	22,000	5	65-135	≤50	≥90
Bromochloromethane	3xbkg	---	---	0.5	65-135	≤50	≥90
Chloroform	3xbkg	---	360	0.5	65-135	≤50	≥90
1,1,1-Trichloroethane	3xbkg	---	200	0.5	65-135	≤50	≥90
Cyclohexane	3xbkg	---	---	0.5	65-135	≤50	≥90
Carbon tetrachloride	3xbkg	---	0.66	0.5	65-135	≤50	≥90
Benzene	3xbkg	---	1.5	0.5	65-135	≤50	≥90
1,2-Dichloroethane	3xbkg	---	0.94	0.5	65-135	≤50	≥90

Method Analytes	Site Assessment Action Level (surface water, food chain)	Site Assessment Action Level (surface water, environmental)	Site Assessment Action Level (groundwater)*	CRQL	Accuracy (% Recovery for MS/MSD)	Precision (RPD for MS/MSD and duplicates)	Percent Complete
Trichloroethene	3xbkg	---	5	0.5	65-135	≤50	≥90
Methylcyclohexane	3xbkg	---	---	0.5	65-135	≤50	≥90
1,2-Dichloropropane	3xbkg	---	1.3	0.5	65-135	≤50	≥90
Bromodichloromethane	3xbkg	---	1.4	0.5	65-135	≤50	≥90
cis-1,3-Dichloropropene	3xbkg	---	0.85	0.5	65-135	≤50	≥90
4-Methyl-2-pentanone	3xbkg	---	---	5	65-135	≤50	≥90
Toluene	3xbkg	---	1,000	0.5	65-135	≤50	≥90
trans-1,3-Dichloropropene	3xbkg	---	0.85	0.5	65-135	≤50	≥90
1,1,2-Trichloroethane	3xbkg	---	1.5	0.5	65-135	≤50	≥90
Tetrachloroethene	3xbkg	---	1.6	0.5	65-135	≤50	≥90
2-Hexanone	3xbkg	---	---	5	65-135	≤50	≥90
Dibromochloromethane	3xbkg	---	---	0.5	65-135	≤50	≥90
1,2-Dibromoethane	3xbkg	---	0.001	0.5	65-135	≤50	≥90
Chlorobenzene	3xbkg	---	100	0.5	65-135	≤50	≥90
Ethylbenzene	3xbkg	---	700	0.5	65-135	≤50	≥90
Xylenes (total)	3xbkg	---	7,300	0.5	65-135	≤50	≥90
Styrene	3xbkg	---	100	0.5	65-135	≤50	≥90
Bromoform	3xbkg	---	---	0.5	65-135	≤50	≥90
Isopropylbenzene	3xbkg	---	---	0.5	65-135	≤50	≥90
1,1,2,2-Tetrachloroethane	3xbkg	---	0.43	0.5	65-135	≤50	≥90
1,3-Dichlorobenzene	3xbkg	---	---	0.5	65-135	≤50	≥90
1,4-Dichlorobenzene	3xbkg	---	3.5	0.5	65-135	≤50	≥90
1,2-Dichlorobenzene	3xbkg	---	---	0.5	65-135	≤50	≥90

Method Analytes	Site Assessment Action Level (surface water, food chain)	Site Assessment Action Level (surface water, environmental)	Site Assessment Action Level (groundwater)*	CRQL	Accuracy (% Recovery for MS/MSD)	Precision (RPD for MS/MSD and duplicates)	Percent Complete
1,2-Dibromo-3-chloropropane	3xbkg	---	0.061	0.5	65-135	≤50	≥90
1,2,4-Trichlorobenzene	3xbkg	---	70	0.5	65-135	≤50	≥90
1,2,3-Trichlorobenzene	3xbkg	---	---	0.5	65-135	≤50	≥90
EPA Method 900.1 Radionuclides by Gamma Spectroscopy, pCi/l							
Cesium 137	**	---	15	1.5			
Potassium 40	**	---	15	1.5			
Thorium 228	**	---	15	1.5			
Thorium 230	**	---	15	1.5			
Thorium 232	**	---	15	1.5			

mg/l milligrams analyte per liter water

ug/l micrograms analyte per liter water

CRDL CLP Contract Required Detection Limits

MS/MSD Matrix Spike/Matrix Spike Duplicate

RPD Relative Percent Difference

CLPAS: EPA Contract Laboratory Program Analytical Services

*: Maximum contaminant limit (MCL) for water. Water concentrations will also be compared to background.

** : 2 standard deviations above the mean background concentration

Table 3-3: Data Quality Indicator Goals - Air Samples

Method Analytes	Site Assessment Action Level (observed release)	Site Assessment Action Level (actual contamination)	Removal Action Level	CRQL	Accuracy (% Recovery for MS/MSD)	Precision (RPD for MS/MSD and duplicates)	Percent Complete
EPA Method 6020B for metals, ug/cubic meter							
Aluminum	3xbkg	---	5.0	1	65-135	≤50	≥90
Antimony	3xbkg	0.42	---	6	65-135	≤50	≥90
Arsenic	3xbkg	0.00057	0.0045	0.001	65-135	≤50	≥90
Barium	3xbkg	0.52	0.52	0.05	65-135	≤50	≥90
Beryllium	3xbkg	0.001	0.008	0.001	65-135	≤50	≥90
Cadmium	3xbkg	0.0014	0.0011	0.0001	65-135	≤50	≥90
Calcium	3xbkg	---	---	500	65-135	≤50	≥90
Chromium	3xbkg	0.0083	0.0016	0.0001	65-135	≤50	≥90
Cobalt	3xbkg	---	0.0069	0.001	65-135	≤50	≥90
Copper	3xbkg	---	---	2.5	65-135	≤50	≥90
Iron	3xbkg	---	---	10	65-135	≤50	≥90
Lead	3xbkg	1.5	---	1	65-135	≤50	≥90
Magnesium	3xbkg	---	---	500	65-135	≤50	≥90
Manganese	3xbkg	0.052	0.051	1.5	65-135	≤50	≥90
Mercury	3xbkg	0.00031	---	0.1	65-135	≤50	≥90
Nickel	3xbkg	---	0.008	4	65-135	≤50	≥90
Potassium	3xbkg	---	---	500	65-135	≤50	≥90
Selenium	3xbkg	---	---	3.5	65-135	≤50	≥90
Silver	3xbkg	---	---	1	65-135	≤50	≥90
Sodium	3xbkg	---	---	500	65-135	≤50	≥90
Thallium	3xbkg	---	---	2.5	65-135	≤50	≥90
Vanadium	3xbkg	---	---	5	65-135	≤50	≥90
Zinc	3xbkg	---	---	6	65-135	≤50	≥90
EPA Method 900 Radionuclides by Gamma Spectroscopy, pCi/cubic meter							
Cesium 137	2 st dev	0.4	3 x bkgd	0.01	65-135	≤50	≥90
Potassium	2 st dev	---	3 x bkgd	0.01	65-135	≤50	≥90
Thorium	2 st dev	0.00011	3 x bkgd	0.01	65-135	≤50	≥90

The action levels for wetland soils, freshwater sediments and marine sediments are the National Oceans and Atmosphere Administration's Screening Quick Reference Table (SQuiRT) values. The SQuiRTs are guidance values developed by NOAA's Coastal Protection and Restoration Division to identify and evaluate the threat of these contaminants to ecologic resources.

The action level for air samples will be three times background for removal purposes, and two standard deviations above background for HRS purposes. In the event that an analyte is not detected in background, then the detection limit becomes the action level for the analyte in down-gradient samples.

3.3.2.2 Waste Characterization Action Levels

The action levels for the characterization of waste materials at the site are based on the Federal and California State Regulatory Statutes for Hazardous Wastes. For leachable solids, the RCRA TCLP values are the action levels for characterization as a RCRA Hazardous Waste, and the STLC values are the action levels for characterization as a California Hazardous Waste. In addition, the TTLC values are the action levels for total metals for a California Hazardous Waste. There is currently no RCRA standard for total metals concentrations.

3.4 Decision Rules

Because this Integrated Assessment utilizes field screening and definitive methodologies to generate data for multiple decisions based on HRS and Removal considerations and action levels, a series of Data Decision Trees are presented in Figures 3-1 through 3-5 to help explain the decision processes described below. These figures will also help explain the determination of which samples are sent for definitive analysis and how the results may be used.

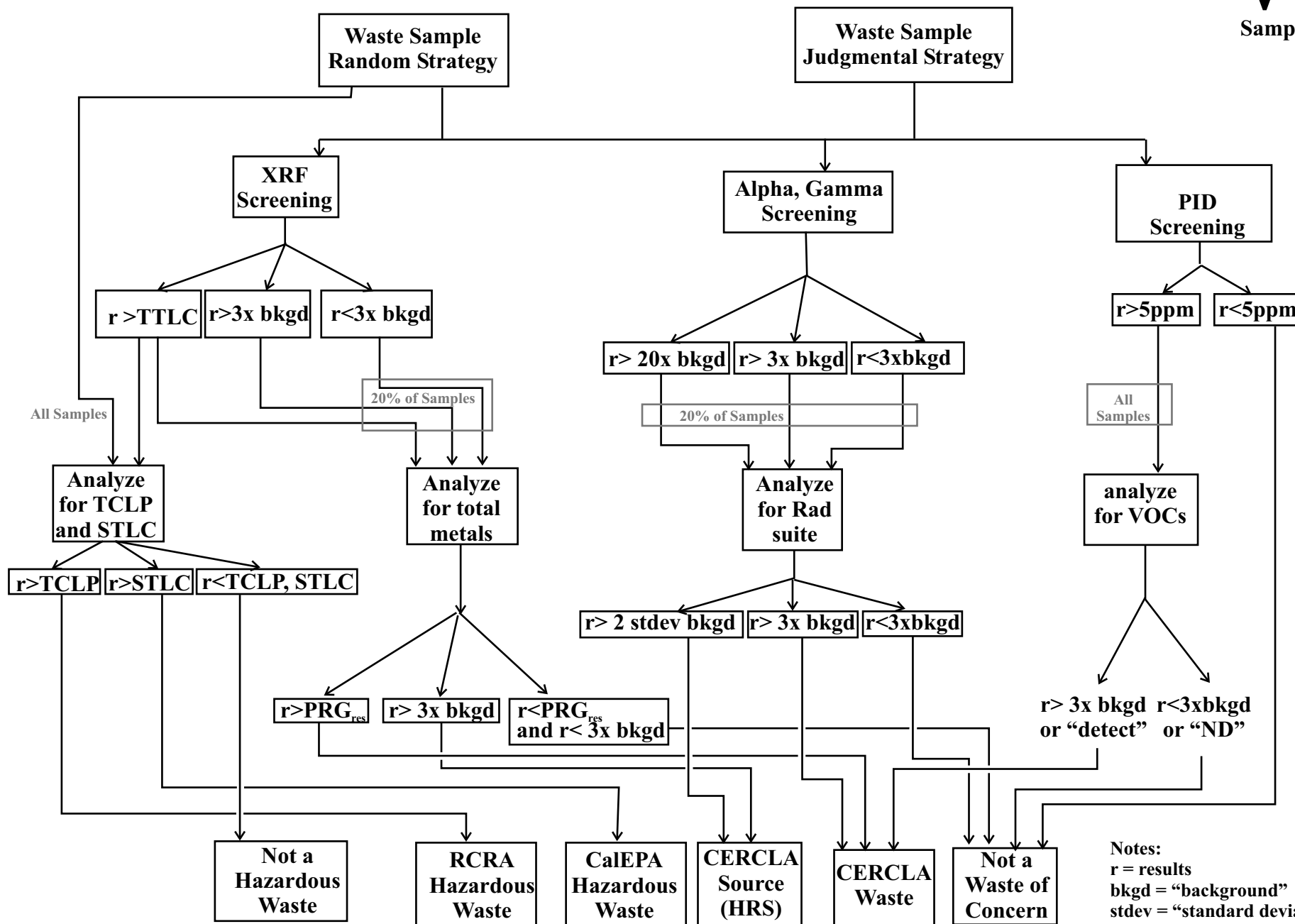
3.4.1 HRS Decision Rules

If source materials (site soils and smelter materials) are found to be contaminated by VOCs, metals, or radionuclides, then the presence of hazardous substances in the source will be documented and integrated into the site's HRS score. If groundwater samples are found to contain concentrations of individual VOCs, metals, or radionuclides significantly above background, then an observed release will be documented and integrated into the site's HRS score. If surface water or sediment samples are found to contain concentrations of individual metals or radionuclides significantly above background, then an observed release will be documented and integrated into the site's HRS score. If air samples are found to contain concentrations of individual metals or radionuclides significantly above background, then an observed release will be documented and integrated into the site's HRS score.

3.4.2 Removal Decision Rules

If the waste materials in the Smelter and/or WMU are demonstrated by statistical sampling methods to be RCRA Hazardous Wastes, the EPA OSC may chose to conduct a removal of all or part of the waste, or stabilize the waste until a long-term remedial solution can be determined. If the waste

Figure 3-1: Solid WasteData Decision Tree
Halaco Integrated Assessment



**Figure 3-2: Wetland Soil and Sediments
Data Decision Tree
Halaco Integrated Assessment**

SWL
Sample Prefix
SED

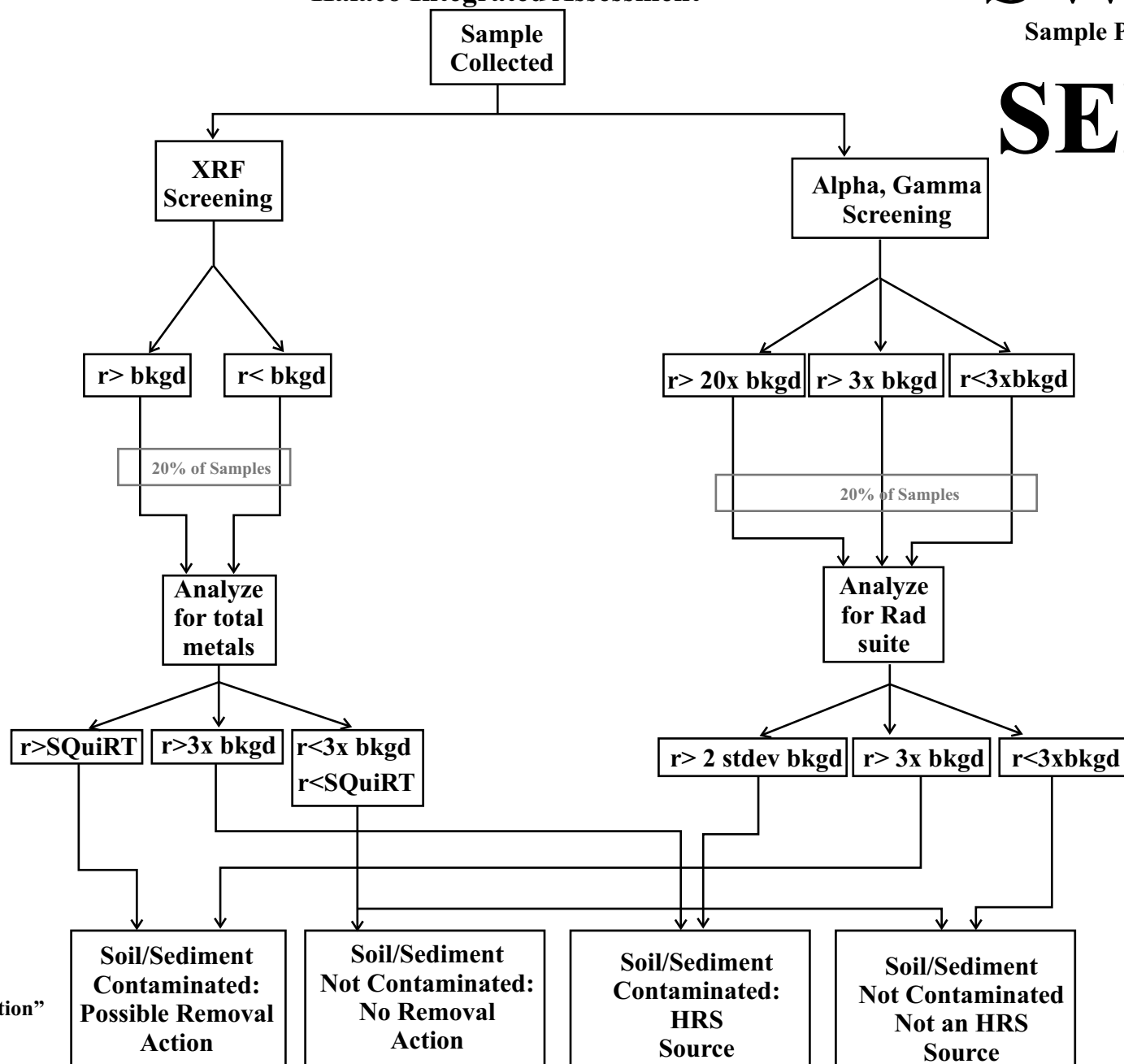


Figure 3-3: Non-Wetland Soil Data Decision Tree
Halaco Integrated Assessment

SS
Sample Prefix

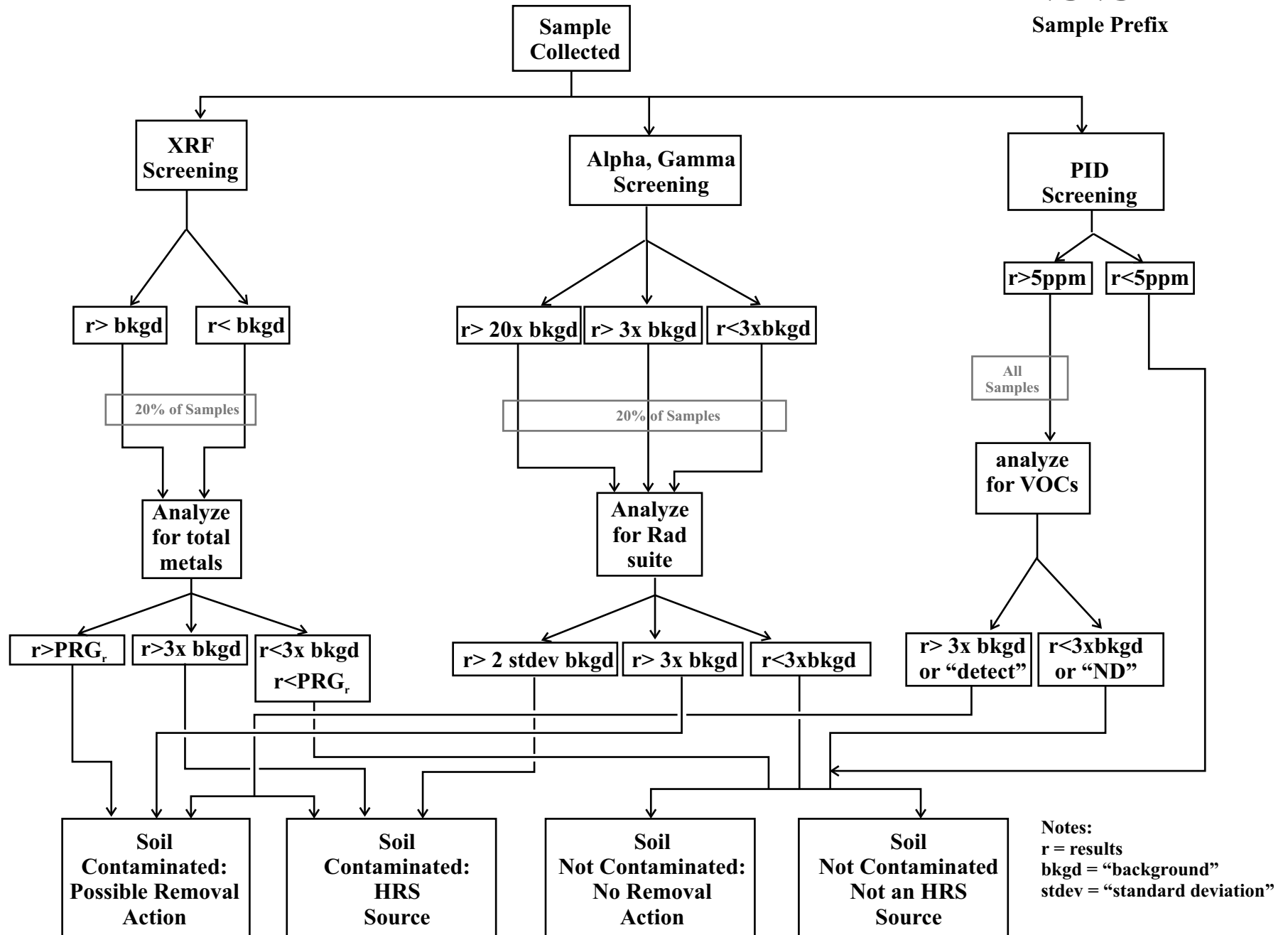


Figure 3-4: Groundwater and Surface Waterx Data Decision Tree
Halaco Engineering Integrated Assessment

MW
 Sample Prefix
SW

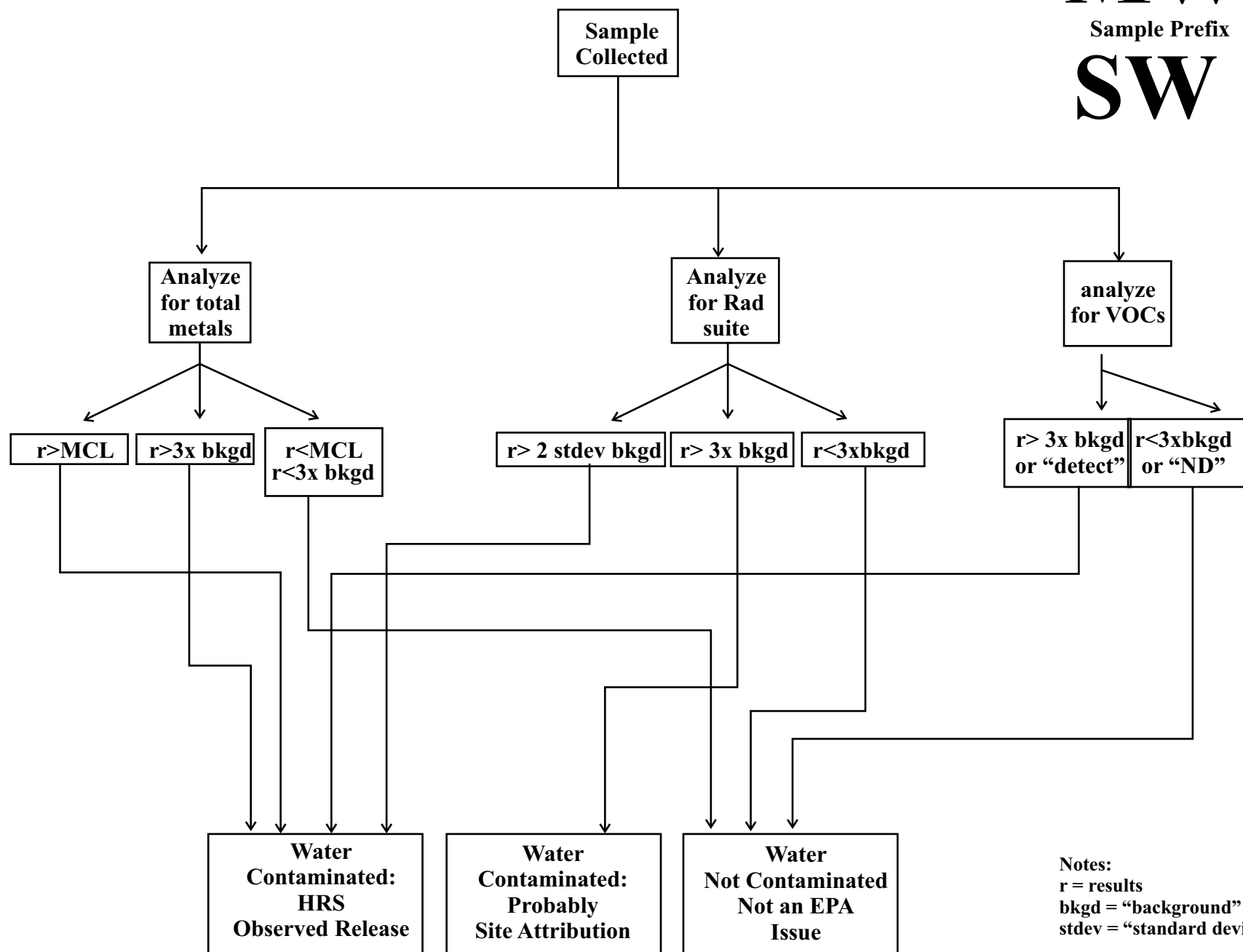
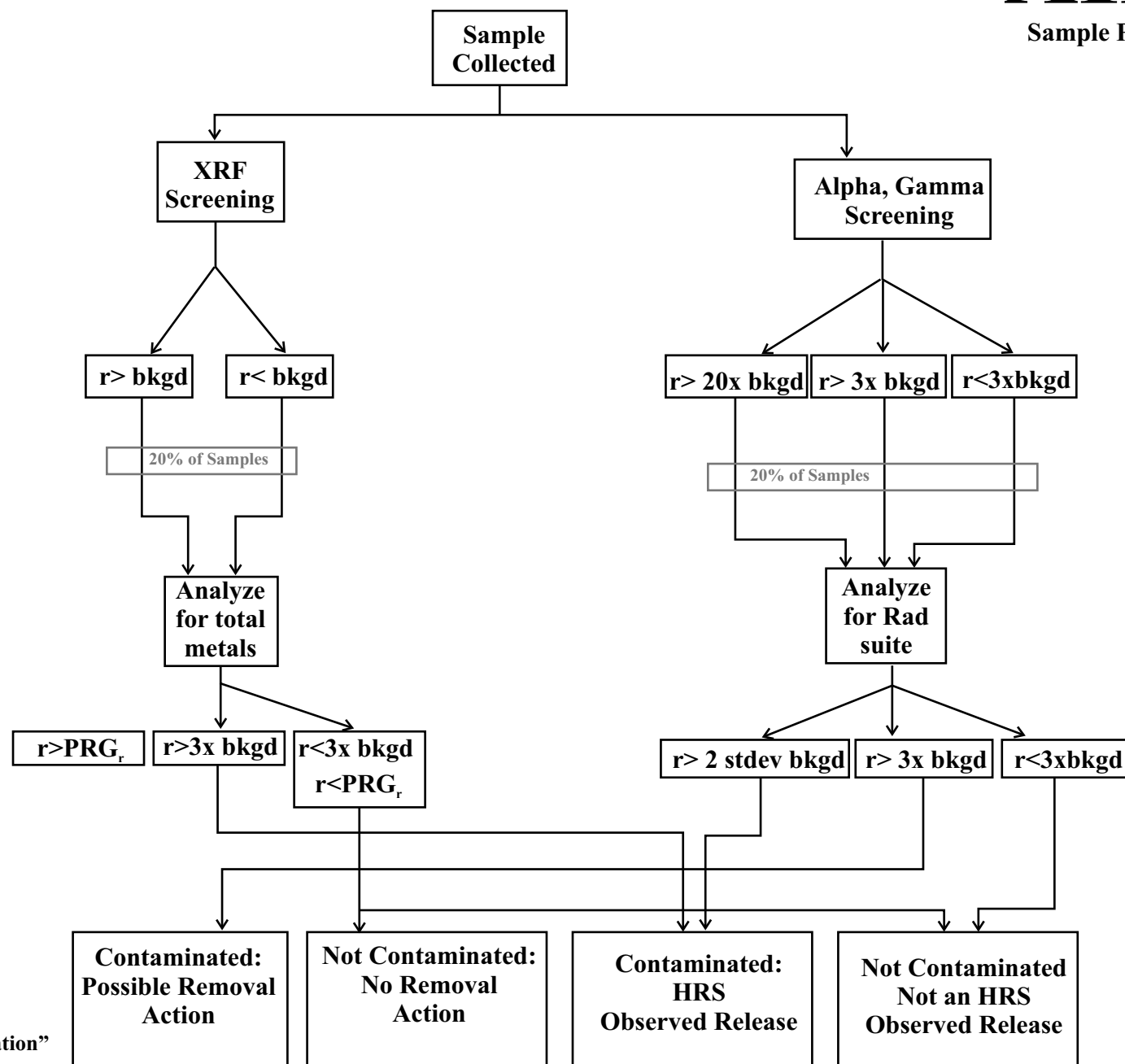


Figure 3-5: Air Samples Data Decision Tree
Halaco Integrated Assessment



Notes:
r = results
bkgd = “background”
stdev = “standard deviation”

materials are demonstrated by statistical sampling methods to be California Hazardous Wastes, then the EPA OSC may choose to conduct a removal of all or part of the waste, or the EPA OSC may choose to consolidate and stabilize the waste until a long-term remedial solution can be determined. If the waste materials are not considered Hazardous under RCRA or California law, they may still pose a threat to human health and the environment, and the EPA OSC may choose to consolidate and stabilize the waste until a long-term remedial solution can be determined.

If contaminants are found to be present in adjacent air samples, soils, sediments, and or surface waters above the site action levels, the EPA OSC may choose to conduct a removal of these contaminated materials, as well as stabilize the release points at the site. If contaminants are not found to be present in adjacent air samples, soils, sediments and/or surface waters above the site action levels, the EPA OSC may choose to conduct no further action at the site.

3.5 DQO Data Categories

This investigation will involve the generation of definitive data for metals, VOCs and radionuclides in soil, sediment and air samples. Screening data will be used to aid in the identification of samples to be submitted to the laboratory. At least 20% of the solid/soil/sediment samples screened for metals and radiation will be submitted for definitive analysis; at least 10% of the solid/soil/sediment samples screened for VOCs will be submitted for definitive analysis. While the screening data will not be used for enforcement purposes, the data may be used for delineation purposes at a later time. 100% definitive data will be generated for all water, leachate, and random samples collected expressly for the characterization of the wastes. The specific requirements for these data categories are detailed in Section 9. The data generated under this project will comply with the requirements for these data categories as defined in *Data Quality Objective Process for Superfund*, EPA 540/G-93/71, September 1993. All analytical methods employed for this project will be methods approved by the EPA.

3.6 Data Quality Indicators

Data quality indicator goals (DQIs) for this project were developed following guidelines in *EPA Guidance for Quality Assurance Project Plans*, EPA QA/G-5 Final. All sampling will be guided by procedures detailed in Section 6.2 to ensure representativeness of sample results. Tables 3-1 through 3-3 document the DQIs for this project. As presented in these tables, EPA CLP standard Contract Required Quantitation Limits (CRQLs) were determined to be appropriate for this project.

3.7 Data Management

All samples collected will be logged on a chain-of-custody form as discussed in Section 8.4. Samples will be kept secure in the custody of the sampler at all times, who will assure that all preservation parameters are being followed. Samples will be either hand-delivered or shipped to the laboratory under chain of custody documentation. Samples will be laboratory via a certified carrier in a properly custody-sealed container with chain-of-custody documentation. The laboratory should note any evidence of tampering upon receipt.

The completed laboratory data report will be submitted to the EPA QAO. Data validation will be contracted by the EPA-QAO, who will provide the data validation reports to the EPA lead. The EPA SAM and/or the EPA OSC will then provide the data reports to the WESTON PM. The data validation reports and laboratory data summary sheets will be included in the final report to be submitted to the EPA SAM and EPA OSC. Before submittal, the final report will undergo a technical review to ensure that all data have been reported and discussed correctly.

3.8 Schedule of Sampling Activities

It is anticipated that field activities will begin the week of June 19, 2006. Field sampling is expected to last eight days, but not exceed two weeks. Subsequent to the field sampling event, samples will be analyzed, data will be evaluated and validated, and a final report will be prepared. The target date for completion of the final report is September 30, 2006.

3.9 Special Training Requirements/Certifications

There are no special training or certification requirements specific to this project. Training requirements relevant to WESTON's health and safety program comply with 29 CFR 1910.120. The Site-Specific Health and Safety Plan is presented in Appendix B.

4.0 SAMPLING RATIONALE

4.1 Sampling Locations and Rationale

The sampling strategy involves the collection of air, groundwater, surface water, waste, soil, and sediment samples from the facility and surrounding areas. The sample locations are presented in Figures 4-1 through 4-3.

4.1.1 Groundwater Sampling

To establish whether a release to groundwater has occurred, groundwater will be sampled at the five existing wells at the site, as well as nine new wells to be installed. The locations of the new wells have been chosen in order to: 1) establish the groundwater gradient under the Smelter, 2) sample downgradient and background groundwater under the Smelter, 3) sample groundwater directly under the WMU, and 4) sample groundwater directly downgradient of the WMU. Groundwater will be sampled at a total of 14 locations at the site. Proposed groundwater sampling locations are presented in Figures 4-2 and 4-3.

4.1.2 Soil/Waste/Sediment Sampling

A total of 429 soil/sediment/waste samples will be collected from 321 locations as surface and subsurface samples. The locations have been chosen to address the following: 1) HRS hazardous substance source, 2) Removal Waste Characteristics, 3) HRS Surface Water Pathway, 4) Substantial release to the environment of wastes from the site to human health targets, such as residences, agricultural soils, sediments that support fisheries, soils on lands used for recreational purposes and



Figure 4-1: Sampling Map
Overview with
Distal Sampling Locations

Halaco Engineering, Inc.
Integrated Assessment

May 2006

- Surface Soil Sample
- Sediment Sample Location
- ◆ Air Sample Station
- ☪ Surface Water Sample

See Figures 5-2 and 5-3 for sample
locations in the Foundry and Waste
Management Unit areas.









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**Figure 4-2: Smelter Sampling
Location Map
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Integrated Assessment**

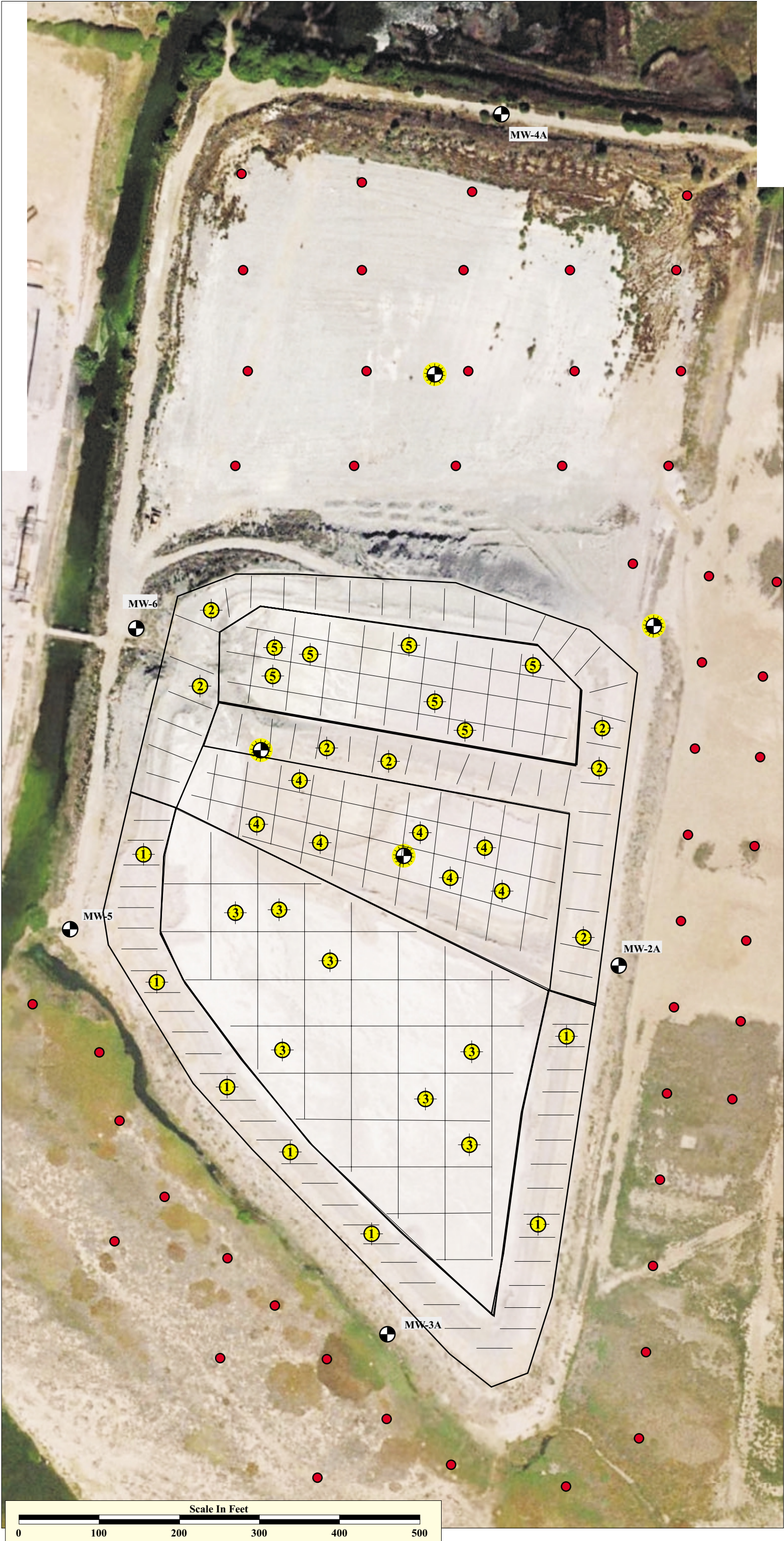


-  Groundwater Monitoring Well (existing)
-  Groundwater Monitoring Well (new)
-  Surface Soil Sample
-  Sediment Sample
-  Soil Boring
-  Chemical Storage



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**Figure 4-3:
Waste Areas
Sampling
Location Map
Halaco
Engineering, Inc.
Integraed
Assessment**



- Existing Groundwater Monitoring Well
- New Groundwater Monitoring Well
- Surface Soil Sample
- Soil Boring

Random Borings

- Area 1: South Berm
- Area 2: North Berm
- Area 3: South Pond
- Area 4: Central Pond
- Area 5: North Pond

Area Boundary and Random Grid Spacing

Note: The grid layout and boring placement are conceptual. The actual grid placement and random selection of grids for borings will be conducted in the field.



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soils which may be developed for residential purposes in the future, 5) Substantial release to the environment of wastes from the site to ecologic targets, including wetlands, surface waters and marine environments. Soil, waste, and sediment sample locations are judgmental, except where described below, and will be chosen in the field based on proximity to the site and/or target populations. The number of samples, except where noted below, is a maximum number based on cost-effectiveness for a judgmental sampling strategy; the actual number of samples collected may be lower. In addition, the OSC may chose to utilize these samples to conduct delineation of contamination based on field screening data. Approximate soil, waste, and sediment sampling locations are presented in Figures 4-1 through 4-3.

4.1.2.1 Waste Sampling

In order to determine whether the concentrations of metals and radionuclides exceed health-based guidance and/or regulatory threshold values, samples will be collected from wastes in both the Smelter and the WMU. Samples from wastes in the Smelter will be representative of waste in piles and groups of containers; the determination of heterogeneity between these populations will be based on visual inspection and a small subset of QA samples intended to test this hypothesis. Approximately 20 samples are expected; although OSC Wise may choose to collect fewer or greater samples.

The waste in the WMU must be characterized as per RCRA law; as a result, a statistically defensible, random sampling strategy will be employed for this waste, as per SW-846, Chapter 9. A previous waste characteristic sampling event (Padre, 2002) conducted a random sampling at the waste pile, and analyzed the samples for barium, copper, lead, and zinc for STLC (California Title 22 leachate test). Thorium radionuclides were also analyzed during this time. The results indicated that copper failed for STLC (25 mg/l) in eight of the 20 samples, and lead one sample out of twenty failed the STLC threshold for lead (5 mg/l). Barium and zinc leachates were also analyzed, but not for other metal leachates. Statistical analysis of the copper leachate and radionuclides indicate a non-normal distribution of data (variance is significantly greater than the mean) for these analytes.

WESTON calculated the number of samples required for each of these areas using the Padre, 2002, data and determined that the minimum number of samples to resolve the results against the regulatory thresholds (Table 4-1). These results indicate 1) The waste pile is heterogeneous and probably reflects changing character of the waste stream as the pile grew, 2) Padre did not analyze for beryllium, cadmium, chromium, nickel, and other leachable metals that are likely present in elevated concentrations in the waste pile, and 3) the sample points are highly skewed toward the southern berm wall of the waste pile, representing the earliest materials added to the WMU, and 4) the copper STLC results indicate an economically unfeasible number of samples (1754 samples) to resolve whether the waste exceeds the regulatory threshold to within 90% confidence.

Because there is concern that the waste in the WMU is heterogeneous, the waste pile will be divided into five populations (see Figure 4-3), each of which will be subjected to a random sampling strategy, as outlined in Section 6.2.4. The areas are determined based on the apparent growth of the WMU, which includes: Area 1 - berm walls of the southern containment, Area 2 - berm walls of the northern two containment structures, Area 3 - the southernmost containment interior, Area 4 - the

Table 4-1: Characteristic Waste Sampling Calculations for the WMU									
			Radionuclides			STLC			
sample	depth	population	²²⁸ Th	²³⁰ Th	²³² Th	Barium	Copper	Lead	Zinc
DH-1	4	2	0.37	0.99	0.50	4.10	12.00	1.00	2.00
DH-1	23	2	0.24	0.63	0.17	4.60	32.00	1.00	1.70
DH-2	25	5	9.17	9.52	6.92	2.00	12.00	1.70	3.00
DH-2	30	5	1.19	1.37	0.90	9.10	7.20	1.00	8.00
DH-3	11	2	0.37	0.49	0.25	4.60	26.00	3.00	2.20
DH-3	30	2	2.03	1.78	1.90	1.60	3.80	1.00	2.40
DH-4	3	3	0.29	0.36	0.19	5.00	31.00	1.00	3.40
DH-4	12	3	0.55	0.49	0.36	6.70	140.00	6.30	54.00
DH-5	5	1	0.39	0.44	0.34	3.90	14.00	1.00	3.00
DH-5	16	1	1.05	1.33	1.00	4.90	11.00	1.00	2.80
DH-6	4	1	0.72	0.57	0.35	3.70	10.00	1.00	2.40
DH-6	19	1	0.27	0.73	0.20	2.90	25.00	1.40	4.10
DH-7	19	1	0.26	0.42	0.29	4.30	26.00	2.50	6.30
DH-7	28	1	5.83	3.25	5.44	2.40	8.60	1.00	3.40
DH-8	2	1	0.77	1.10	0.98	4.40	13.00	1.00	2.20
DH-8	14	1	0.40	0.68	0.22	3.80	30.00	1.20	6.40
DH-9	10	1	0.73	0.72	0.50	1.80	5.30	1.00	0.80
DH-9	24	1	0.39	0.44	0.71	4.10	76.00	3.10	23.00
DH-10	6	1	0.86	1.11	0.82	8.00	2.00	1.00	0.60
DH-10	17	1	0.50	0.59	0.21	2.00	2.00	0.90	0.60
Statistics									
RT			24.20	3.49	3.10	100	25	5	250
mean			1.32	1.35	1.11	4.20	24.35	1.61	6.62
stdev			2.22	2.04	1.80	1.97	31.98	1.30	12.16
variance			4.94	4.14	3.24	3.89	1022.88	1.69	147.88
sterr			0.50	0.46	0.40	0.44	7.15	0.29	2.72
CI low			0.66	0.75	0.58	3.61	14.85	1.22	3.00
CI high			1.98	1.95	1.65	4.78	33.84	1.99	10.23
# samples			20	20	20	20	20	20	20
Results:									
samples required			0.38088	3.41457	2.872206	0.071549	2754.103	0.878429	1.071543
whole number			1	4	3	1	***	1	2

Notes:

Sample data from Padre, 2002

population = the areas outlined in Figure 4-3 defined by the temporal growth of the WMU.

Statistical analyses as per Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (OSWER SW-846 see Chapter 9, Random Sampling Section)

RT = Regulatory Threshold

mean = $\sum(x)/n$ where x = individual results and n = number of results

variance = $v = [\sum(x^2) - (\sum(x)^2/n)]/(n-1)$

stdev = standard deviation = the square root of v

sterr = standard error = stdev/square root of n

CI = Confidence Interval, expressed as low or high. CI = mean \pm $t_{0.20}$ *sterr

$t_{0.20}$ = student T test value for 19 degrees of freedom (n-1) is 1.328, as per Table 9-2 in OSWER SW-846.

Samples Required = number of samples necessary to determine whether waste exceeds characteristic thresholds within 90% confidence interval. This is calculated as $(t_{0.20}^2 * \text{variance})/(\text{RT} - \text{mean})$. The result is the next highest whole number.

*** The variability of copper data and the proximity of data to the RT indicate an unacceptably high number of samples are required to resolve the characteristic within the upper CI.

central containment interior, and Area 5 - the northern containment area. The number of samples for each area is determined by the statistical analysis described above and in Table 4-1 for all analytes except copper. The highest whole number (excepting copper) is four samples. Because this study addresses the WMU as five new, separate populations that have not been statistically sampled, and the SAP calls for the analysis of several analytes for which no data exist, three more samples have been added to each population area. Since this sampling methodology is an iterative approach, additional sampling may be required to resolve the characteristic hazards and stratigraphy of the WMU.

Approximately 140 samples will be collected from the WMU and 35 of these will be submitted to a laboratory for TCLP, STLC analysis, as well as total metals and radionuclides. Ten of these samples will be analyzed for VOCs based on elevated PID readings. The remaining samples will be screened for metals and radionuclides to assist in further characterizing the heterogeneity of the waste pile.

4.1.2.2 Soil Sampling

In order to determine whether contaminants have migrated into soils, including soils at the site and adjacent soils that are used for recreational, agricultural, and/or residential purposes, samples will be collected in areas most likely to have been affected by contaminant migration from sources at the site (Figures 4-1 through 4-3). These areas include subsurface soils beneath chemical storage areas, sumps, and process areas, as well as surface soils where raw materials and/or wastes were staged, stored or managed at the site. In addition, surface soil samples will be collected around the perimeter of the site, up to 200 feet away, to determine whether contaminants may have migrated from the site via direct transport as sediments, windblown particulates, or leachate.

Approximately 20 surface soil samples, and samples from 12 borings will be collected at the Smelter (Figure 4-2); the sampling locations have been chosen based on the most likely areas to find contaminants due to historical site use. Approximately 20 surface soil samples, and samples from one boring will be collected in the Waste Disposal Area, north of the WMU (Figure 4-3); the sampling locations are evenly distributed in the area where there is little or no vegetation in this area. Sample handling for soils is similar to the waste samples described above.

Up to 82 samples are allotted for adjacent soils around the perimeter of the site. These include both delineated wetlands and non-wetlands samples. Sample locations will be chosen in the field based on: 1) visual indications of contaminant migration, including staining, soil color, or distressed vegetation, 2) proximity to sensitive targets, such as critical habitat or waterways, 3) radiation readings above background, and 4) location access. This number includes 12 background sample locations, all of which must be collected in order to establish background concentrations for the study. In addition, up to 10 agricultural and 10 residential soil samples will be collected in order to assess the migration of contaminants to these sensitive areas; the exact locations of these samples will be chosen in the field based on the parameters described for the wetlands soils above. OSC Wise may choose to collect all or a subset of this number of samples; however, the entire suite of background samples will be collected.

In each case, samples will be screened for radiation and metals by field screening methods. Subsurface samples will be screened with a PID for VOCs. A subset of these samples will be analyzed in a field and/or fixed laboratory for radiation, and a fixed laboratory for metals.

4.1.2.3 Sediment Sampling

In order to determine whether contaminants have migrated into sediments in adjacent sensitive environments and fisheries, freshwater sediments from the OID and outfall lagoon, beach sediments, and marine sediments from the marine side of the outfall area will be collected. Sample locations will be chosen based on; 1) grain size (with a preference toward fine-grained sediments), 2) likelihood of impact from the site, and 3) visual indications of impact. These sediments will be screened and analyzed for metals and radionuclides. Sixteen OID sediment samples will be collected, including six background samples upgradient of the site. Thirty-six beach sediment samples, including six background samples, will be collected from the length of beach spanning north from the fishing pier to the power plant to the south. Thirty-six marine sediment samples, including six background samples, will be collected from the marine area along the same stretch of shore as the beach sediments (Figure 4-1).

4.1.3 Surface Water Sampling

Surface water samples will be collected at ten locations from the OID (Figure 4-1). Six of these samples will be collected from areas adjacent to, and downgradient from the site. Four of these samples will be collected from areas upgradient of the site. For each of these locations, both filtered and non-filtered samples will be collected.

4.1.4 Air Sampling

Five high-volume air samples will be collected each day for a ten day period. The locations of these air sampling stations (Figure 4-1) are determined on the basis of most likely background, and greatest potential health threat posed to downgradient human targets. The determination of background will be made on a daily basis in consultation with meteorological data collected at the site.

4.2 Analytes of Concern

Based on available information regarding hazardous substances used and stored on the Halaco site, soil and groundwater samples will be analyzed for metals, radionuclides and/or VOCs. Sediment, surface water, and air samples will be analyzed for metals and radionuclides. Specific AOCs for the Halaco site are listed in Tables 3-1 through 3-3. Metals and VOCs will be analyzed by CLP Methods for the entire list of compounds presented in the SOPs for the methods.

Radionuclides in soil, water and air filters will be performed by the EPA's Radiation and Indoor Environments National Laboratory (RIENL) Mobile Environmental Radiation Laboratory (MERL) for ^{232}Th , ^{228}Th and ^{40}K using gamma spectroscopy by EPA Method 901.1 (see SOP CER-651 for

MERL-specific method), and ^{137}Cs and ^{230}Th using gross alpha beta spectroscopy by EPA Method 900 (see SOP CER-652 for MERL-specific method).

TCLP and STLC analyses will be conducted for all leachable metals in the regulatory suite (RCRA for TCLP and CAM 17 for STLC) by EPA Method 1311 and California Title 22 Waste Extraction Test methods, respectively. Metals in air filter samples will be conducted by EPA Method 6020B, or an equivalent method. SOPs for these analytical methods are presented in Appendix C.

5.0 REQUEST FOR ANALYSES

All non-radiological laboratory services will be scheduled by the EPA Region 9 Regional Sample Control Coordinator (RSCC), Mary O'Donnell. Definitive samples will be analyzed for VOCs and metals by a laboratory to be determined by the RSCC. Sample containers, preservatives, holding times, and estimated number of field and QC samples are summarized in Table 5-1. All SOPs for definitive laboratory methods are included in Appendix C.

5.1 Water Matrix Samples

As shown in Table 5-1, water samples will be collected at 24 locations. Additional sample volume collected at two locations will be identified for use as laboratory QC samples. Ten field blank samples will be collected (one per day) and three field duplicate samples will be collected for a total of 41 water samples. The field blank samples will also be used as travel blank samples. Each water sample will be analyzed for total metals via CLPAS Analytical Services (CLPAS) Method ILM05.2, and VOCs via CLPAS Method OLC03.2.

5.2 Soil/Sediment/Waste (Solid Matrix) Samples

As shown in Table 5-1, 439 soil samples will be collected and screened for metals and gamma radiation. Of these, 118 soil samples will be submitted to a laboratory for definitive analyses of metals by CLPAS Method ILM05.2 (equivalent to EPA Method 6010) and radionuclides by CER-651 and CER-652. 21 subsurface soil samples will be submitted to a laboratory for definitive analysis of VOCs by CLPAS Method OLO03.2 (equivalent to EPA Method 8260). The determination of the samples to be submitted for definitive analyses is described in Section 6

Additional sample volume collected at 6 locations will be identified for use as laboratory QC samples for metals and radionuclides, and 2 locations for VOCs. 12 field duplicate samples will be collected for metals and radionuclides, and 3 field duplicates will be collected for VOCs.

5.3 High-Volume Air Filter Samples

Air Samples will be collected at five locations during each day of sampling activities. Up to 50 air samples on 4-inch diameter filters will be screened in the field for metals by EPA Method 6200 and analyzed for radionuclides by CER-651 and CER-652. A subset of 12 samples will be selected for definitive metals analyses by EPA Method 6020B, or equivalent, based on the results from the XRF

Table 5-1: Request For Analysis

Sample Matrix Screening/Definitive Analyte Suite Method Number Preservation Holding Time							Soilid: Soil/Sediment/Waste								water samples			Air Samples			
							Screening			Definitive					Definitive			Screening	Definitive		
							metals	RAD	VOC	metals	RAD	VOC	VOC	TCLP	STLC	metals	RAD	VOC	metals	metals	RAD
							EPA	SOP	SOP	CLPAS	EPA 900	CLPAS	CLPAS	EPA	EPA	CLPAS	EPA 900	CLPAS	EPA	EPA	EPA 900
							6200			ILM05.2	EPA 901.1	moisture	OLC03.2			ILM05.2	EPA 901.1	OLC03.2	6200	6020B	EPA 901.1
							-	-	-	-	-	content	<4°C	<4°C	<4°C	HNO ₃	-	HCl	-	-	*
							-	-	asap	6 mo	6 mo	NA	48 hours	14 days	14 days	3 mo **	5 days **	7 days			
Area	type	prefix	# locations	solid/loc	water/loc	air/loc															
#1 Smelter Area	borings	SSN	7	3	0	0	21	21	21	2	2	2	2	-	-	-	-	-	-	-	-
	boring/wells	SSN/MW	5	3	1	0	15	15	15	2	2	2	2	-	-	10	10	5	-	-	-
	waste	SWF	20	1	0	0	20	20	20	2	2	2	2	-	-	-	-	-	-	-	-
#2 WMU Area	surface soil	SSN	20	1	0	0	20	20	20	2	2	-	-	-	-	-	-	-	-	-	-
	Area 1	SW1	7	4	0	0	28	28	28	7	7	2	2	7	7	-	-	-	-	-	-
	Area 2	SW2	7	4	0	0	28	28	28	7	7	2	2	7	7	-	-	-	-	-	-
	Area 3	SW3	7	4	0	0	28	28	28	7	7	2	2	7	7	-	-	-	-	-	-
	Area 4	SW4	7	4	0	0	28	28	28	7	7	2	2	7	7	-	-	-	-	-	-
	Area 5	SW5	7	4	0	0	28	28	28	7	7	2	2	7	7	-	-	-	-	-	-
	existing wells	MW	5		1	0	-	-	-	-	-	-	-	-	-	10	10	5	-	-	-
	new wells	MW	3		1	0	-	-	-	-	-	-	-	-	-	6	6	3	-	-	-
#3 Waste Disposal	boring/wells	SSN	1	3	1	0	3	3	3	1	1	1	1	-	-	2	2	1	-	-	-
	surface soil	SSN	20	1	0	0	20	20	-	4	4	-	-	-	-	-	-	-	-	-	-
#4, #5 OID	OID seds	SDF	10	1	0	0	10	10	-	10	10	-	-	-	-	-	-	-	-	-	-
#4, #5 OID	OID sed bkgd	SDF	6	1	0	0	6	6	-	6	6	-	-	-	-	-	-	-	-	-	-
#4, #5 OID	OID water	WS	6	0	1	0	-	-	-	-	-	-	-	-	-	12	12	6	-	-	-
#4, #5 OID	OID water bkgd	WS	4	0	1	0	-	-	-	-	-	-	-	-	-	8	8	4	-	-	-
#6, #7 Wetlands	surface soil	SWL	30	1	0	0	30	30	-	6	6	-	-	-	-	-	-	-	-	-	-
#6, #7 Wetlands	surface soil bkgd	SWL	6	1	0	0	6	6	-	6	6	-	-	-	-	-	-	-	-	-	-
#s 6,7,8 adjacent soils	adjacent soil	SSN	40	1	0	0	40	40	-	8	8	-	-	-	-	-	-	-	-	-	-
#s 6,7,8 adjacent soils	bkgd soil	SSN	6	1	0	0	6	6	-	6	6	-	-	-	-	-	-	-	-	-	-
#9 residential soils	residential soil	SSR	10	1	0	0	10	10	-	2	2	-	-	-	-	-	-	-	-	-	-
#10 Beach	Beach Seds	SDB	30	1	0	0	30	30	-	6	6	-	-	-	-	-	-	-	-	-	-
#10 Beach	Beach sed bkgd	SDB	6	1	0	0	6	6	-	6	6	-	-	-	-	-	-	-	-	-	-
#10 Marine	Marine Seds	SDM	30	1	0	0	30	30	-	6	6	-	-	-	-	-	-	-	-	-	-
#10 Marine	Marine sed bkgd	SDM	6	1	0	0	6	6	-	6	6	-	-	-	-	-	-	-	-	-	-
#11 agricultural soils	ag soil	SSA	10	1	0	0	10	10	-	2	2	-	-	-	-	-	-	-	-	-	-
Air Samples	air	AIR	4	0	0	10	-	-	-	-	-	-	-	-	-	-	-	-	40	8	8
	air bkgd	AIR	1	0	0	10	-	-	-	-	-	-	-	-	-	-	-	-	10	4	4
subtotal			321	44	6	20	429	429	219	118	118	17	17	35	35	48	48	24	50	12	12
Duplicate							44	44	22	12	12	3	3	4	4	3	3	3	5	2	2
QC							-	-	-	6	6	2	2	2	2	2	2	2		1	1
Field Blanks			10	0	1	0	-	-	-	-	-	-	-	-	-	-	-	10			
total samples							473	473	241	136	136	22	22	41	41	53	53	29	55	15	15
Sample Jars							cup	na	bag	4 oz	Marinelli	4 oz	EnCore™	4 oz	4 oz	1 L poly	1 L	VOA	filter	filter	filter
number/analysis							1	1	1	1	1	1	3	1	1	1	1	3	1	All air analyses will use the same filter	
total bottles							473	473	241	136	136	22	64	41	41	53	53	95	55		

Notes:

EPA Method 6200 - Field screening for metals by XRF (See Appendix D).

RAD = Radionuclide screening or analysis

VOC = Volatile Organic Compounds: Screening method is headspace measurement using a PID (see text).

SOP = Standard field screening procedure - see text.

"-" = "not applicable"

QC = Laboratory QC Sample

"cup" = XRF analysis cup - approximately 10 grams of soil sample.

"bag" = 1/2 gallon resealable plastic bag.

Marinelli = Marinelli Beaker - 500 ml sample container for gamma spectroscopy.

EnCore_{TM} = Trademarked volatile organic analysis container for soil/solid samples.

4 oz = 4-ounce, widemouth glass sample jar

1L poly = 1 liter polyethylene bottle

VOA = Volatile organic analysis container (40 ml) with septum top.

"filter" = 4.7 cm diameter air filter for high-volume air sampling device.

** Water samples for metals and radionuclides may require analysis of both filtered and non-filtered samples.

screening and the radionuclide analysis. One duplicate air sample will be collected at a different sample station each day; these will provide additional sample volume for 5 field duplicates, as well as 2 laboratory duplicates and 1 laboratory QC sample.

5.4 General Considerations

One field blank will be collected per matrix for each day that VOCs are collected. A total of up to ten field blanks is expected. As shown in Table 5-1, field blanks will be analyzed for total metals via CLPAS Method ILM05.2, and VOCs via CLPAS Method OLC03.2 in the same manner as the water samples.

To provide analytical quality control for the analytical program, the following measures will be utilized:

- All non-radiologic, definitive sample analysis will be conducted by laboratories to be determined by the RSCC.
- Radiologic sample analysis will be conducted by EPA's MERL.
- Additional sample volume will be collected for at least one sample per media per each analytical method, to be utilized for matrix spike/duplicate analysis.
- A CLP-type data package will be required from the laboratories for all resultant data.
- A Regression calculation will be conducted to measure the correlation between the field screening and definitive data; an R value of 0.8 or greater will be considered an acceptable correlation to use screening data for decision purposes.

6.0 METHODS AND PROCEDURES

6.1 Field Equipment

6.1.1 Sampling Equipment

The following equipment will be used to obtain environmental samples:

Equipment	Fabrication	Dedicated
GeoProbe Cutter	Hardened Steel	No
Sampler Sleeves	Acetate	Yes
Water Level Tape	Plastic/Stainless Steel	No
Trowels	Plastic	Yes
Zip-lock bags	Plastic	Yes
Dredge	Stainless Steel	No
Gloves	Nitrile	Yes

6.1.2 Inspection/Acceptance Requirements for Supplies and Consumables

It is standard operating procedure that personnel will not use broken or defective materials; items will not be used past their expiration date; supplies and consumables will be checked against order and packing slips to verify the correct items were received; and the supplier will be notified of any missing or damaged items.

6.1.3 Field Notes

6.1.3.1 Logbooks

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. The logbook is bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions. At a minimum, the following information will be recorded, if applicable, during the collection of each sample:

- Sample location and description
- Sampler's name(s)
- Date and time of sample collection
- Type of sample (e.g., groundwater)
- Type of sampling equipment used
- Field instrument readings and calibration readings for any equipment used, and equipment model(s) and serial number(s)
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.)
- Sample preservation
- Lot numbers of the sample containers, sample identification numbers and any explanatory codes, and chain-of-custody form numbers
- Shipping arrangements (overnight air bill number)
- Name(s) of recipient laboratory(ies)

In addition to sampling information, the following specifics may also be recorded in the field logbook for each day of sampling:

- Team members and their responsibilities
- Time of arrival on site and time of site departure
- Other personnel on site
- Summary of any meetings or discussions with any potentially responsible parties, or representatives of any federal, state, or other regulatory agency
- Deviations from sampling plans or site safety plan procedures
- Changes in personnel and responsibilities, as well as reasons for the change
- Levels of safety protection
- Record of photographs

6.1.3.2 Photographs

Photographs will be taken at representative sampling locations and at other areas of interest on site. They will verify information entered in the field logbook. When a photograph is taken, the following information will be written on the logbook or will be recorded in a separate field photography log:

- Time, date, location, and weather conditions
- Description of the subject photographed
- Name of person taking the photograph

6.1.4 Field Measurements

6.1.4.1 Underground Utilities Clearance

Location of underground utilities will be provided by the USA Locating Service. If any subsurface utilities are suspected beneath proposed borings, the borings will be relocated in order to avoid the utilities. In addition, a Geophysical Locating Service will be employed to identify potential underground hazards before the commencement of subsurface work.

6.1.4.2 Metals by EPA Method 6200

Each waste, soil, sediment, and air sample will be field screened for metals by EPA Method 6200 (Appendix E). A 20-gram aliquot of sample will be dried at 96 degrees centigrade and sieved to 200 microns (if needed) prior to placing in a dedicated XRF cup in accordance with the XRF Sample Preparation SOP. The XRF will be calibrated using samples collected on site and analyzed by definitive methods prior to field work. The XRF will be calibrated daily and the calibration checked every four hours of running time. The XRF results will be compared with background, PRG_s, and/or TTLC values, depending on the detection limit of the analyte and the data decision tree (Figures 3-1 through 3-3) for the type of sample. The data will be used to determine which samples are sent to a laboratory for definitive analysis by CLPAS Method ILM05.2 for soil and sediment samples, or EPA Method 6020B for air samples.

The determination of samples to be sent for definitive analysis will include prioritization by: 1) Representation of the range of field screening results, 2) Representation of the range of background samples, 3) Representation of the samples exceeding HRS and/or Removal action levels. The number of samples submitted for definitive analysis will be at least 20% of the total number of solid samples. The approximate number of samples from each population is presented in Table 5-1; the actual number of definitive samples should be proportional to the number of field-screened samples for each population if the number of total samples collected differs from Table 5-1. Flow sheets describing the sample collection and analytical decision tree for each matrix are presented in Figures 3-1 through 3-5.

6.1.4.3 Gamma Radiation Field Screening

Soil, sediment, waste, and air samples will be screened for gamma radiation by placing a 3x3-inch sodium-iodide gamma probe within one inch of the surface of the sample. Gamma measurements are useful in screening for target analytes because the decay-chain, intermediate daughter products of ^{232}Th and ^{228}Th , which are primary alpha emitters, and ^{137}Cs , produce gamma radiation. Readings will be measured in “Counts Per Minute” and recorded when the readings stabilize. The measurements will be recorded in the logbook and compared with background measurements (see Figures 3-1 through 3-3). Measurements exceeding three-times background are considered “significantly elevated.” The screening data will be used to determine which samples are analyzed for ^{232}Th , ^{137}Cs , and ^{228}Th by EPA Method 901.1 (see MERL-specific method, CER-651 in Appendix C) and ^{40}K and ^{230}Th by EPA Method 900.0 (see MERL-specific method, CER-652 in Appendix C).

The determination of data to be sent for definitive analysis will include prioritization (figures 3-1 through 3-5) by: 1) Representation of the range of field screening results, 2) Representation of the range of background samples, 3) Representation of the samples exceeding HRS and/or Removal action levels. The number of samples submitted for definitive analysis will be at least 20% of the total number of solid samples. The approximate number of samples from each population is presented in Table 5-1; the actual number of definitive samples should be proportional to the number of field-screened samples for each population if the number of total samples collected differs from Table 5-1.

6.1.4.4 VOC Field Screening

Subsurface soil and waste samples will be screened for total VOCs by placing an aliquot into a plastic bag and disturbing the sample for approximately one minute. Total VOC concentrations in the head space of the bag will be measured by inserting the probe of the PID into the opening of the bag. The highest reading will be recorded in the logbook. The data will be used in part to help identify which of the subsurface soil samples will be sent to a laboratory and analyzed for VOCs by CLPAS Method OLC03.2.

The number of samples submitted for definitive VOC analysis will be 10%, and the distribution throughout the sample population will be determined based on the decision tree process outlined in figures 3-1 and 3-2, and will reflect the numbers presented in Table 5-1. The choice of samples will include at least one shallow, representative subsurface sample from each boring, any sample that exceeds 3 ppm above background on the PID, and any remaining samples randomly chosen so that the total equals 10% of the sample suite.

6.2 Sampling Procedures

6.2.1 Groundwater Sampling

Groundwater samples will be collected from five existing wells and nine new wells installed at the site. Groundwater sampling locations are shown in Figures 4-2 and 4-3. The existing wells will be

reconditioned by surging for ten minutes, then pumping five well volumes, as described in Section 6.2.1.3 below and in accordance with ERT SOP # 2044 (See Appendix E). Existing wells will be installed as described below in Section 6.2.1.1.

6.2.1.1 Installation of New Wells

Nine new wells will be installed at the site in order to determine the groundwater gradient in the Smelter Area and to determine the extent of groundwater contamination beneath the site. Wells will be installed in accordance with ERT SOP # 2048 (Appendix D) by advancing a direct-push (GeoProbe™) boring to the appropriate depth, which is anticipated to be approximately six to eight feet below ground surface. The borings will be advanced in accordance with ERT SOP # 2050 (Appendix E). Once the boring is completed, water will be allowed to equilibrate in the boring and the level will be gauged. The well will be completed using a five foot screen with a 0.02 inch slot size. The screen will be installed with four feet below, and one foot above the water level. The screen interval annulus will be backfilled with a #3 sand, or the most appropriate sand size for the sediment encountered during the boring advancement, to a height of approximately six inches above the top of the screen. A 2-foot bentonite-cement sanitary seal will be installed above the sand pack, and any remaining height will be grouted with bentonite.

New wells will be allowed to sit for at least 24 hours before developing. The new wells will be developed by surging for ten minutes, then purging, as described in Section 6.2.1.3 below.

6.2.1.2 Water-Level Measurements

All wells will be sounded for depth to water and total well depth prior to purging. Wells will be sounded from top of casing. An electronic sounder, accurate to the nearest ± 0.01 foot, will be used to measure depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the top of the water column, the graduated markings on the probe wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. Typically, the measuring device emits a constant tone when the probe is submerged in standing water and most electronic water level sounders have a visual indicator consisting of a small light bulb or diode that turns on when the probe encounters water. Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of the well screen. Total well depths will be measured by lowering the weighted probe to the bottom of the well and recording the depth to the nearest 0.01 foot.

Water-level sounding equipment will be decontaminated before and after use in each well. Water levels will be measured in wells that have the least amount of known contamination first. Wells with known or suspected contamination will be measured last.

6.2.1.3 Purging

All wells will be purged in accordance with ERT SOP # 2044 (See Appendix E) prior to sampling. If the well casing volume is known, a minimum of three casing volumes of water will be purged using a hand pump, submersible pump, or bailer, depending on the diameter and configuration of

the well. When a submersible pump is used for purging, clean flexible Teflon tubes will be used for groundwater extraction. All tubes will be decontaminated before use in each well. Pumps will be placed 2 to 3 feet from the bottom of the well to permit reasonable draw down while preventing cascading conditions.

Water will be collected into a measured bucket to record the purge volume. Casing volumes will be calculated based on total well depth, standing water level, and casing diameter. One casing volume will be calculated as:

$$V = \pi d^2 h / 77.01$$

where:

- V** is the volume of one well casing of water ($1\text{ft}^3 = 7.48$ gallons);
- d** is the inner diameter of the well casing (in inches);
- h** is the total depth of water in the well (in feet).

It is most important to obtain a representative sample from the well. Stable water quality parameter (temperature, pH and specific conductance) measurements indicate representative sampling is obtainable. Water quality is considered stable if for three consecutive readings:

- temperature range is no more than $\pm 1^\circ\text{C}$;
- pH varies by no more than 0.2 pH units;
- specific conductance readings are within 10% of the average.

The water in which measurements were taken will not be used to fill sample bottles.

If the well casing volume is known, measurements will be taken before the start of purging, in the middle of purging, and at the end of purging each casing volume. If the well casing volume is NOT known, measurements will be taken every 2.5 minutes after flow starts. If water quality parameters are not stable after 5 casing volumes or 30 minutes, purging will cease, which will be noted in the logbook, and ground water samples will be taken. The depth to water, water quality measurements and purge volumes will be entered in the logbook.

If a well dewateres during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80% of the static water column and dewatered once more. After water levels have recharged to 80% of the static water column, groundwater samples will be collected.

6.2.1.4 Well Sampling

At each sampling location, all bottles designated for VOC analysis will be filled sequentially before bottles designated for metals or radionuclide analysis are filled. If a duplicate sample is to be collected at this location, all bottles designated for a particular analysis for both sample designations will be filled sequentially before bottles for another analysis are filled. In the filling sequence for duplicate samples, bottles with the two different sample designations will alternate. Groundwater will be transferred directly from the sampling device into the appropriate sample containers with

preservative, chilled if appropriate, and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the sampling device to the sample container.

Three VOA vials and two 1-liter poly bottles will be collected at each sample location. Vials for VOC analysis will be filled first to minimize the effect of aeration on the water sample. The vials, pre-preserved with hydrochloric acid (HCl), will be filled directly from a dedicated bailer then capped. The vial will be inverted and checked for air bubbles to ensure zero headspace. If a bubble appears, the vial will be discarded and a new sample will be collected. Sample containers will be closed as soon as they are filled, chilled immediately to 4°C and prepared for shipping to an offsite laboratory for metals, VOCs and radionuclide analyses.

Samples for metals and radionuclide analysis will be collected in 1-liter polyethylene sample bottles (one bottle for each analysis). Samples will be preserved by adding several drops of nitric acid (HNO₃) to the sample bottle. The bottle will be capped and lightly shaken to mix in the acid. A small quantity of sample will be poured into the bottle cap where the pH will be measured using pH paper. The pH must be ≤ 2 . The sample in the cap will be discarded, and the pH of the sample will be adjusted further if necessary..

After well purging and prior to collecting groundwater samples for metals analyses, the turbidity of the groundwater extracted from each well will be measured using a portable turbidity meter. A small quantity of groundwater will be collected from the well and transferred to a disposable vial and a turbidity measurement will be taken. The results of the turbidity measurement will be recorded in the field logbook. The water used to measure turbidity will be discarded after use. If the turbidity of the groundwater from a well is above 5 Nephelometric Turbidity Units (NTUs), both a filtered and unfiltered sample will be collected. A 5-micron filter will be used to remove larger particles that have been entrained in the water sample, using a sample-dedicated Teflon tube. A clean, unused filter will be used for each filtered sample collected. Groundwater samples will be transferred from the filter directly into the appropriate sample containers with a preservative and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the filter to the sample container. After the filtered sample has been collected, the Teflon tube and filter will be removed and an unfiltered sample will be collected. A sample number appended with an "FI" will represent a sample filtered with a 5-micron filter.

6.2.2 Surface Water Sampling

Surface water samples for metals and radionuclides will be collected at ten locations in the OID and outfall lagoon. Samples will be collected by submerging two 1-liter poly bottles (one for metals, one for radionuclides) in the surface water at the sample point, then opening the cap. Samples will be preserved by adding several drops of HNO₃ to the sample bottle. The bottle will be capped and lightly shaken to mix in the acid. A small quantity of sample will be poured into the bottle cap where the pH will be measured using pH paper. The pH must be ≤ 2 . The sample in the cap will be discarded, and the pH of the sample will be adjusted further if necessary.e

A small quantity of surface water will be collected from the well and transferred to a disposable vial and a turbidity measurement will be taken. The results of the turbidity measurement will be recorded

in the field logbook. The water used to measure turbidity will be discarded after use. If the turbidity of the groundwater from a well is above 5 Nephelometric Turbidity Units (NTUs), both a filtered and unfiltered sample will be collected. A 5-micron filter will be used to remove larger particles that have been entrained in the water sample, using a sample-dedicated Teflon tube. A clean, unused filter will be used for each filtered sample collected. Surface water samples will be transferred from the filter directly into the appropriate sample containers with a preservative and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the filter to the sample container. After the filtered sample has been collected, the Teflon tube and filter will be removed and an unfiltered sample will be collected. A sample number appended with an "FI" will represent a sample filtered with a 5-micron filter.

6.2.3 Sediment Sampling

Sediment samples will be collected from the OID, beach, and marine environments. OID sediments will be collected from the first six inches of sediment, using a dedicated plastic scoop and/or gloved hand and placed in a plastic bag. In each OID sample, the sediment lithology will be described in the logbook; silt to sandy silt sediments will be preferentially sampled. Beach sediments will be collected from the first six inches of sediment using a dedicated plastic scoop and or gloved hand and placed in a clean, resealable plastic bag. Marine sediments will be collected using a dredge from the upper six to eight inches of sediments at marine depths ranging from 5 to 15 feet below sea level. The marine sediment lithology will be carefully logged in the logbook and the sediments will be placed in a clean, resealable plastic bag. For all sediment samples, aliquots for XRF and radionuclide analysis will be taken from the bag, dried, and placed in the appropriate analytical container. The remaining sediments will be archived at the site pending the decision of which samples to submit for definitive analysis, as described above and illustrated in Figure 3-2. Samples submitted for definitive analysis will be placed into 4-ounce glass jars for shipment to the laboratory.

6.2.4 Soil/Waste Sampling

Surface soil/waste samples will be collected in accordance with EPA ERT SOP #2012. Samples will be collected from the first six inches of soil at the surface at 236 locations across the site and in adjacent parcels. Surface samples will be collected from the first six inches of soil using a dedicated trowel and/or gloved hand. New gloves will be used to collect each sample, and the sample will be placed in a new resealable plastic bag. The volume of sample collected will be approximately 2 liters, enough to perform field screening for XRF (about 10 grams), radionuclide analysis (500 cubic centimeters), fill two 4-oz. jars for laboratory analysis, and provide enough archive sample for the selection of metals/radionuclide duplicates (see section 9.1.2) and laboratory QA/QC (see Section 9.3), as needed. Samples will be archived in a clean, secure area in the Smelter Area.

Subsurface soil samples will be collected using a direct-push drill rig in accordance with EPA ERT SOP #2050 (Appendix E). Soil samples will be collected from 48 boring locations. 35 of these borings will be advanced at random locations in five distinct areas within the WMU as part of the random sampling method for the characterization of the waste. Borings will be backfilled with hydrated medium bentonite chips, except for those locations where a well will be installed.

Samples will be collected in a GeoProbe™ sampler lined with dedicated acetate sleeves. The sampler will be retrieved to the surface and screened for VOCs. If VOC analysis is warranted, material to be analyzed for VOCs will be prepared first. Soil samples for VOC field screening analyses will be collected from the liner sleeves as independent, discrete samples, using 5-gram EnCore samplers. Three En Core® samplers (En Cores) will be collected for each sample. The En Cores will be immediately refrigerated to 4°C, and shipped to the laboratory for analysis within 48 hours of collection. Soils remaining in the liners will be transferred into a resealable plastic bag and prepared for field screening, as described above for the surface soil samples. The results of the field screening will be used to determine which samples are sent to the laboratory for definitive analysis, as described above and illustrated in Figures 3-1 through 3-3.

All soil/waste samples will be examined for color, grain size/type, cohesion, and organic content as they are collected. This information will be recorded in the logbook.

The waste in the WMU is presumed to be heterogeneous, based on historical information regarding the nature of materials processed at the Site, including the thorium-enriched wastes processed between 1969 and 1977. The WMU has been divided into five populations based on the approximate stages of emplacement; these populations are: 1) The southern berm, 2) The northern berm, 3) The southern waste pond, 4) The central waste pond, and 5) The northern waste pond. A Random Sampling Strategy, as described in SW-846, Chapter 9, will be conducted in each of the five populations. The surface of each population has been arbitrarily divided into 42 grids. Boring locations will be advanced at seven randomly chosen grids from each population, and a sample will be collected at a randomly chosen depth interval between 2 and 25 feet below the waste pile surface. These randomly collected samples will be analyzed in a laboratory for total metals, leachable metals, and radionuclides in order to statistically determine the waste characteristics of each area.

In addition, waste materials from each boring will be screened at regular intervals for metals and alpha and gamma radiation in order to identify potential “hot spots” in the waste pile. A subset of these field-screened samples will be submitted to a laboratory for confirmation analyses. These samples will also be used to fulfill the HRS Source/Waste Characteristics defined in Section 2.6.1 above.

6.2.5 Air Sampling

Air samples will be collected using EPA ERS-owned, high-volume air samplers fitted with 47 mm glass fiber filters. Samples will be collected for ten hours each day at five different stations. Air will be pumped air at a rate of 32 liters per minute. One sample will be collected each day at each station, and the filters will be screened for metals by XRF and radiation using a gamma probe. Based on the criteria described above and illustrated in Figure 3-5, a subset of these samples will be selected for definitive analysis. In addition, a sixth high-volume air sampler will be used to collect duplicate samples at a different station each day. These duplicates will be used for QC purposes described in Section 9 below.

6.3 Decontamination Procedures

The decontamination procedures that will be followed are in accordance with approved procedures. Decontamination of sampling equipment must be conducted consistently to assure the quality of samples collected. All non-dedicated equipment that comes into contact with potentially contaminated water, soil, and/or sediment will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of non-dedicated equipment. All non-dedicated sampling devices used will be steam-cleaned or decontaminated according to EPA Region 9 recommended procedures.

The following, to be carried out in sequence, is an EPA Region 9 recommended procedure for the decontamination of sampling equipment

- Non-phosphate detergent and tap water wash, using a brush if necessary
- Tap-water rinse
- Deionized/distilled water rinse
- Isopropanol or Methanol rinse
- Deionized/distilled water rinse (twice)

Equipment will be decontaminated in a predesignated area on pallets or plastic sheeting, and clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered.

7.0 DISPOSAL OF INVESTIGATION-DERIVED WASTE

In the process of collecting environmental samples at the site, several different types of potentially contaminated investigation-derived wastes (IDW) will be generated, including the following:

- Used personal protective equipment (PPE);
- Disposable sampling equipment;
- Decontamination fluids;
- Excess soil, including cuttings from soil borings; and
- Purge water.

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with all relevant and appropriate requirements to the extent practicable. This sampling plan will follow the *Office of Emergency and Remedial Response Directive 9345.3-02* (May 1991) which provides the guidance for management of IDW. In addition, other legal and practical considerations that may affect the handling of IDW will be considered. Listed below are the procedures that will be followed for handling IDW. The procedures are flexible enough to allow the sampling team to use its professional judgement on the proper method for the disposal of each type of IDW generated at each sampling location.

- Used PPE and disposable sampling equipment will be double-bagged in plastic trash bags and disposed of in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE or dedicated equipment that is to be disposed of that can still be reused will be rendered inoperable before disposal.
- Decontamination fluids that will be generated in the sampling event will consist of dilute isopropanol/methanol, deionized water, residual contaminants, and water with non-phosphate detergent. Decontamination fluids will be drummed and staged on site.
- Soil cuttings generated during the subsurface sampling will be returned to the WMU.
- Purge water will consist of water from monitoring wells; this water will be drummed and staged on site.

8.0 SAMPLE IDENTIFICATION, DOCUMENTATION AND SHIPMENT

8.1 Sample Nomenclature

A unique, identifiable name will be assigned to each sample. Sample prefixes are assigned by matrix as follows:

SW - solid waste - add an "F" for samples from the Smelter Area (example: SWF-), or a number from 1 - 5 to describe the area of random sampling (example: SW3-).

SSN - soils not otherwise specified

SSR - residential soils

SSA - agricultural soils

SWL - wetland soil

SDF - freshwater sediments from the OID and outfall

SDB - beach sediments

SDM - marine sediments

WS - surface water

AIR - air sample - add a number from 1 to 5 for the station location.

MW - groundwater sample - add number for well identification.

For soil samples, the prefix will be used to identify the matrix type. For subsurface samples, a modifier for the depth will be added in the form '/d.' The suffix will be a unique number defined by the date and time in the format, 'DDMMYY-hhmm'. For example, the name, SW4/22-220606-1322 signifies a sample from the random boring location from Area 4 in the WMU at a depth of 22 feet below ground surface, and collected on June 22, 2006 at 1322 hours. Duplicate and blank samples will be assigned fictitious names that comply with the nomenclature established above. The EPA Regional Sample Control Center Coordinator may assign additional sample numbers.

8.2 Container, Preservation, and Holding Time Requirements

All sample containers used will have been delivered to WESTON in a pre-cleaned condition with preservatives already added, where applicable. Container, preservation, and technical holding time requirements are summarized in Table 5-1.

8.3 Sample Labeling, Packaging and Shipping

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. Sample labels will be created using the Forms II Lite data management system. Sample labels will be affixed to the sample containers and secured with clear tape. Where vials have been pre-weighed, the vials will be enclosed in a zip-lock bag, and the label and custody seal will be affixed to the bag to avoid skewing the sample weight. Samples will have preassigned, identifiable, and unique numbers in accordance with Section 8.1. The sample labels will contain the following information where appropriate:

- Sample number
- Sample location
- Date and time of collection
- Site name
- Analytical parameter and method of preservation
- CLP Case Number (if applicable)

Samples will be stored on ice or in a refrigerator or freezer in a secure location pending shipment to the contract laboratory. Sample coolers will be retained in the custody of site personnel at all times or secured so as to deny access to anyone else. The procedures for shipping samples are as follows:

- The bottom of the container will be lined with bubble wrap to prevent breakage during shipment.
- Screw caps will be checked for tightness.
- Containers will have custody seals affixed so as to prevent opening of the container without breaking the seal.
- All glass sample containers will be wrapped in bubble wrap.
- All containers will be sealed in zip-lock plastic bags.

All samples will be placed in shipping containers with the appropriate chain-of-custody forms. All forms will be enclosed in plastic bags and affixed to the underside of the container lid. Empty space in the container will be filled with bubble wrap or styrofoam peanuts to prevent movement and breakage during shipment. Each container will be securely taped shut with strapping tape, and custody seals will be affixed to the front, right, and back of each cooler.

Samples will be shipped for immediate delivery to the Region 9 Laboratory. The QAO's Region 9 Sample Control Center Coordinator (Mary O'Donnell, 510-412-2389) will be notified daily of the sample shipment schedule and will be provided with the following information:

- Sampling contractor's name
- The name of the site
- Case number
- Shipment date and expected delivery date
- Total number of samples by matrix, and relative level of contamination (i.e., low, medium, or high)

- Carrier, air bill number(s), and method of shipment (e.g., FedEx)
- Irregularities or anticipated problems associated with the samples
- Whether additional samples will be sent or if this is the last shipment

8.4 Chain of Custody Forms and QA/QC Summary Forms

Samples from this investigation will be delivered to at least three laboratories including the MERL, The Region 9 Laboratory in Richmond, California, and a CLP Laboratory yet to be determined. A chain of custody form will be maintained for all samples to be submitted for analysis, from the time the sample is collected until its final deposition. Every transfer of custody must be noted and signed for; a copy of this record is kept by each individual who has signed. Corrections on sample paperwork will be made by drawing a single line through the mistake and initialing and dating the change. The correct information will be entered above, below, or after the mistake. When samples are not under the direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. The chain of custody must include the following:

- Sample identification numbers
- Site name
- Sample date
- Number and volume of sample containers
- Required analyses
- Signature and name of samplers
- Signature(s) of any individual(s) with control over samples
- Airbill number
- Note(s) indicating special holding times and/or detection limits

Traffic reports will be used to document sample collection and shipment to the laboratory for analysis. The Forms II Lite data management system will be used to generate all traffic reports and chains of custody. One copy will be completed and sent with the samples for each laboratory and each shipment. If multiple coolers are sent to a single laboratory on a single day, only one form will be completed. If all sample information cannot be entered in one form, then multiple forms will be used. One copy will be provided to RSCC Mary O'Donnel, one copy of the form will be sent to the EPA QAO, and one copy will accompany the samples to the laboratory. A photocopy of the original will be made for WESTON's master file. The document titled "*Instructions for Sample Shipping and Documentation*," Quality Assurance Management Section, EPA Region 9, November 1997, will be taken to the field as a reference. This document is included in Appendix F.

A QA/QC summary form will be completed for each laboratory and each matrix of the sampling event. The sample number for all blanks, reference samples, laboratory QC samples (matrix spike/matrix spike duplicate [MS/MSD]) and duplicates will be documented on this form. This form is not sent to the laboratory. The original form will be sent to the EPA QAO; a photocopy of the original will be made for WESTON's master file.

9.0 QUALITY ASSURANCE AND CONTROL (QA/QC)

9.1 Field Quality Control Samples

The QA/QC samples described in the following subsections, which are also listed in Table 5-1, will be collected during this investigation.

9.1.1 Assessment of Field Contamination (Blanks)

9.1.1.1 Field Blanks

All equipment coming into contact with samples will be dedicated. Therefore, no equipment blanks will be collected. Instead, field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to ambient conditions or from sample containers. Field blank samples will be obtained by pouring distilled VOC free water into a sampling container at the sampling point. The field blanks that are collected will be analyzed for VOCs and metals.

The field blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory.

9.1.1.2 Temperature Blanks

For each container that is shipped or transported to an analytical laboratory, a 40-ml vial, or equivalent, of water will be included that is marked "temperature blank." This blank will be used by the sample custodian to check the temperature of samples upon receipt.

9.1.2 Assessment of Sample Variability (Field Duplicate or Co-located Samples)

Duplicate samples will be collected at two groundwater and one surface water sample locations to be determined on the basis of most downgradient location where contaminants are most likely to be found. The final determination of duplicates will be made in the field. When collecting duplicate water samples, bottles with the two different sample identification numbers will be alternated in the filling sequence.

Duplicate soil/sediment/waste samples will be collected at 44 field screening sample locations, as indicated in Table 5-1. These locations will be selected in the field and will represent a minimum of 10% of the samples collected in the day's activities. Duplicate selection should be representative of the matrices collected during both the daily activity and the life of the field project. No VOC screening duplicates will be collected due to the time-critical nature of identifying and processing the definitive VOC samples.

Duplicate soil/sediment/waste samples for definitive analysis will be collected at 12 sample locations. The duplicate samples to be analyzed for metals and radionuclides will be selected based on representation of the matrix and screening results. Soil samples to be analyzed for metals will

be homogenized in a sample-dedicated zip-loc bag. Homogenized material will then be transferred to 4-ounce glass jars. Soil samples for VOC analysis will not be homogenized. Equivalent samples (co-located samples) will be collected from the sample sleeve, alternating with collection of the original samples.

Duplicate air samples will be collected every other day for field screening purposes, for a total of five duplicate samples. In addition, two duplicate samples will be submitted to the laboratory for definitive analyses. Duplicate samples will be collected by installing a second high-volume air pump within ten feet of the primary sample station. The location of the duplicate station will change daily. Samples collected by the second station that are not used for duplicate samples may be submitted for MS/MSD samples (see Section 9.3 below).

Duplicate samples will be preserved, packaged, and sealed in the same manner described for the environmental samples in Section 6.2. A separate sample number will be assigned to each duplicate, and they will be submitted blind to the laboratory. The variability criteria for co-located (duplicate) soil samples is $\pm 50\%$ due to typical soil heterogeneity. All duplicate samples will be submitted blind to the laboratories.

9.2 Background Samples

Background groundwater will be collected upgradient of the site to differentiate between on-site and off-site contributions to contamination. Background groundwater samples indicated in Table 5-1 will be collected from the locations based on the groundwater gradient measured at the time of sampling. Background soil samples will be collected in areas not expected to have been impacted by contaminants from the site. Background surface water samples indicated in Table 5-1 will be collected over a 2-mile stretch of the OID to the north of the site. Background soil samples indicated in Table 5-1 will be collected from locations thought not to be affected by the site (See Figure 4-1). Background OID, marine, and beach sediment samples will be collected in areas upgradient of the site, as described in Section 6. The background samples will be submitted blind to the laboratory for the same analysis suite as the equivalent media from potentially affected areas, as described in Table 5-1. Because wind directions vary considerably, air samples will be collected at five locations daily; the determination of which of the five samples is designated as “background” will be made based on a review of wind rosettes generated from a field meteorological station provided by the ERS.

9.3 Laboratory Quality Control Samples

A laboratory QC sample, called an MS/MSD for organic analysis, is not an extra sample; rather, it is a sample that requires additional QC analyses.

For groundwater and surface water samples, a double-volume groundwater sample will be collected at two locations, one from each sample type, to ensure that sufficient volume is collected for both routine sample analysis and additional laboratory QC analysis. Two sets of water sample containers will be filled and all containers will be labeled with a single sample number. The locations will be determined in the field at locations thought to contain detectable levels of AOCs; these locations will most likely be from water directly downgradient of the sources of contaminants.

For soil, sediment, and waste samples, double-volume soil samples will be collected at six locations (2 locations for VOCs) to ensure that sufficient volume is collected for both routine sample analysis and additional laboratory QC analysis. Soil samples to be analyzed for metals will be homogenized in a sample-dedicated zip-loc bag. Homogenized material will then be transferred to 4-oz glass jars. Soil samples for VOC analysis will not be homogenized. Two additional EnCore samples will be collected from the sample sleeve immediately following the collection of the original sample.

For this sampling event, the samples collected at the areas indicated in Table 5-1 will be the designated laboratory QC samples; specific locations will be chosen in the field based on field screening data indicating that the samples contain detectable levels of AOCs. The sample labels and chain-of-custody records for these samples will identify them as a laboratory QC samples. At a minimum, one sample per 20 samples, per matrix, will be designated as a laboratory QC sample.

9.4 Analytical and Data Package Requirements

It is required that all definitive samples be analyzed in accordance with the methods listed in Table 5-1. The laboratory is required to supply documentation to demonstrate that their data meet the requirements specified in the contract.

The data validation package shall include all original documentation generated in support of this project. In addition, the laboratory will provide original documentation to support that all requirements of the method have been met. This includes, but is not limited to, sample tags, custody records, shipping information, sample preparation/extraction records, and instrument printouts such as mass spectra. Copies of information and documentation required in this document are acceptable. The following deliverables are required. Note that the following data requirements are included to specify and emphasize general documentation requirements and are not intended to supersede or change requirements of the specific method.

- Copy of the chain of custody, sample log-in records, and a Case Narrative describing the analyses and methods used and discussing the presence of any interferences, the criteria used to identify tentatively identified compounds (TICs), and the failure of the lab to meet any of the requirements or re-analyses.
- Analytical data (results) up to 3 significant figures for all samples, method blanks, MS/MSD, Laboratory Control Samples (LCS), duplicates, and field QC samples.
- QC summary sheets: EPA CLP forms that summarize the following
 1. MS/MSD/LCS recovery summary
 2. Method/preparation blank summary
 3. Initial and continuing calibration summary (including retention time windows)
 4. Sample holding time and analytical sequence (i.e., extraction and analysis)
 5. Calibration curves and correlation coefficients
 6. Duplicate summary
 7. Detection limit information
- Analyst bench records describing dilution, weighing of samples, percent moisture (solids), sample size, sample extraction and cleanup, final extract volumes and amount injected.

- Detailed explanation of the Quantitation and identification procedure used for specific analyses, giving examples of calculations from the raw data.
- The final deliverable report will consist of sequentially numbered pages.
- Internal/surrogate recoveries
- Gas Chromatograph/Mass Spectrometer tuning conditions.
- Reconstructed ion current chromatogram and Quantitation reports for all sample standards, blanks, MS/MSD, and performance evaluation samples.
- For every compound identified and each field sample, provide raw versus enhanced spectra and enhanced versus reference spectra.
- For target analytes, the reference spectrum shall be the check standard for that sample. For TICs, the reference mass spectrum shall be the best fit spectrum from a search of the spectral library.

9.5 Data Validation

Data validation of all definitive analytical data will be conducted by the EPA. Tier 3 traditional full validation for 100% of the definitive data will be required.

To meet requirements for categorization as definitive data, the following criteria must be evaluated:

- Holding times
- Sampling design approach
- Blank combination
- Initial and continuing calibration
- Detection limits
- Analyte identification and Quantitation
- Matrix spike recoveries
- Performance evaluation samples when specified
- Analytical and total error determination
- Laboratory Control Samples

Upon completion of validation, data will be classified as one of the following: acceptable for use without qualifications, acceptable for use with qualifications, or unacceptable for use.

9.6 Comparison of Field Screening and Confirmation Data

Screening and Laboratory data will be tabulated comparatively by sample to determine the first-order deviation (difference between the results) of the screening method versus the laboratory method. The deviation should be no more than 50 percent between individual results from the two analytical methods.

False positive and false negative screening results will be determined for each screening/definitive result set. This is determined by comparing the screening results to the site action level for each analyte. A false positive occurs when the screening method result exceeds the site action level when the definitive laboratory measurement indicates that the action level has not been exceeded. A false negative occurs when the screening method yields a result below the action level when the definitive

lab measurement indicates that the action level has been exceeded. While both the false positive and the false negative results indicate issues with the precision and accuracy of the analytical method, false negatives can result in exposing target populations to potentially harmful concentrations of contaminants.

In addition, a least squares regression will be calculated in order to test the comparability of the two data populations. Resulting R² values greater than 0.8 will be considered a good fit for the two analytical methods. R² values between 0.8 and 0.6 will be considered acceptable if there are no false negative results in the screening results. R² values below 0.6 will be considered unacceptable.

9.7 Field Variances

As conditions in the field may vary, it may become necessary to implement minor modifications to this plan. When appropriate, the EPA QAO will be notified of the modifications and a verbal approval will be obtained before implementing the modifications. Modifications to the original plan will be documented in the final report.

9.8 Assessment of Project Activities

9.8.1 WESTON Assessment Activities

The following assessment activities will be performed by WESTON:

- All project deliverables (SAP, Data Summaries, Data Validation Reports, Investigation Report) will be peer-reviewed prior to release to the EPA. In time-critical situations, the peer review may be concurrent with the release of a draft document to the EPA. Errors discovered in the peer review process will be reported by the reviewer to the originator of the document, who will be responsible for corrective action.
- The PM will review project documentation (logbooks, chain of custody forms, etc.) to ensure the SAP was followed and that sampling activities were adequately documented. The PM will document deficiencies and will be responsible for corrective actions.

9.8.2 EPA Assessment Activities

EPA assessment activities, which can include surveillance, management system reviews, readiness reviews, technical system audits, performance evaluation, and audits and assessments of data quality, have not been formally identified to WESTON by the EPA at the time of completion of the SAP.

9.8.3 Project Status Reports to Management

It is standard procedure for the WESTON PM to report to the EPA SAM any issues, as they occur, that arise during the course of the project that could affect data quality, data use objectives, the project objectives, or project schedules.

9.8.4 Reconciliation of Data with DQOs

Assessment of data quality is an ongoing activity throughout all phases of a project. The following outlines the methods to be used by WESTON for evaluating the results obtained from the project.

- Review of the DQO outputs and the sampling design will be conducted by the WESTON PM and the EPA QAO prior to sampling activities. The QAO reviewer will submit comments to the WESTON PM for action, comment, or clarification. This process will be iterative.
- A preliminary data review will be conducted by WESTON. The purpose of this review is to look for problems or anomalies in the implementation of the sample collection and analysis procedures and to examine QC data for information to verify assumptions underlying the DQOs and the SAP.
- When appropriate to sample design, basic statistical quantities will be calculated and the data will be graphically represented.
- When appropriate to the sample design and if specifically tasked to do so by the EPA SAM, WESTON will select a statistical hypothesis test and identify assumptions underlying the test.
- When appropriate to the sample design and if specifically tasked to do so by the EPA SAM, WESTON will examine the underlying assumptions of the statistical hypothesis test in light of the environmental data. This will be accomplished by determining the approach for verifying assumptions, performing tests for assumptions, and determining corrective actions.

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