Quality Assurance Project Plan

Salt Chuck Mine

Intertidal Area, Marine Operable Unit

Tongass National Forest, Alaska

Prepared for

U.S. Environmental Protection Agency
Region 10

July 2011

Prepared by

CH2MHILL

AES10
Architect and Engineering Services Contract
Contract No. 68-S7-04-01

Quality Assurance Project Plan
Salt Chuck Mine
Intertidal Area, Marine Operable Unit
Tongass National Forest, Alaska

Plan approvals:

Jeremy Blei, P.E.
CH2M HILL Project Manager

Jacques Gusmano
EPA Task Order Project Officer

Artemis Antipas, Ph.D.
CH2M HILL Quality Assurance Officer

Gina Grepo-Grove
EPA Quality Assurance Manager

Other Agency Approval, Agency *(if required)*

Distribution List

Name and Organization	Address, Telephone, and Email	Document Distribution
Jacques Gusmano EPA Task Order Project Officer	222 West 7th Avenue Room 537, Box 19 Anchorage, AK 99513 (907) 271-1271 gusmano.jacques@epa.gov	QAPP
Gina Grepo-Grove EPA Quality Assurance Manager	1200 Sixth Avenue, OEA-095 Seattle, WA 98101 (206) 553-1632 grepo-grove.gina@epamail.epa.gov	QAPP
Jeremy Blei CH2M HILL Project Manager	949 East 36th Avenue, Suite 500 Anchorage, AK 99508 (907) 762-1357 Jeremy.Blei@CH2M.com	QAPP
Dennis Shelton CH2M HILL Lead Toxicologist and Risk Assessor, Senior Reviewer	1000 NE Circle Boulevard Building10, Suite 10350 Corvallis, OR 97330 (541) 768-3524 Dennis.Shelton@CH2M.com	QAPP (e-copy only)
David Bunte CH2M HILL Review Team Lead	2525 Airpark Drive Redding, CA 96001 (530) 229-3223 David.Bunte@CH2M.com	QAPP (e-copy only)
Joy Chen CH2M HILL Task Manager	1100 112th Avenue NE, Suite 400 Bellevue, WA 98004-4504 (425) 233-3311 Joy.Chen9@CH2M.com	QAPP (e-copy only)
Jeff Schut CH2M HILL Field Team Leader	332 East Front Street, Suite 200 Boise, ID 83702 (208) 383-6160 Jeff.Schut@CH2M.com	QAPP (e-copy only)
Artemis Antipas CH2M HILL Quality Assurance Officer	1100 112th Avenue NE, Suite 400 Bellevue, WA 98004-4504 (425) 233-3051 Artemis.Antipas@CH2M.com	QAPP (e-copy only)
Tina Rice CH2M HILL Data Base Manager	2020 Southwest 4th Avenue, 3rd Floor Portland, OR 97201-4958 (503) 872-4513 Tina.Rice@CH2M.com	QAPP (e-copy only)

Contents

Acronyms and Abbreviations

°C	degrees Celsius
µg/g	micrograms per gram
µg/L	micrograms per liter
µS/cm	micro Siemens per centimeter
ADEC	Alaska Department of Environmental Conservation
AES	Architect and Engineering Services
AET	apparent effects threshold
ASTM	American Society for Testing and Materials
AVS/SEM	acid volatile sulfide and simultaneously extracted metals
AWQC	ambient water quality criteria
CCME	Canadian Council of the Ministers of the Environment
CLP	Contract Laboratory Program
CSM	conceptual site model
DMMP	Dredged Material Management Program
DQO	Data Quality Objective
DRO	diesel range organics
ECW	environmental contaminant in wildlife
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
ERBSC	ecological risk-based screening concentration
ERL	effects range low
ERM	effects range medium
ESU	U.S. EPA Environmental Services Unit
FP	field procedure
FS	Feasibility Study
FTL	field team leader
GPS	HSP Health and Safety Plan

IDW	investigation-derived waste
MCL	maximum contaminant level
MDL	method detection limit
MEL	Manchester Environmental Laboratory
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MRL	method reporting limits
NA	not applicable; organics analyses not conducted for this media
NC	natural conditions
NE	not established
NEHC	Navy Environmental Health Center
NOAA	National Oceanic and Atmospheric Administration
NOEC	No Observed Effects Concentration
ORNL	Oak Ridge National Laboratory
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEL	probable effects level
PM	Project Manager
PO	Project Officer
ppm	parts per million
ppt	parts per thousand
ppt	parts per thousand
PRG	preliminary remedial goal
PSEP	Puget Sound Estuary Program
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RBSL	risk-based screening level

RI	Remedial Investigation
RPD	relative percent difference
RRO	residual range organics
RSCC	Regional Sample Control Coordinator
RSD	relative standard deviation
RTL	Review Team Leader
SEPA	State Environmental Policy Act
SOP	Standard Operating Procedure
SOW	Statement of Work
SPLP	synthetic precipitate leaching procedure
SQuiRT	screening quick reference tables
SRM	standard reference material
TAL	target analyte list
TCL	target compound list
TEL	threshold effects level
TOPO	Task Order Project Officer
USEPA	U.S. Environmental Protection Agency
WQC	water quality criteria
yd^3	cubic yards

SECTION 1

Introduction

This Quality Assurance Project Plan (QAPP) presents the policies, organizations, objectives, and functional activities and procedures for the Salt Chuck Mine intertidal area preremedial investigation being conducted by the U.S. Environmental Protection Agency (EPA) in the Tongass National Forest, Alaska. The preremedial investigation is limited to remedial investigation planning and preliminary field work that will support a more extensive Remedial Investigation/Feasibility Study (RI/FS) effort to be performed starting in 2012. The QAPP and its supporting documents, found in Appendices A and B (Data Quality Objectives [DQO] and Field Procedures [FPs]), have been developed to document the type and quality of data needed for environmental decisions.

The intertidal area investigation will be conducted in late August 2011 to early September 2011. Activities to be conducted as part of the Investigation are as follows:

- Verify sampling and analysis for selected historical (pre-2007) intertidal tailings, sediment, water, and tissue sample locations
- Perform additional intertidal tailing sampling and analysis to evaluate the nature and extent of contamination
- Perform additional sediment sampling and analysis to evaluate the nature and extent of contamination
- Perform additional bivalves tissue analyses to evaluate the nature and extent of contamination
- Evaluate background concentrations
- Evaluate additional characterization methods (bioassay and modified synthetic precipitate leaching procedure [SPLP])

Various investigations have been conducted for both upland and intertidal areas at the Salt Chuck Mine. This QAPP only addresses the intertidal areas, which is generally defined as areas located below the high tide line, with the exception of including a tailing spit located at the southwest corner of the mill. Previous investigations in the intertidal area were conducted in 1995, 1997, 2002, and 2006, which are hereinafter referred to as historical data (i.e., pre-2007 data); the 2007 *Engineering Evaluation/Cost Analysis Draft Report (EE/CA)* (URS, 2007) summarizes these historical data. The sampling approach presented in this QAPP is staged in a manner so that the results can be compared to those included in the EE/CA. Results collected during this preremedial investigation may be combined with the historical data if current concentrations in the environmental media are found to be consistent with the results from these previous investigations.

The QAPP follows EPA guidelines contained in *USEPA Guidance for Quality Assurance Project Plans* (EPA, 2002a), and *EPA Requirements for Quality Assurance Project Plans* (EPA, 2001). The contents of the QAPP also meet the *Uniform Federal Policy for Quality*

Assurance Project Plans (EPA, 2005). The development review, approval, and implementation of the QAPP is part of EPA's mandatory quality system, which requires all organizations to develop and operate management structures and processes to ensure that data used in agency decisions are of the type and quality needed for their intended use. The following sections of this document correlate with the subtitles found in the EPA guidelines (EPA, 2001) and are consistent with *Uniform Federal Policy for Quality Assurance Project Plans*. This document is organized as follows:

- **Section 1, Introduction,** provides the purpose and organization of this report.
- **Section 2, Project Management (EPA Group A),** describes the project and task organization, background and problem definition, work tasks and project schedule, quality and objectives criteria, special training and certifications, and documents and records.
- **Section 3, Data Generation and Acquisition (EPA Group B),** describes the sampling design; sampling methods; sample handling and custody; analytical methods; quality control; instrument and equipment testing, inspection and maintenance; instrument and equipment calibration and frequency; inspection and acceptance of supplies and consumables; nondirect measurements; and data management.
- **Section 4, Assessment and Oversight (EPA Group C),** describes any response actions and reports to management.
- **Section 5, Data Validation and Usability (EPA Group D),** describes data review, verification, and validation; verification and validation methods; and reconciliation with user requirements.
- **Section 6, References,** lists the references used in this document.
- **Appendix A, Data Quality Objectives for Preremedial Investigation, Salt Chuck Mine, Tongass National Forest, Alaska**
- **Appendix B, Field Procedures**
- **Appendix C, Health and Safety Plan**
- **Appendix D, Analytical Specs**

SECTION 2

Project Management (EPA Group A)

2.1 Project and Task Organization (A4)

The task order for this project was issued pursuant to EPA Architect and Engineering Services (AES) Contract No. 68-S7-04-01. The task order is managed by CH2M HILL's Project Manager (PM), who works directly with the EPA Task Order Project Officer (TOPO) to accomplish the task order. The PM manages the financial, schedule, and technical aspects of the task order. The key people involved in interfacing with the PM are the EPA TOPO and the CH2M HILL Quality Assurance Officer (QAO), Review Team Leader (RTL), Task Leader, and Field Team Leader (FTL).

Figure 2-1 illustrates the project organization and lines of authority for CH2M HILL staff (figures appear at the end of each respective section), and Figure 2-2 shows the data flow. The data for this task include both field measurements and analytical data. Figure 2-1 shows both EPA and CH2M HILL technical and quality assurance personnel. The organizational functions shown are consistent with the overall AES 10 Program Plan (*EPA Management Plans and Standard Operating Procedures for Region 10 Architect Engineering Services, Contract Solicitation No. PR-R7-02-10217* [EPA, 2003a]). The AES 10 Program Plan provides additional details for these organizational functions.

The review team (led by the RTL) and the QAO will review project planning documents, data evaluation, and deliverables. The primary responsibility for project quality rests with the PM, and independent quality control is provided by the RTL and QAO.

The field team will implement the QAPP and Health and Safety Plan (HSP). The site safety coordinator is responsible for adhering to the HSP and field decontamination procedures, and the entire field effort is directed by the FTL. Field team responsibilities are further described in Appendix B.

The subcontract administrator is responsible for procuring subcontracts for EPA's AES projects under Federal Acquisition Regulations and provides the interface with subcontractors. Subcontractors may be used on this task order for laboratory analyses depending on EPA regional laboratory availability. Where quality assurance problems or deficiencies requiring special action are uncovered, the PM, RTL, and QAO will identify the appropriate corrective action to be initiated by the FTL.

The EPA Regional Sample Control Coordinator (RSCC) is responsible for both Contract Laboratory Program (CLP) and EPA Manchester Environmental Laboratory (MEL) coordination. The RSCC works with the EPA Regional Quality Assurance Manager, the region's CLP Project Officer (PO), and the project's PMs in resolving laboratory and field quality assurance (QA) issues and laboratory scheduling. The RSCC provides the regional sample tracking numbers, sample tags, custody seals, and other CLP-required chain-of-custody documentation.

2.2 Background and Problem Definition (A5)

2.2.1 Background

This section is based predominantly on information obtained from the 2007 EE/CA (URS 2007, and references therein).

2.2.2 Site Description, Past Investigations, and Conceptual Site Model (CSM)

Salt Chuck Mine was added to the EPA National Priorities List on March 4, 2010. The site is an inactive former gold, silver, and copper mine located on Prince of Wales Island in the Tongass National Forest at the northern end of Kasaan Bay, Alaska (Figure 2-3 and Figure 2-4). The upland portions of the site encompass nearly 45 acres. An extensive tailings deposit comprising roughly 100,000 cubic yards (yd^3) of material is located primarily in the intertidal zone south and southeast of the mill. Previous investigations divided these tailings into four zones, referred to as Zones A through D, based on natural boundaries and elevations. Smaller areas of tailings lies above the intertidal zone along the tailings spit, around the mill, adjacent to the unnamed creek (Piles D14 and D15), and in the bottom of the unnamed creek. Together, the tailings deposits cover an area of approximately 23 acres. Figure 2-3 shows the distribution of the deposit.

A small, unnamed stream, originating northeast of the site from Power Lake, bisects the mine property and terminates at the head of Salt Chuck Bay. The stream continues to flow along the west side of the tailings pile and merges with the Lake Ellen Creek during low tide before entering Salt Chuck Bay. An intertidal zone encompassing approximately 80 acres is located south of the mill site, and extends around an unnamed island in the middle of Salt Chuck Bay. The intertidal zone is covered by focus, gravel, and beach grasses. At high tide, seawater from Salt Chuck Bay inundates the lower portions of Lake Ellen Creek, the unnamed stream, and the main tailings pile. The streams, tailings, and outlying sediment are exposed at low tide.

There is an abundance of shellfish located in the intertidal area adjacent to the site. Example shellfish species include blue mussel, littleneck clam, butter clam, and softshell clam. Salt Chuck Bay drains into Kasaan Bay, which is host to the Kasaan Tribe (several hundred people), which uses the bay as a commercial and subsistence fishery and shell fishery. Heavy metals from tailings both in the upland and in the bay are impacting water quality and sediments in the bay and Lake Ellen Creek, which drains into the bay. These impacts affect salmon and shellfish in areas where both are harvested intensively by the local native community.

Previous site investigations at Salt Chuck Mine were conducted between 1995 and 2006, and the results are summarized in the 2007 EE/CA (URS 2007). Historical samples generally indicated that chemical concentrations in the intertidal tailings, intertidal seatwater emanating from the tailings area, and food chain impacts from shellfish may pose a threat to human health or the environment. Historical data from the reference areas (i.e. Browns Bay area) indicated that the reference areas are generally below the screening levels.

A preliminary conceptual site model (CSM) for human health and ecological receptors depicting potential complete and incomplete exposure pathways at the Salt Chuck Mine is

presented in Figure 2-4. The preliminary CSM was developed based solely on historical data and observations from the initial site visit conducted on June 6 and 7, 2011.

2.2.3 Purpose

This QAPP presents the policies, organizations, objectives, and functional activities and procedures for the Salt Chuck Mine preremedial intertidal investigation. The QAPP was developed to document the type and quality of data needed for environmental decisions and to describe the methods for collecting and assessing those data during the implementation of this study. This study includes both field and laboratory measurements.

Specifically, the purpose of this QAPP is to gather selected preremedial field investigation data to support a more extensive RI/FS effort to be performed starting in 2012.

2.2.4 Problem Definition

The following problem statements are per the DQO process presented in Appendix A:

1. Data representing current conditions are required to characterize potential risks to human health and the environment and to support a remedial decision.

2. Some methods used to characterize risk to marine aquatic and benthic resources might not be suitable to adequately characterize potential risks to marine aquatic or benthic resources and/or to support a remedial decision, thus there is a need to evaluate methods to further evaluate potential characterization approach.

3. Insufficient data representing naturally occurring concentrations of metals exist to allow for reliable comparison between background and contamination from the Salt Chuck Mine site, thus there is a need to collect additional metals data

4. The nature and extent of contamination is not adequately defined to characterize potential risks to human health or the environment and/or to support a remedial decision, thus there is a need to obtain additional data to characterize nature and extent

5. Investigation-derived waste (IDW) must be characterized for disposal.

Data collected during the preremedial intertidal investigation will be evaluated to answer the following questions:

1. Are current concentrations in environmental media (sediment, water, and biota) at the site consistent with historical data?

2. Can additional methods be used to better characterize risks to marine aquatic and benthic resources and/or to support a remedial decision?

3. Can the nature and extent of contamination be adequately defined, in part, by considering a comparison with naturally-occurring background concentrations?

4. Is the nature and extent of contamination sufficiently delineated, so that site risks can be characterized to support a remedial decision?

5. Do the types of IDW generated require characterization?

2.3 Description (A6)

2.3.1 Description of Work Tasks

The work activities intended to be covered under this QAPP include the following:

- Collect samples (tailing, sediment, surface water, and bivalve) from selected previous investigation sample locations and analyze for selected analytes included in the previous investigations. Results will enable current and previous concentrations to be compared and will assist in evaluating the utility of historical data in support of environmental decisions.
- Conduct a battery of species (amphipods, polychaetes, and bivalves) for the bioassay tests to support characterization method selection for the 2012 investigation.
- Collect samples in multiple media (sediment, surface water, and bivalves) from the reference areas to provide naturally occurring levels to support the sampling design and screening level selection for the 2012 investigation.
- Collect additional samples (tailing, sediment, surface water, and bivalve) from the site and nearby areas to enable better delineation of nature and extent of contamination.

2.3.2 Project Schedule

Activities listed in this QAPP are expected to occur in late August and early September 2011.

2.4 Quality Objectives and Criteria (A7)

2.4.1 Project Quality Objectives

Project-specific technical systematic planning has been carried out through the DQO process and planning tool (EPA, 2006) to meet the decision-makers' and data users' needs for each activity. Appendix A presents the DQO process findings. Tables 2-1 presents the data needs as determined through the DQO process are (tables appear at the end of the respective section). This table lists the specific analytes, data uses, data users, and needed detection levels. The listed detection level is the lowest regulatory, risk, or technical criterion identified for the specific analyte. Appendix A describes the various criteria that were evaluated. The required levels shown in Table 2-1 were considered in selecting appropriate analytical methodology. Table 2-2 presents the selected analytical methodology and associated laboratory and field analytical reporting limits.

The project-required limits and action levels (Table 2-1) and the analytical reporting limits (Tables 2-2) are compared in Appendix A. The selected methods are state-of-the-art and what are appropriate for this study. Laboratory-specific method detection limits (MDL) are expected to be below target reporting levels listed in Tables 2-1 and 2-2. Where reporting limits are higher than regulatory limits, the project team will use MDLs, as needed, for project decisions.

2.4.2 Measurement Performance Criteria

The QA objective of this plan is to identify procedures and criteria that will provide data of known and appropriate quality for the needs identified in Section 2.4.1. Data quality is assessed by representativeness, comparability, accuracy, precision, and completeness. These parameters, the applicable procedures, and level-of-effort are described in the following paragraphs.

The applicable quality control (QC) procedures, quantitative target limits, and level-of-effort for assessing data quality are dictated by the intended use of the data and nature of the analytical methods. Analytical parameters, analytical methods, applicable detection levels, analytical precision, accuracy, and completeness in alignment with needs identified in Section 2.4.1 are presented in Table 2-2. Analytical methods and quality control procedures are further detailed in Section 3.

Reporting detection levels and target detection limits listed in Tables 2-2 are laboratory method reporting limits (MRLs), equivalent to MEL Reporting Limits or EPA CLP contract-required detection levels. "Target" implies that final sample detection levels might be higher because of sample matrix effects. Detection levels for the individual samples will be reported in the final data. As described in Section 2.4.1, some of the reporting levels might be higher than regulatory limits because of matrix effect, dilutions, preparation and/or digestion weight (solids) or because no practicable methodology for lower detection is available. Laboratory-specific MDLs are significantly below reporting levels. Where reporting limits are higher than regulatory limits, the project team will use MDLs, as needed, for project decisions. Values below the reporting are an estimate and will be qualified for proper use.

Following are definitions and levels of effort for the data assessment parameters:

- **Representativeness** is a measure of how closely the results reflect the actual concentration or distribution of the chemical compounds in the matrix samples. Sampling plan design, sampling techniques, and sample-handing protocols (e.g., for storage, preservation, and transportation) have been developed and are discussed in Appendices A and B. The proposed documentation will establish that protocols have been followed and sample identification and integrity ensured.

- **Comparability** expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using defined procedures and the use of consistent methods and consistent units. Actual detection limits will depend on the sample matrix and will be reported as defined for the specific samples.

- **Accuracy** is an assessment of the closeness of the measured value to the true value. For samples, accuracy of chemical test results is assessed by spiking samples and blanks with known standards and establishing the average recovery. For a matrix spike, known amounts of a standard compound identical to the compounds being measured are added to the sample. A quantitative definition of average recovery accuracy is given in Section 5.3. Accuracy is a combination of random error (precision) and systematic error (bias), introduced during sampling and analytical operations. Bias is the systematic distortion of a measurement process that causes errors in one direction, so that the expected sample measurement is always greater or lesser to the same degree than the

sample's true value. The accuracy of measurement data will be determined by calculating the recoveries from the analysis of standard reference materials and laboratory and laboratory fortified samples (matrix spikes).Accuracy measurement will be carried out with a minimum frequency of 1 in 20 samples analyzed.

- **Precision** of the data is a measure of the data spread, when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference; a quantitative definition is given in Section 5.3. The level of effort for precision measurements will be a minimum of 1 in 20 samples.
- **Completeness** is a measure of the amount of valid data obtained from the analytical measurement system and the complete implementation of defined FPs. The quantitative definition of completeness is given in Section 5.3. The target completeness objective will be 90 percent; the actual completeness might vary depending on the intrinsic nature of the samples and the ability to assess sample locations and collect field samples. The completeness of the data will be assessed during QC reviews.

2.5 Special Training/Certification (A8)

All project staff working on the site will be trained in health and safety and follow requirements specified in the project's HSP (Appendix C). The HSP describes the specialized training required for personnel on this project, and the documentation and tracking of this training is included in Appendix C.

2.6 Documents and Records (A9)

Required field documentation and records are described in Appendix B. Laboratory documentation will be provided in accordance with methods and QA protocols listed in Sections 3.4 and 3.5 of this QAPP and with EPA Regional Laboratory-specific standard operating procedures (SOPs). Overall project documentation will be prepared in accordance with the EPA Region 10 AES Program Plan (EPA, 2003a).

Table 2-1a. Sediment/Tailings Data Needs and Uses

Chemical	Data Uses	Users	ADEC Screening Values[a] (mg/kg)	TELs/PELs[c]	Other Benchmarks* mg/kg	Other Benchmarks* Reference	Lowest Regulatory Criteria
METALS							
TAL Metals							
Aluminum	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	NE	NE	18,000	e,i	18,000
Antimony			NE	NE	9.3	e,g	9.3
Arsenic			7.24/41.6	7.24/41.6	8.2/70	b	7.24
Barium			130.1/NE	130.1/NE	48	e,h	48
Beryllium			NE	NE	NE	--	--
Cadmium			0.68/4.21	0.676/4.21	1.2/9.6	b	0.676
Calcium			NE	NE	NE	--	--
Chromium			52.3/160	52.3/160	81/370	b	52.3
Cobalt			NE	NE	NE	--	--
Copper			18.7/108	18.7/108	34/270	b	18.7
Iron			NE	NE	220,000	e,i	220,000
Lead			30.24/112	30.2/112.18	46.7/218	b	30.2
Magnesium			NE	NE	NE	--	--
Manganese			NE	NE	NE	--	--
Mercury			0.13/0.7	0.13/0.696	0.15/0.71	b	0.13
Nickel			2	15.9/42.8	20.9/51.6	b	2
Potassium			NE	NE	NE	--	--
Selenium			NE	NE	1.0	e,h	1
Silver			0.73/1.77	0.73/1.77	1.0/3.7	b	0.73
Sodium			NE	NE	NE	--	--
Thallium			NE	NE	NE	--	--
Vanadium			NE	NE	57	e,i	57
Zinc			124/271	124/271	150/410	b	124
HYDROCARBONS							
Petroleum Hydrocarbon Mixtures: (Analyze for Sample SCSD-106 only)							
DRO	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	NE	NE	NE	--	--
RRO			NE	NE	NE	--	--
TCL PAHs							
High Molecular Weight PAHs:							
Benzo(a)anthracene	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	0.0748/0.693	0.07483/0.69253	0.261/1.6	b	0.07483
Benzo(a)pyrene			0.4	0.08881/0.76322	0.43/1.6	b	0.08881
Benzo(b)fluoranthene			NE	NE	2.8	d	2.8
Benzo(k)fluoranthene			NE	NE	2.8	d	2.8
Benzo(g,h,i)perylene			NE	NE	0.67	d	0.67
Chrysene			0.108/0.846	0.10777/0.84598	0.384/2.8	b	0.10777
Dibenzo(a,h)anthracene			0.06/0.135	0.00622/0.13461	0.063/0.26	b	0.00622
Indeno(1,2,3-cd)pyrene			NE	0.02021/0.20128	0.6	d	0.02021
Pyrene			0.153/1.398	0.15266/1.3976	0.665/2.6	b	0.15266
Total High Molecular Weight PAHs			0.5/6.676	0.65534/6.67614	1.7/9.6	b	0.5
Low Molecular Weight PAHs:							
Acenaphthene	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	0.00671/0.0889	0.00671/0.0889	0.016/0.5	b	0.00671
Acenaphthylene			0.00587/0.128	0.00587/0.12787	0.044/0.64	b	0.00587
Anthracene			0.0469/0.245	0.04685/0.245	0.085/1.1	b	0.04685
Fluoranthene			0.1/1.494	0.11282/1.49354	0.6/5.1	b	0.1
Fluorene			0.0212/0.144	0.02187/0.14435	0.019/0.54	b	0.019
Naphthalene			0.0346/.391	0.03457/0.39064	0.16/2.1	b	0.03457
Phenanthrene			0.0867/0.544	0.08668/0.54353	0.24/1.5	b	0.08668
Total Low Molecular Weight PAHs			0.312/1.442	0.3117/1.442	0.552/3.16	b	0.3117
Total PAHs			1.684/16.77	1.68406/16.7704	4.0/44.792	b	1.68406
PCBs							
TCL PCBs							
Arochlor 1016	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	NE	NE	0.53	f	0.53
Arochlor 1221			NE	NE	0.12	f	0.12
Arochlor 1232			NE	NE	0.60	f	0.60
Arochlor 1242			NE	NE	29	f	29
Arochlor 1248			NE	NE	1.0	f	1.0
Arochlor 1254			0.0633/0.709	0.0633/0.709	72	f	0.0633
Arochlor 1260			NE	NE	63	f	63
Arochlor 1262			NE	NE	NE	--	--
Arochlor 1268			NE	NE	NE	--	--
Total PCBs			0.02/0.189	0.02155/0.18879	0.0227/0.180	b	0.02
BIOASSAY							
10-day static solid-phase sediment toxicity test using amphipods conducted according to EPA 600/R-94/025 and/or American Society for Testing and Materials (ASTM) E-1367.	Comparison to past data and characterize risk to marine aquatic or benthic resources	Risk assessors, and regulatory specialists	--	--	--	--	--
20-day static solid-phase tests using polychaetes conducted following procedures described in ASTM E-1611 and/or Puget Sound Estuary Program (PSEP) protocols (PSEP, 1995).			--	--	--	--	--

Table 2-1a. Sediment/Tailings Data Needs and Uses

Chemical	Data Uses	Users	ADEC Screening Values[a] (mg/kg)	TELs/PELs[c]	Other Benchmarks*		Lowest Regulatory Criteria
					mg/kg	Reference	
Embryo-larval development water column test of sediment elutriate (Mytilus sp.[preferred], Crassostrea, Dendraster, or Strongylocentrotus), following procedures described in EPA-823-B-98-004	Comparison to past data and characterize risk to marine aquatic or benthic resources						
Physical Parameter							
Grain Size (ASTM D422)**	Support bioassay analysis	Risk assessors, and regulatory specialists					
Total Organic Carbon	Determine bioavailability of organic analytes	Risk assessors, and regulatory specialists					
SPLP							
Modified SPLP test using site water (Method SW1312)	Determine Mobility of constituents in site sediments	Hydrogeologists, risk assessors, and regulatory specialists	NA	NE	NE		
AVS/SEM							
AVS/SEM Metals: Cd, Cu, Ni, Pb, and Zn (PSEP)	Determine Bioavailability of divalent metals in site sediments	Risk assessors, and regulatory specialists	NA	NE	NE		

NOTES:
ADEC = Alaska Department of Environmental Conservation
AET = Apparent effects threshold
ASTM = American Society for testing and materials
AVS/SEM = Acid Volatile Sulfide and Simultaneously Extracted Metals
DRO = Diesel range organics
DMMP = Dredged Material Management Program
ERL = Effects range low
ERM = Effects range medium
mg/kg = Milligrams per kilogram
NA = Not applicable; organics analyses not conducted for this media
NE = Not established
NOAA = National Oceanic and Atmospheric Administration
ORNL = Oak Ridge National Laboratory
PAHS = Polynuclear aromatic hydrocarbons
PCBs = Polychlorinated biphenyls
PRG = Preliminary remedial goal
PEL = Probable effects level
PSEP = Puget Sound Estuary Program
RRO = Residual range organics
SPLP = Synthetic precipitation leaching procedure
TAL = Target analyte list
TCL = Target compound list
TEL = Threshold effects level
USEPA = U.S. Environmental Protection Agency

REFERENCES:
* = Other marine benchmarks selected in the following order of preference:
a = ADEC (2009) Environmental media-specific conservative screening values: saltwater sediment
b = ERL/ERM NOAA marine benchmarks (Long et al., 1995; Buchman, 2008)
c = marine sediment TELS/PELs (ADEC, 2004; Buchman, 2008)
d = Sediment Cleanup Objectives for Commencement Bay (USEPA, 1993) or screening levels for DMMP Guidelines Chemistry Values (DMMP, 2011)
e = NOAA marine AET (Buchman, 2008)
f = ORNL (1997) PRGs for sediment
** = Only analyze for sediment samples co-located with bioassay samples
g = Lowest AET for echinoderm larvae (Buchman, 2008)
h = Lowest AET for amphipods (Buchman, 2008)
i = Lowest AET based on Neanthes bioassay (Buchman, 2008)
Not applicable
Screening level has been updated from those used in the EE/CA (URS 2007) to reflect the more stringent level in the updated guidance document
Screening level in the updated guidance document is less stringent than those used in the EE/CA (URS 2007), therefore screening level in the EE/CA (URS 2007) was retained for comparison purposes
Analyte not included in the EE/CA (URS 2007)

Table 2-1b. Surface Water and Leachate Data Needs and Uses*

Chemical	Data Uses	Users	WQC for Fish Ingestion[a] (µg/L)	ADEC Marine ERBSC[b] (µg/L)	Other Marine WQC[c] (µg/L)	Lowest Regulatory Criteria
METALS**						
TAL Metals						
Aluminum	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	NE	2.71	NE	2.71
Antimony			4,300	500	500[e]	500
Arsenic			0.14	10.4[i]	36	0.14
Barium			NE	5000	NE	5000
Beryllium			4[h]	NE	8.8	4
Cadmium			5[h]	0.12	9.3	0.12
Calcium			NE	NE	NE	
Chromium			100[h]	56	27.4[e]	27.4
Cobalt			NE	NE	NE	
Copper			1,300[d]	2.4	3.1	2.4
Iron			NE	NE	NE	
Lead			NE	8	8.1	8
Magnesium			NE	NE	NE	
Manganese			100	NE	NE	100
Mercury			0.051	0.016[j]	0.94	0.016
Nickel			4,600	8	8.2	8
Potassium			NE	NE	NE	
Selenium			11,000	1	71	1
Silver			NE	0.23	1.9[f]	0.23
Sodium			NE	NE	NE	
Thallium			6.3	20	17[e]	6.3
Vanadium			NE	NE	50[e]	50
Zinc			69,000	80	81	80
FIELD PARAMETERS						
pH	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	NA	NE	6.5-8.5, and ≤ 0.2±NC[g]	6.5-8.5, and ≤ 0.2±NC[g]
Conductivity (µS/Cm)			NA	NE	NE	NE
Temperature (°C)			NA	NE	1>NC[g]	1>NC[g]
Salinity (ppt)			NA	NE	gk	gk
Dissolved Oxygen (mg/L)			NA	NE	5-17[g]	5-17[g]

NOTES:

* = Leachate samples will be analyzed for metals (Hg, Ag, As, Ba, Cd, Cr, Pb, and Se) only

** = Only dissolved metals will be analyzed for leachate samples and both dissolved and total metals will be analyzed for surface water

ppt = parts per thousand

°C = Degree Celsius

ADEC Alaska Department of Environmental Conservation

AWQC = Ambient Water Quality Criteria

ERBSC = Ecological risk-based screening concentration

MCL = Maximum Contaminant Level

µg/L = Micrograms per liter

µS/Cm = Micro Siemens per centimeter

NA = Not applicable

NC = Natural conditions

NE = Not established

SQuiRT = Screening Quick Reference Tables

TAL = Target Analyte List

USEPA = U.S. Environmental Protection Agency

WQC = Water Quality Criteria

REFERENCES:

a = WQC for marine water were selected in the following order of preference:

1) ADEC (2008) criteria for noncarcinogens, consumption of aquatic organisms only

2) USEPA (2004) AWQC: Human Health for Consumption of Organism Only, unless otherwise noted

b = ADEC (2009) Environmental media-specific conservative screening values

Table 2-1b. Surface Water and Leachate Data Needs and Uses*

Chemical	Data Uses	Users	WQC for Fish Ingestion[a] (µg/L)	ADEC Marine ERBSC[b] (µg/L)	Other Marine WQC[c] (µg/L)	Lowest Regulatory Criteria

c = ADEC (2008, 2006)/USEPA (2004) AWQC: Saltwater Aquatic Life chronic, unless otherwise noted
d = NE, USEPA (2002c) value for consumption of water and organism listed
e = Proposed AWQC [USEPA (1986) and/or Buchman (2008) NOAA SQuiRT values]
f = NE, acute value listed
g = ADEC (2006) WQC for aquatic life and/or aquaculture water supply
h = NE, USEPA (2004) defaults to drinking water MCL
i = ERBSCs for Arsenic III and Arsenic V
j = ERBSC for inorganic mercury
k = Maximum allowable variation above natural salinity of 1, 2, and 4 ppt for natural salinity ranges of 0 to 3.5, greater than 3.5 to 13.5, and greater than 13.5 to 35 ppt, respectively
Not applicable

Screening level has been updated from those used in the EE/CA (URS 2007) to reflect the more stringent level in the updated guidance document

Screening level in the updated guidance document is less stringent than those used in the EE/CA (URS 2007), therefore screening level in the EE/CA (URS 2007) was retained for comparison purposes

Analyte not included in the EE/CA (URS 2007)

Table 2-1c. Tissue Data Needs and Uses

Chemical	Data Uses	Users	Human Health RBSLs*		Ecological Benchmarks			Lowest Regulatory Criteria
			Shellfish Ingestion RBSL (µg/g tissue)	Reference	Screening Values (µg/g) Dry Weight	Wet Weight	Reference	
METALS								
TAL Metals								
Aluminum	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	1,300	b	NE	NE		1,300
Antimony			0.54	b	NE	NE		0.54
Arsenic			0.003/0.026	a	NE	NE		0.003
Barium			270	b	NE	NE		270
Beryllium			2.7	b	NE	NE		2.7
Cadmium			0.49/4.0	a	NE	NE		0.49
Calcium			NE		NE	NE		
Chromium			2,000	**	NE	NE		2,000
Cobalt			NE		NE	NE		
Copper			54	b	23.9/80.3	NE	g	23.9
Iron			NE		NE	NE		
Lead			0.8	c	NE	NE		
Magnesium			NE		NE	NE		
Manganese			190	b	NE	NE		190
Mercury			0.049/0.4	a	NE	0.033/3	h/i	0.033
Nickel			27	b	NE	NE		27
Potassium			NE		NE	NE		
Selenium			2.457/20	a	NE	1.0	j	1
Silver			6.8	b	NE	NE		6.8
Sodium			NE		NE	NE		
Thallium			0.014	b	NE	NE		0.014
Vanadium			1.4	**	NE	NE		1.4
Zinc			410	b	NE	NE		410
HYDROCARBONS								
TCL PAHs								
High Molecular Weight PAHs:								
Benzo(a)anthracene	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	0.0043	b	NE	NE		0.0043
Benzo(a)pyrene			0.000673/0.00547	a	NE	NE		0.000673
Benzo(b)fluoranthene			0.0043	b	NE	NE		0.0043
Benzo(k)fluoranthene			0.043	b	NE	NE		0.043
Benzo(g,h,i)perylene			0.0043[d]	b	NE	NE		0.0043
Chrysene			0.43	b	NE	NE		0.43
Dibenzo(a,h)anthracene			0.00043	b	NE	NE		0.00043
Indeno(1,2,3-cd)pyrene			0.0043	b	NE	NE		0.0043
Pyrene			41	b	NE	NE		41

Table 2-1c. Tissue Data Needs and Uses

Chemical	Data Uses	Users	Human Health RBSLs*		Ecological Benchmarks			Lowest Regulatory Criteria
			Shellfish Ingestion		Screening Values (µg/g)			
			RBSL (µg/g tissue)	Reference	Dry Weight	Wet Weight	Reference	
Low Molecular Weight PAHs:								
Acenaphthene	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	81	b	NE	NE		81
Acenaphthylene			81[e]	b	NE	NE		81
Anthracene			410	b	NE	NE		410
Fluoranthene			54	b	NE	NE		54
Fluorene			54	b	NE	NE		54
Naphthalene			27	b	NE	NE		27
Phenanthrene			410[f]	b	NE	NE		410
Total PAHs			0.000673/0.00547	a	NE	NE		0.000673
PCBs								
TCL PCBs								
Arochlor 1016	Comparison to past data and to characterize nature and extent	Hydrogeologists, risk assessors, and regulatory specialists	0.045	b	NE	NE		0.045
Arochlor 1221			0.0016	b	NE	NE		0.0016
Arochlor 1232			0.0016	b	NE	NE		0.0016
Arochlor 1242			0.0016	b	NE	NE		0.0016
Arochlor 1248			0.0016	b	NE	NE		0.0016
Arochlor 1254			0.0016	b	NE	NE		0.0016
Arochlor 1260			0.0016	b	NE	NE		0.0016
Arochlor 1262			NE		NE	NE		
Arochlor 1268			NE		NE	NE		
Total PCBs			0.00245/0.02	a	NE	0.436	k	0.00245
Percent Lipids	Characterize potential bioavailability of organic analytes	Hydrogeologists, risk assessors, and regulatory specialists	NE		NE	NE		

NOTES:

CCME = Canadian Council of the Ministers of the Environment
ECW = environmental contaminant in wildlife
Hg = mercury
µg/g = Micrograms per gram (=mg/kg or ppm)
NE = Not established
NEHC = Navy Environmental Health Center
NOEC = No Observed Effects Concentration
PAHS = Polynuclear aromatic hydrocarbons
PCBs = Polychlorinated biphenyls
RBSL = Risk based screening level
Se = selenium
TAL = Target analyte list

Table 2-1c. Tissue Data Needs and Uses

Chemical	Data Uses	Users	Human Health RBSLs*		Ecological Benchmarks			Lowest Regulatory Criteria
			Shellfish Ingestion RBSL (µg/g tissue)	Reference	Screening Values (µg/g) Dry Weight	Wet Weight	Reference	

TCL = Target compound list

TEL = Threshold effects level

USEPA = U.S. Environmental Protection Agency

REFERENCES:

* = Benchmarks selected in the following order of preference:

a = USEPA (2000) Screening Value for fish ingestion (subsistence/recreational)

b = USEPA (2011) Region 3 values for fish/shellfish ingestion

** = USEPA (2006b) Region 3 values for fish/shellfish ingestion

c = CCME (2010) total lead alert level in edible portions of fish/shellfish

d = Indeno (1,2,3-cd)pyrene used as surrogate

e = Acenaphthene used as surrogate

f = Anthracene used as surrogate

g = Salazar and Salazar (2003) tissue levels indicating harm to invertebrates: NOEC/mean effects concentration

h = CCME (1991a, 2010) maximum concentration of methyl Hg in fish/shellfish consumed by wildlife

I = Beyer et al. (1996) total Hg ECW for protection of fish

j = CCME (1991b, 2010) aquatic life (tissue) guideline for Se

k = NEHC (2005) bioaccumulation endpoint for marine invertebrate tissue

Not applicable

Screening level is not available in the updated guidance document and therefore screening level in the EE/CA (URS 2007) was retained for comparison purposes

Screening level has been updated from those used in the EE/CA (URS 2007) to reflect the more stringent level in the updated guidance document

Screening level in the updated guidance document is less stringent than those used in the EE/CA (URS 2007), therefore screening level in the EE/CA (URS 2007) was retained for comparison purposes

Analyte not included in the EE/CA (URS 2007)

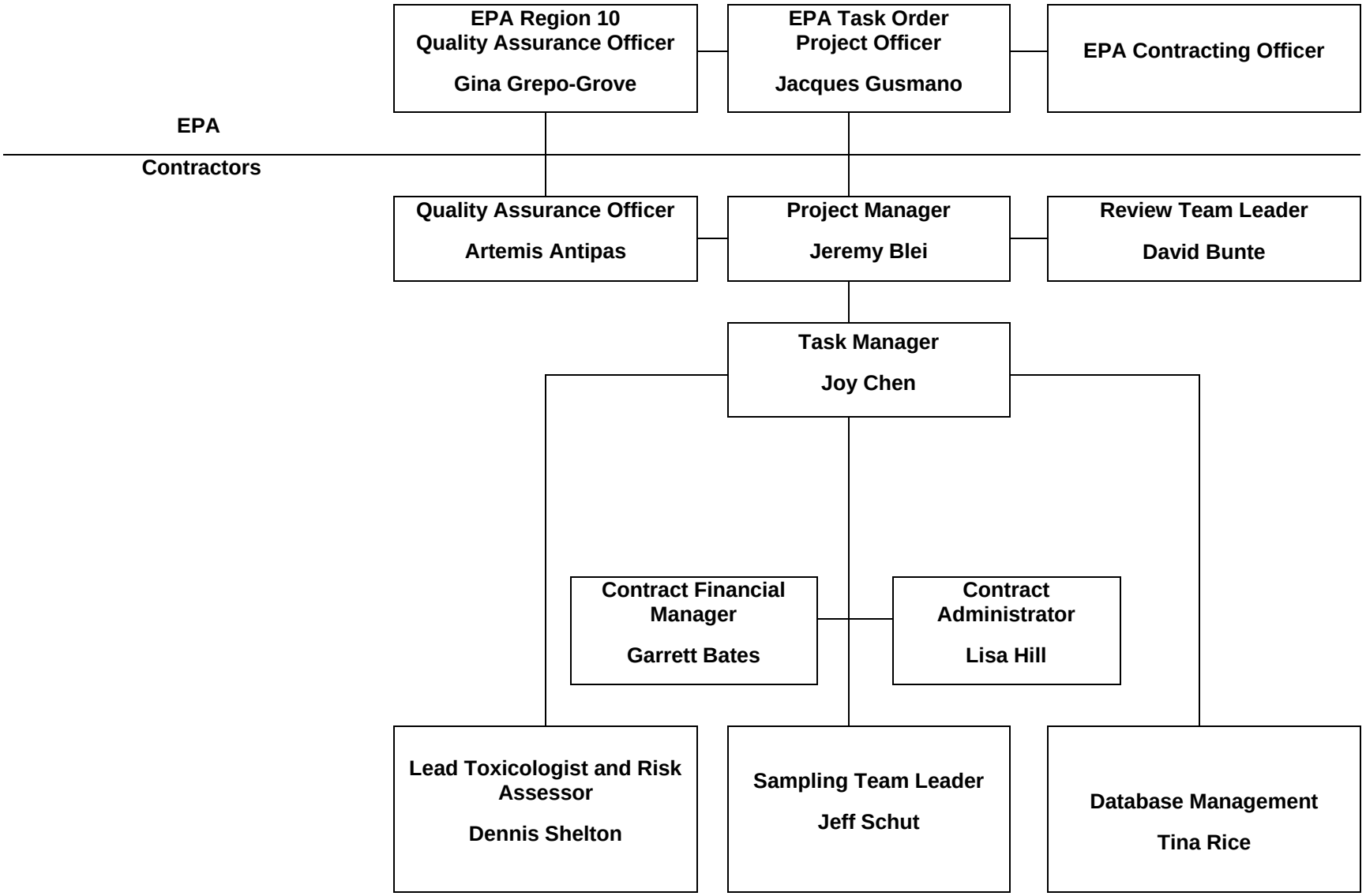


FIGURE 2-1
Project Organization
Quality Assurance Project Plan, Salt Chuck Mine Intertidal Investigation, Tongass National Forest, Alaska

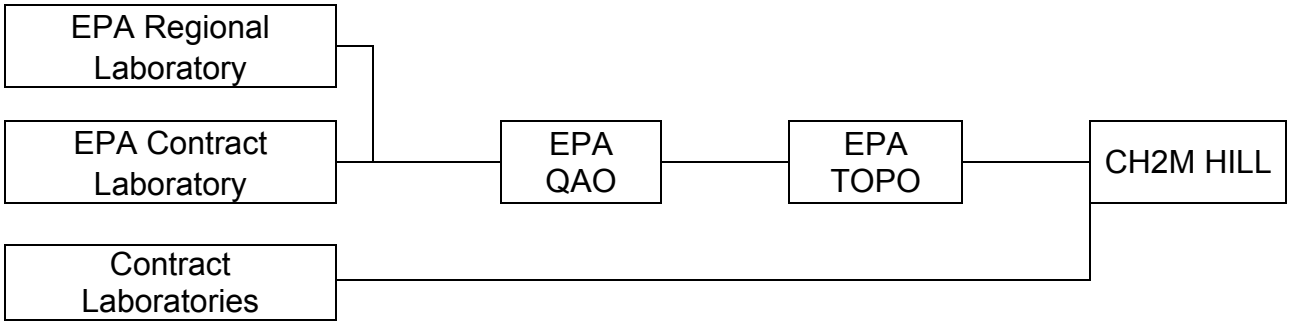
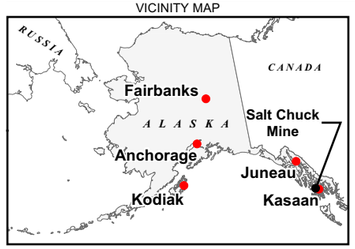


FIGURE 2-2
Data Users/Recipients
Quality Assurance Project Plan, Salt Chuck Mine Intertidal Investigation, Tongass National Forest, Alaska

VICINITY MAP



LEGEND

Sample Type

- Proposed Surface Water Sample
- Proposed Sediment Sample at Historic Location
- Proposed Sediment Sample
- Proposed Tissue Sample
- Confirmation Surface Water Sample
- Confirmation Sediment Sample
- Confirmation Tissue Sample

N

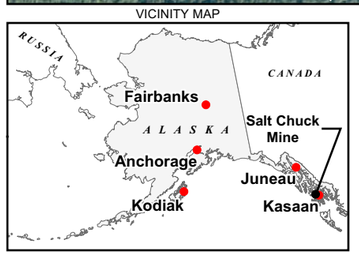
0 375 750

Feet

Notes:
(1) Aerial photography courtesy US Census Bureau; approximate date 2006. NAD83, UTM Zone 8N, Meters. Pixel size 1 meter.
(2) Contour Interval: 100 feet.

Figure 2-3
Location Map and Proposed Sample Location for Salt Chuck Mine
Tongass National Forest, Alaska

VICINITY MAP



LEGEND

Sample Type

- Proposed Surface Water Sample
- Proposed Sediment Sample at Historic Location
- Proposed Sediment Sample
- Proposed Tissue Sample
- Confirmation Surface Water Sample
- Confirmation Sediment Sample
- Confirmation Tissue Sample

N

0 375 750

Feet

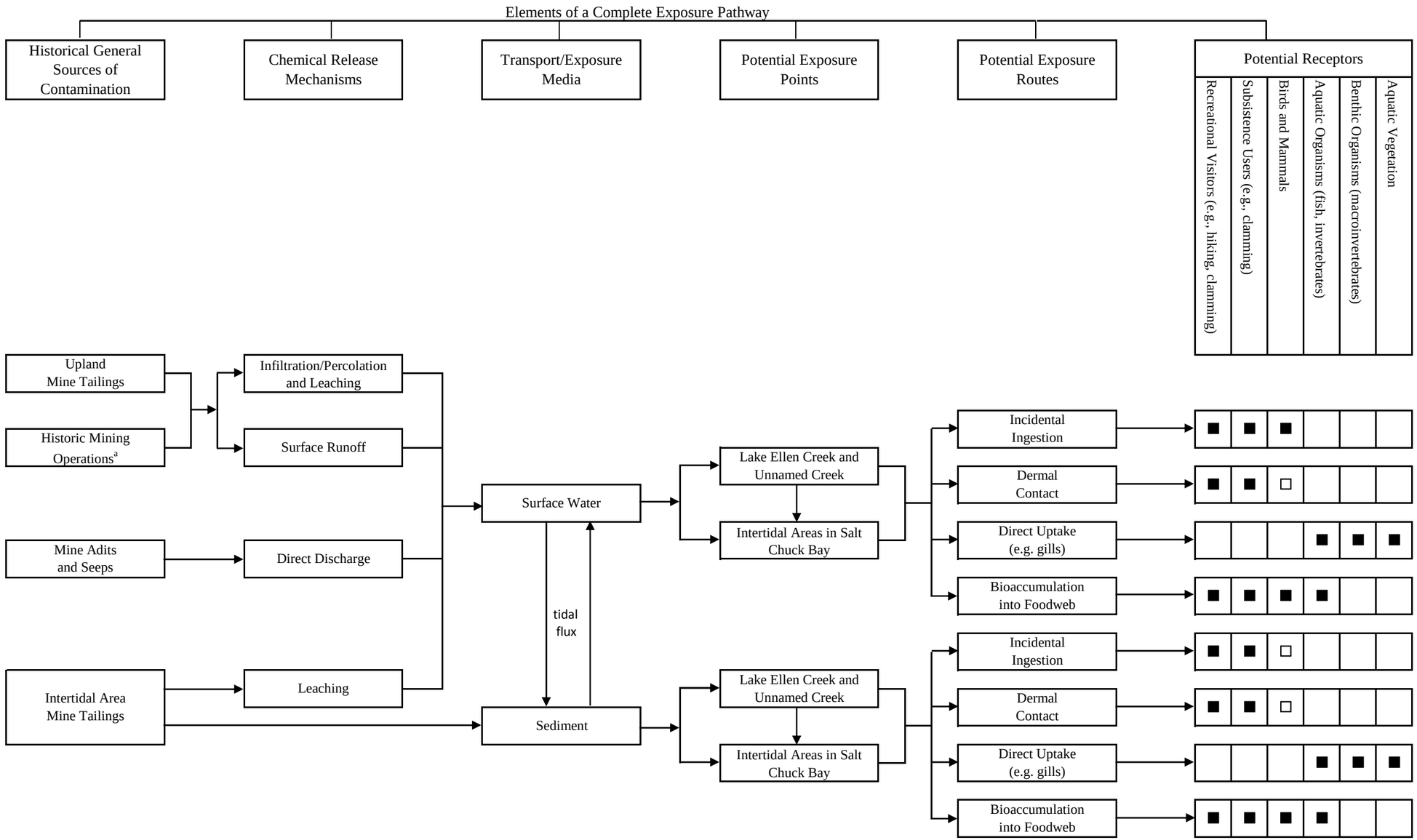
Notes:
(1) Aerial photography courtesy US Census Bureau; approximate date 2006. NAD83, UTM Zone 8N, Meters. Pixel size 1 meter.
(2) Contour Interval: 100 feet.

Figure 2-4
Location Map and Proposed Sample Location for Browns Bay
Tongass National Forest, Alaska

FIGURE 2-5

Conceptual Site Model for Potential Human and Ecological Exposures for the Intertidal Area, Marine Operable Unit

Pre-Remedial Investigation, Salt Chuck Mine – Tongass National Forest, Alaska



Notes:

■= Potentially complete pathway

⌊⌋= Pathway considered minor

Blank = Incomplete pathway

a. Includes aboveground fuel storage tanks, battery banks, and other upland sources (PCBs) associated with historic mining operations.

SECTION 3

Data Generation and Acquisition (EPA Group B)

3.1 Sampling Design (Experimental Design) (B1)

The rationale for the Phase 2 investigation design is described in step seven of the DQO process shown in Appendix A.

3.2 Sampling Methods (B2)

All methods and protocols are listed in Section 4 of the FPs (Appendix B).

3.3 Sample Handling and Custody (B3)

A sample is physical evidence collected from a potential hazardous waste site, the immediate environment, or another source. Because of the potential evidentiary nature of samples, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence. In addition to field notebooks, there are a number of documents for tracking sample custody.

Field documents including sample custody seals and chain-of-custody records will be obtained from the RSCC in EPA's Region 10 Quality Assurance Office. Chain-of-custody procedures will be used to maintain and document sample collection and possession. After sample packaging, the appropriate chain-of-custody form will be completed. Forms II Lite software will be used for completing chain-of-custody documentation for CLP.

Copies of the form will be filled out and distributed in accordance with the instructions for sample shipping and documentation per Forms II Lite. Completed field QA/QC summary forms will be sent to the RSCC at EPA's Region 10 Quality Assurance Office at the conclusion of the sampling event.

The following subsections summarize each element of sample handling and custody. The sample management and documentation procedures will be detailed in the program-specific FPs.

3.3.1 Chain-of-Custody

Because samples collected during any investigation could be used as evidence, their possession must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. Chain-of-custody procedures are followed to document sample possession.

3.3.1.1 Definition of Custody

A sample is under custody if one or more of the following criteria are met:

- The sample is in a person's physical possession.
- The sample is in a person's view after being in his or her physical possession.

- The sample was in a person's physical possession and was then locked up or sealed to prevent tampering.
- The sample is kept in a designated secured area.

3.3.1.2 Field Custody

Only enough material to provide a good representation of the media being sampled will be collected. To the extent possible, the quantity and types of samples and sample locations are determined before the actual fieldwork is performed. As few people as possible should handle samples. The field sampler is personally responsible for the care and custody of the samples collected until they are transferred or dispatched properly. The PM determines whether proper custody procedures were followed during the fieldwork, and decides whether additional samples are required.

3.3.1.3 Transfer of Custody and Shipment

Samples are accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving the samples sign, date, and note the time on the record. This record documents custody transfer from the sampler, often through another person, to the analyst at the laboratory.

Samples are packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate chain-of-custody record accompanying each shipping container (one for each field laboratory, and one for samples driven to the laboratory). Shipping containers will be sealed with custody seals for shipment to the laboratory. Courier names and other pertinent information are entered in the "Received by" section of the chain-of-custody record.

All shipments are accompanied by the chain-of-custody record identifying its contents. The original record and one copy accompany the shipment to the laboratory, and a second copy is retained by the PM. Freight bills, postal service receipts, and bills of lading are retained as part of the permanent documentation.

3.3.1.4 Laboratory Custody Procedures

A designated sample custodian accepts custody of the shipped samples and verifies that the sample numbers match those on the chain-of-custody records. Pertinent information about shipment, pickup, and courier is entered in the "Remarks" section. The custodian then enters the sample numbers into a bound notebook. The laboratory custodian uses the sample identification number or assigns a unique laboratory number to each sample, and is responsible for ensuring that all samples are transferred to the proper analyst or stored in the appropriate secure area.

The custodian distributes samples to the appropriate analysts. Laboratory personnel are responsible for the care and custody of samples from the time they are received until the sample is exhausted or returned to the custodian. The data from sample analyses are recorded on the laboratory report form.

When sample analyses and necessary QC checks have been completed in the laboratory, the unused portion of the sample will be disposed of properly. All identifying sample tie tags, data sheets, and laboratory records are retained as part of the documentation. Sample

containers and remaining samples are disposed of by the laboratory in compliance with all federal, state, and local regulatory requirements.

3.3.2 Custody Seals

Custody seals will be placed on coolers during transport of samples to the laboratory. Custody seals will be placed on two sides of the lid (one in front, and one on the side) and covered with tape to prevent inadvertent breaking of the seals.

3.3.3 Field Notebooks

A bound field notebook will be maintained by each sampling FTL to provide a daily record of significant events, observations, and measurements during field investigations. All entries will be signed and dated. The notebook will be retained by each agency as a permanent record, and copies of field notes from each sampling event will be submitted to EPA. These notebooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project, and to refresh the memory of the field personnel, if required.

3.3.4 Corrections to Documentation

All original data recorded in field notebooks and field data forms will be written in water-proof ink, unless prohibited by weather conditions. None of these accountable serialized documents is to be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. If an error is made on an accountable document, the FTL may make corrections simply by drawing a single line through the error and entering the correct information. The erroneous information should not be obliterated. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections must be initialed and dated.

3.4 Analytical Methods (B4)

Project analytes, methods and target laboratory detection limits are listed in Table 2-2. Samples will be analyzed through EPA Contract Laboratory Program and the associated statements of work. Depending on availability, the analyses may also be carried through the EPA regional laboratory, MEL, per MEL SOPs or contract laboratories as directed by EPA QAO. The needed bioassay analytical QC specs are provided in Appendix D.

3.5 Quality Control (B5)

3.5.1 Field Quality Control Procedures

QC requirements related to the sample collection process (i.e., sample design, sampling procedures, and field QC samples) are described in Appendix B. The QC samples will be collected immediately following collection of normal samples and using the same procedures as the collection of the normal sample. The field QC samples are also described in the FPs (Appendix B).

3.5.2 Laboratory Quality Control Procedures

Laboratory QC procedures will include the following:

- Analytical methodology and QC according to the methods listed in Table 2-2 and the laboratory's appropriate Statement of Work (SOW) or SOP
- Instrument calibration and standards as defined in the methods listed in Table 2-2 and CLP or laboratory-specific SOPs
- Laboratory blank measurements at a minimum of 5 percent or 1-per-batch frequency
- Analysis of metals for a subsample of site water used for the modified SPLP prior to extractions to allow for determination of any contributions introduced from the water.
- Accuracy and precision measurements at a minimum of 1 in 20, 1 per set
- Data reduction and reporting according to the methods listed in Table 2-2
- Laboratory documentation equivalent to the CLP SOW or appropriate MEL SOP

3.6 Instrument/Equipment Testing, Inspection, and Maintenance (B6)

Instrument maintenance will be recorded in field logbooks. Preventative maintenance is performed according to the procedures described in the manufacturer's instrument manuals, if applicable, including lubrication, cleaning, and the frequency of such maintenance. Instrument downtime is minimized by keeping adequate supplies of all expendable items, where expendable means an expected lifetime of less than 1 year. These items include batteries, oil, cables. Preventative maintenance for field equipment (e.g., water quality meters) will be conducted in accordance with procedures and schedules outlined in the particular model's operation and maintenance handbook.

3.7 Instrument/Equipment Calibration and Frequency (B7)

3.7.1 Field Calibration Procedures

Field measurements include Global Positioning System (GPS) readings, dissolved oxygen, temperature, pH, conductivity, and salinity. No manual calibration is required for the GPS unit; self-testing is performed automatically each time the unit is turned on. The water meter used to obtain these measurements will be rented for use on the project, and contain manufacturer-supplied calibration solution that will calibrate the meter over the full instrument range of pH, conductivity, and salinity. Prior to field mobilization, the range of previous field measurements for these parameters will be discussed with the manufacturer/ equipment rental firm to ensure that the calibration solution reflects the field situations likely to be encountered. The meters will be maintained, calibrated, and operated per manufacturer instructions. Manufacturer instructions will be kept within each meter case and brought with the equipment to the sites. Calibration solutions will be checked prior to the field investigation to ensure sufficient fluid is available onsite.

The meter will be zeroed, if applicable, before the start of work according to the instrument manual. Any instrument "drift" from prior zeroing should be recorded in the field notebook. Instrument zeroing will be in accordance with procedures and schedules outlined in the particular instrument's operations and maintenance manual. Scheduled periodic

calibration of testing equipments does not relieve field personnel of the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, the device must be removed from service and tagged so that it is not inadvertently used, and appropriate personnel notified so that a recalibration can be performed or a substitute piece of equipment can be obtained.

Equipment that fails calibration or becomes inoperable during use will be removed from service and either segregated to prevent inadvertent use or tagged to indicate it is out of calibration. Such equipment will be repaired and satisfactorily recalibrated. Equipment that cannot be repaired will be replaced. Results of activities performed using equipment that has failed recalibration will be evaluated. If the activity results are adversely affected, the results of the evaluation will be documented, and the PM and data users will be notified.

3.7.2 Laboratory Calibration Procedures

Laboratory calibration procedures are specified in the methods referenced in Table 2-2 and in the laboratory's SOP. All calibrations, unless specified otherwise by method (such as for metals), at a minimum will be conducted at the following level of effort:

- Initial calibration unless specified otherwise by standard EPA method will include, at a minimum, three-point calibration before a run
- Continuing calibration for all methods will include a mid-range (or as defined by method) calibration standard after every tenth sample or every 12 hours

3.8 Inspection and Acceptance of Supplies and Consumables (B8)

Supplies and consumables will be acquired and inspected in accordance with acquisition specifications upon receipt.

3.9 Nondirect Measurements (B9)

As described in Step 3 of the DQO process (Appendix A), data collected during the preremedial intertidal investigation will be augmented with historical data summarized in the EE/CA (URS 2007) and data collected during previous field work at the Salt Chuck Mine. Original sources of historical data collected prior to 2002 that may be used as part of the preremedial intertidal investigation data analysis are generally not available. Historical information (including site background information, tailings and sediment, surface water, and tissue analytical data) used in the preremedial intertidal investigation are based on information provided in the 2007 EE/CA (URS, 2007). Validation of site data collected prior to 2002 was conducted and findings were summarized in the EE/CA (URS 2007), which classified the data as Level II quality. These Level II data do not have QA/QC reports that can be used to validate information and therefore these data can only provide approximate quantity for the purpose of roughly identifying extent. The 2002 and 2006 data were reviewed as part of the 2007 EE/CA (URS 2007) and the reported results were qualified based on the definition and use of qualifying flags outlined in the USEPA Contract Laboratory Program National Functional Guidelines, therefore the post-2002 data set is of appropriate quality for the decisions identified under this task's DQOs (Appendix A).

3.10 Data Management (B10)

Data obtained as part of the preremedial intertidal investigation will undergo three levels of review and validation: (1) in the field, (2) laboratory data review and verification, and (3) outside the laboratory by third-party independent data verification and validation. Following receipt of reviewed and validated data, data will be uploaded to an electronic data warehouse (STORET) to facilitate data access, queries, and report preparation.

SECTION 4

Assessment and Oversight (EPA Group C)

4.1 Assessments and Response Actions (C1)

The QAO, senior reviewers, and PM will monitor the performance of the QA procedures. If problems arise and/or the EPA TOPO or EPA QAO directs the PM or QAO accordingly, then the QAO will conduct field audits. Field audits may be scheduled to evaluate the following:

- The execution of sample identification, chain-of-custody procedures, field notebooks, sampling procedures, and field measurements
- Whether trained personnel staffed the sample event
- Whether equipment was in proper working order
- Availability of proper sampling equipment
- Whether appropriate sample containers, sample preservatives, and techniques were used
- Whether sample packaging and shipment were appropriate
- Whether QC samples were properly collected

Sample analyses will be carried out at EPA MEL. The distribution of analyses to the laboratories will be determined according to laboratory capability and capacity and the sampling schedule. The distribution of analyses may change at the time of analysis depending on capacity and implementation of specific procedures at the Regional Laboratory. The RSCC, residing at EPA's Environmental Services Unit (ESU), will be responsible for coordinating and scheduling analytical services from the CLPs and MEL. The data quality and laboratory performance of CLP laboratories are monitored by the Analytical Services Branch in EPA Headquarters and the region's CLP PO and RSCC. For MEL, QA oversight is provided by the laboratory's QA Coordinator. In addition, onsite audits or performance evaluation samples will be administered by the CH2M HILL QAO and EPA Regional QAO, as necessary. Audits will be followed up with an audit report prepared by the reviewer. The auditor will also debrief the laboratory or the field team at the end of the audit and request that the laboratory or field team comply with the corrective action request.

If QC audits result in detection of unacceptable conditions or data, the PM will be responsible for developing and initiating corrective action. The TOPO will be notified if non-conformance is of program significance or requires special expertise not normally available to the project team. In such cases, the PM will decide whether any corrective action should be pursued. Corrective action could include the following:

- Reanalyzing samples if holding time criteria permit

- Resampling and analyzing
- Evaluating and amending sampling and analytical procedures
- Accepting data acknowledging a level of uncertainty

All corrective actions will be documented in field logbook.

4.2 Reports to Management (C2)

The PM or TOPO may request that a QA report be made to the TOPO on the performance of sample collection and data quality. The report will include the following:

- Assessment of measurement data accuracy, precision, and completeness
- Results of performance audits
- Results of systems audits
- Significant QA problems and recommended solutions

Progress reports prepared as needed will summarize overall project activities and any problems encountered. QA reports generated on sample collection and data quality will focus on specific problems encountered and solutions implemented. Alternatively, in lieu of a separate QA report, sampling and field measurement data quality information may be summarized and included in the final reports. The objectives, activities performed, overall results, sampling, and field measurement data quality information for the project will be summarized and included in the final reports along with any QA reports. A field sampling report listing the samples collected, sample locations, field duplicates, and dates of sample collection and shipment will also be generated to support the data validation activities.

SECTION 5

Data Validation and Usability (EPA Group D)

5.1 Data Review, Verification, and Validation (D1)

All data for all parameters will undergo the following three levels of review and validation: (1) in the field, (2) laboratory data review and verification, and (3) independent data verification and validation by a third-party outside of the laboratory. All CLP-generated data will be verified and validated by the CLP PO or designee from the chemists at EPA's Environmental Services Unit prior to authorization of payment to the laboratory. The data generated by the regional EPA laboratory (MEL) are verified by the EPA chemists at the lab and validated by the project QAO or designee.

5.2 Verification and Validation Methods (D2)

[The following will be revised according to project specifics and directive from EPA Quality Assurance Manager (QAM)]

Initial data reduction, validation, and reporting at the laboratory (with the exception of MEL) will be performed as described in the laboratory SOPs. For data produced by MEL, a full data review is conducted prior to release as is required by their NELAC accreditation. The data generated by MEL are verified by the EPA chemists at the lab and validated by the project QAO or designee. Independent data validation of CLP data by EPA or their designee will follow EPA *Contract Laboratory Program National Functional Guidelines for Inorganic/ Organic Data Review* (EPA, 2010b). The level of validation for CLP generated data will be in accordance with EPA guidance: " EPA-540-R-08-005 Externally Validated Superfund Data". In this case, the summary forms data review will be tagged as a stage "S2BVE" and the fully validated data as "S4VEM".

A full data validation will be performed on all samples if resources and time are available. The following reduced approach may be implemented if resources are constrained. The first four sample delivery groups submitted by the laboratory will undergo full data validation. If problems are not encountered with the data and if there are resource and time constraints, only 30 percent of the rest of the data will undergo full data validation, and the remaining 70 percent will undergo summary forms data review. Electronic data, validation report memoranda and qualified results will be prepared by the validator and submitted to EPA and the contractor's PM (Jeremy Blei), contractor's data manager (Tina Rice) and contractor's QAO (Artemis Antipas).

5.3 Reconciliation with User Requirements (D3)

Analytical data obtained will be reconciled with the requirements specified in Table 2-2. Assessment of data for precision, accuracy, and completeness will be performed in accordance with the quantitative definitions in the following subsections.

5.3.1 Precision

If calculated from duplicate measurements, use the following equation:

$$RPD = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2) / 2} \quad (1)$$

Where:

RPD = relative percent difference
C_1 = larger of the two observed values
C_2 = smaller of the two observed values

If calculated from three or more replicates, use relative standard deviation (RSD) rather than the RPD, as follows:

$$RSD = (s / \bar{y}) \times 100\% \quad (2)$$

Where:

RSD = relative standard deviation
s = standard deviation
$\bar{y}$ = mean of replicate analyses

Standard deviation, s, is defined as follows:

$$S = \sqrt{\sum_{i=1}^{n} \frac{(y_i / \bar{y})^2}{n - 1}} \quad (3)$$

Where:

s = standard deviation
y_i = measured value of the i^{th} replicate
$\bar{y}$ = mean of replicate analyses
n = number of replicates

5.3.2 Accuracy

For measurements where matrix spikes are used, use the following:

$$\%R = 100\% \; x \left[\frac{S - U}{C_{sa}} \right] \quad (4)$$

Where:

%R = percent recovery
S = measured concentration in spiked aliquot
U = measured concentration in unspiked aliquot
C_{sa} = actual concentration of spike added

For situations where a standard reference material (SRM) is used instead of or in addition to matrix spikes, use the following:

$$\%R = 100\% \; x\left[\frac{C_m}{C_{sm}}\right] \tag{5}$$

Where:

%R	=	percent recovery
C_m	=	measured concentration of SRM
C_{sm}	=	actual concentration of SRM

5.3.3 Completeness (Statistical)

Defined as follows for all measurements:

$$\%C = 100\% \; x\left[\frac{V}{T}\right] \tag{6}$$

Where:

%C	=	percent completeness
V	=	number of measurements judged valid
T	=	total number of measurements

SECTION 6

References

ADEC. 2006. 18 AAC 70, Water Quality Standards. As amended through December 28. Alaska Department of Environmental Conservation.

ADEC. 2008. *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*. As amended through December 12. Alaska Department of Environmental Conservation.

ADEC. 2009. *Ecoscoping Guidance*. Alaska Department of Environmental Conservation, Division of Spill Prevention and Response, Contaminated Sites Program. March.

ASTM. 2008. *Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Invertebrates*. ASTM E-1367. American Society for Testing and Materials.

Buchman, M.F., 2008. *NOAA Screening Quick Reference Tables*. NOAA OR&R Report 08-1, National Oceanic and Atmospheric Administration, Office of Response and Restoration Division, Seattle, Washington, 34 pages.

CCME. 1991a. *Ambient Water Quality Guidelines for Mercury, Overview Report*. Canadian Council of the Ministers of the Environment, Water Quality Branch, Water Management Division. February.

CCME. 1991b. *Ambient Water Quality Guidelines for Selenium, Overview Report*. Canadian Council of the Ministers of the Environment, Water Quality Branch, Water Management Division. August.

CCME. 2010. *British Columbia Approved Water Quality Guidelines, 2010 Edition*. Updated. Canadian Council of the Ministers of the Environment, Science and Information Branch, Water Quality. January.

Dredged Material Management Program (DMMP). 2011. DMMP Guideline Chemistry Values. June.

EPA. 1983. *Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020*. U.S. Environmental Protection Agency. March.

EPA. 1986. *Quality Criteria for Water*. EPA 440/5-85-001. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, DC. May 1.

EPA. 1993. *A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective*. EPA/630/R-92/005. U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, DC. May.

EPA. 1994. *Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods*. EPA 600/R-94/025. U.S. Environmental Protection Agency. June.

EPA. 2000. *Guidance for Assigning Chemical Contaminant Data for Use in Fish Advisories, Volume 1: Fish Sampling and Analysis*. Third Edition. 823-B-00-007. U.S. Environmental Protection Agency, Office of Water. November.

EPA. 2001. *EPA Requirements for QA Project Plans (QA/R-5).* (EPA/600/R-98-018). Washington, D.C. U.S. Environmental Protection Agency.

EPA. 2002a. *EPA Guidance for Quality Assurance Project Plans. (QA/G-5).* (EPA/240/R-02-009). Washington, D.C. U.S. Environmental Protection Agency.

EPA. 2002b and 2010. *Contract Laboratory Program National Functional Guidelines for Inorganic/Organic Data Review*. Washington, D.C. U.S. Environmental Protection Agency.

EPA. 2002c. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Solid Waste and Emergency Response, OSWER 9355.4-24. December. U.S. Environmental Protection Agency.

EPA. 2003a. *EPA Program Plan for Region 10 Architect Engineering Services, Contract Solicitation No. PR-R7-02-10217.* U.S. Environmental Protection Agency.

EPA. 2003b. *EPA Management Plans and Standard Operating Procedures for Region 10 Architect Engineering Services, Contract Solicitation No. PR-R7-02-10217.* U.S. Environmental Protection Agency.

EPA. 2004. National *Recommended Water Quality Criteria*. U.S. Environmental Protection Agency, Office of Water.

EPA. 2005. *Uniform Federal Policy for Quality Assurance Project Plans*. Part 1 UFP-QAPP Manual, Final, Version 1. U.S. Environmental Protection Agency. March.

EPA. 2006. *Guidance for the Data Quality Objectives Process (QA/G-4)*. EPA/600/R-96/066. U.S. Environmental Protection Agency. Washington, D.C.

EPA. 2006b. *Region 3 Risk-Based Concentration Table*. U.S. Environmental Protection Agency. April 7.

EPA. 2008c. *Test Methods*. http://www.epa.gov/sw-846/main.htm. Accessed on May 20, 2011. U.S. Environmental Protection Agency.

EPA. 2010b. *Superfund Analytical Services/Contract Laboratory Program*. http://www.epa.gov/superfund/programs/clp/index.htm. Accessed on May 20,2011. U.S. Environmental Protection Agency.

EPA. 2011. Region *3 Regional Screening Level (RSL) Fish Ingestion Table*. U.S. Environmental Protection Agency. June.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." *Environmental Management*. 19(1):81-97.

NEHC. 2005. *PCB Analysis and Risk Assessment at Navy Installations, Part C: PCB Ecological Risk Assessment*. Prepared by R.L. DeGrandchamp and M.G. Barron. Prepared for U.S. Navy Environmental Health Center. December.

ORNL. 1997. *Preliminary Remediation Goals for Ecological Endpoints*. Prepared by Oak Ridge National Laboratory. Prepared for the U.S. Department of Energy. Office of Environmental Management. R.A. Efroymson, G.W. Suter II, B.E. Sample, and D.S. Jones., eds. August 1997.

PSEP. 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments, In: *Puget Sound Protocols and Guidelines.* Puget Sound Estuary Program.

Salazar, M. and S. Salazar. 2003. *Using Bivalve Tissue Copper Residues and Effects for Ecological Risk Assessment*. Presented at the 24th Annual Society of Environmental Toxicology and Chemistry Meeting. November 11.

URS. 2007. *Draft Report Engineering Evaluation/Cost Analysis (EE/CA) Salt Chuck Mine Tongass National Forest, Alaska*. Prepared by URS Group, Inc. Prepared for U.S. Department of Agriculture Forest Service, Alaska Region. March.

Appendix A
Data Quality Objectives for Preremedial Investigation, Salt Chuck Mine, Tongass National Forest, Alaska

APPENDIX A

Data Quality Objectives for Preremedial Investigation, Salt Chuck Mine, Tongass National Forest, Alaska

Step 1 Problem Statement	Step 2 Decision to be Made	Step 3 Inputs to the Decision	Step 4 Study Area Boundaries	Step 5 Decision Rule	Step 6 Acceptable Limits on Decision Error	Step 7 Optimize the Design[1]
DQO 1: Verification of Previous Investigation Results						
Background Information and CSM: See Section 2.2.2. Previous investigations, historical records, and visual evidence indicate that releases of environmental contamination from the Salt Chuck Mine site to intertidal areas have occurred. The degree to which historical analytical data (pre-2007) represent current conditions in environmental media (sediment, water, and biota) at the site is unknown and requires confirmation. Problem Statement: Data representing current conditions are required to characterize potential risks to human health and the environment and to support a remedial decision. Planning Team Members: Project Manager Jeremy Blei; Risk Assessor, Dennis Shelton; Senior Reviewer, David Bunte; QAO Artemis Antipas; Task Manager, Joy Chen Resources and Relevant Deadlines: Resources include previous reports including the March 2007 EE/CA. Data will be gathered during the 2011 summer field season.	Key Questions/Decisions: Decide whether current concentrations in environmental media (sediment, water, and biota) at the site are consistent with historical data Possible Outcomes: If current concentrations are consistent with historical data, consider using historical data in combination with new data. If concentrations are inconsistent, use only new data.	Needed information: • CSM • Historical analytical data for sediment, water, and biota from near-shore areas and reference area • GPS coordinates for historical data • New analytical data (see Table 2-1 for analyte lists) for tailing, sediment, surface water, and biota from near-shore areas and reference area Source of information: Past data as summarized in Section 3.9 and new data to be collected as described in Step .7 Action levels: See Table 2-1. Methods: Methods to meet above needs are available and described in Table 2-2 and Appendix B.	Lateral extent for site: Area defined as intertidal areas, including areas below high tide extending towards Salt Chuck Bay where previous sampling was conducted (see Figure 2-3 and Figure 2-4). Lateral extent for reference areas: Areas below high tide where previous sampling was conducted (see Figure 2-3 and Figure 2-4). Vertical extent: Sediment will be collected from depths where previous sampling was conducted. Bivalves will be collected at shallowest depths where they occur (see Figure 2-3 and Figure 2-4). Target analytes: Same as used for historical samples, as identified in EE/CA and Table 2-1. Temporal boundaries: Since this DQO is evaluating temporal boundaries, all historical data presented in the 2007 EE/CA will be considered. The decisions based on this phase of data will hold until the 2012 study. Practical constraints: The ability to collect new samples precisely from previously sampled locations will be limited by the accuracy of GPS data of the previously-sampled locations and the accuracy of the GPS used to locate the new sample locations.	If current tailing, sediment, water, and/or biota analytical data are found to be consistent with levels previously reported for the same locations, then historical data will be considered representative of current conditions and can be used (in combination with new data) to characterize site risks to support a remedial decision. Otherwise, only newer data will be considered useable.	The sampling design is judgmental, based on a subset of those locations where tailing, sediment, water, and biota (bivalves) have been previously sampled. New analytical data will meet USEPA specifications for PARCC.	• Sample tailing (13 locations), sediment (12 locations), water (1 location), and bivalves (4 locations) in the intertidal zone adjacent to and in the vicinity of the Salt Chuck mine site; analyze samples for analytes listed in Table 2-1. • Sample sediment (2 locations), and bivalves (1 location) in the intertidal zone at the reference areas; analyze samples for analytes listed in Table 2-1. • Conduct qualitative evaluation to compare the new data with historical data from the same locations.

Step 1 Problem Statement	Step 2 Decision to be Made	Step 3 Inputs to the Decision	Step 4 Study Area Boundaries	Step 5 Decision Rule	Step 6 Acceptable Limits on Decision Error	Step 7 Optimize the Design[1]
DQO 2: Investigation of Methods for Characterization of Risk to Marine Aquatic and Benthic Resources						
Background information and CSM: See Section 2.2. Previous investigations, historical records, and visual evidence indicate that releases of environmental contamination from Salt Chuck Mine site to intertidal areas have occurred. Problem Statement: Some of the methods used to characterize risk to marine aquatic and benthic resources may not be suitable to adequately characterize potential risks to marine aquatic or benthic resources and/or to support a remedial decision. Planning Team Members: Project Manager, Jeremy Blei; Risk Assessor, Dennis Shelton; Senior Reviewer, David Bunte; QAO, Artemis Antipas; Task Manager, Joy Chen Resources and Relevant Deadlines: Resources include previous reports including the March 2007 EE/CA. Data will be gathered during the 2011 summer field season.	Key Questions/Decisions: Decide whether additional methods can be used to better characterize risks to marine aquatic and benthic resources and/or to support a remedial decision. Possible Outcomes: If additional methods can be used to better characterize risks, then those methods may be utilized during the 2012 RI. If additional methods do not improve characterization of risk, then methods used previously may be utilized during the 2012 RI.	Needed information: • CSM (see Section 2.2). • Historical analytical data for tailing/sediment (including bioassay), water, and biota from near-shore areas and reference area (see Section 3.9) • Ecological SRE as presented in the 2007 EE/CA. Source of information: Past data as described above and bioassay data to be obtained as described in Table 2-2. Action levels: See Table 2-1. Methods: Applicable bioassay methods provided in Table 2-2.	Spatial and Temporal Boundaries: Since this DQO focuses on investigating alternate methods, spatial and temporal boundaries do not apply. The sampling will focus on higher concentration areas, to increase the chances of measurable toxicity and/or leachability of tailings, so that the relative sensitivity of bioassay and extraction methods can be determined.	If additional methods are found to provide a more robust and relevant measure of exposure to marine aquatic and benthic resources, they will be included as additional lines of evidence in the characterization of potential risks to these resources and/or to support a remedial decision.	Bioassay data will meet the requirements of USEPA, ASTM, and/or PSEP protocols. Past analytical data will meet USEPA guidelines for usability.	• Sample sediment from two locations in the intertidal zone adjacent to the Salt Chuck mine site; Conduct the following bioassays (with five serial dilutions): — 10-day static solid-phase sediment toxicity test using amphipods conducted according to EPA 600/R-94/025 and/or ASTM E-1367. — 20-day static solid-phase tests using polychaetes conducted following procedures described in ASTM E-1611 and/or PSEP protocols (PSEP, 1995). — Embryo-larval development water column test of sediment elutriate (*Mytilus sp.* [preferred], *Crossostrea, Dendraster, or* Strongylocentrotus) (EPA-823-B-98-004). • Sample sediment samples from the 2 co-located bioassay samples and analyze for AVS/SEM and modified SPLP with site water.
DQO 3: Evaluation of Background Concentrations						
Background Information and CSM: See Section 2.2. Previous investigations, historical records, and visual evidence indicate that releases of environmental contamination from the Salt Chuck Mine site to intertidal areas have occurred. Problem Statement: Insufficient data representing naturally-occurring concentrations of metals exist to allow for reliable comparison between background and contamination from the Salt Chuck Mine site. Planning Team Members: Project Manager, Jeremy Blei; Risk Assessor, Dennis Shelton; Senior Reviewer, David Bunte; QAO, Artemis Antipas; Task Manager, Joy Chen Resources and Relevant Deadlines: Resources include previous reports including the March 2007 EE/CA. Data will be gathered during the 2011 summer field season.	Key Questions/Decisions: Decide whether the nature and extent of contamination can be adequately defined, in part, by considering a comparison with naturally-occurring background concentrations. Possible Outcomes: If site is sufficiently delineated, no additional delineation is required to support remedial decisions. If site is not sufficiently delineated, additional delineation will be required during the 2012 RI.	Needed information: • CSM • Site reconnaissance records • Historical analytical data for sediment, surface water, and biota from reference area • New analytical data (see Table 2-1 for analyte lists) for sediment (including bioassay) and biota from reference area	Lateral extent for reference areas: Areas below high tide where previous sampling was conducted, or additional areas of similar characteristics as determined during field sampling (see Figure 2-3 and 2-4). Vertical extent: Surface sediment will be collected from the top 6 inches where wildlife and human exposure is most likely. Bivalves (and co-located sediment samples) will be collected at the shallowest depths where they occur (See Figure 2-3 and 2-4). Temporal boundaries: The planned 2011 sampling will be the primary focus of the background evaluation, and will be supplemented with historical data (as determined from the outcome of DQO 1). Decision will apply till 2012 study.	If sediment, surface water, and biota samples indicate that background concentrations of target analytes are of sufficient quality and quantity to allow for reliable comparison between background and contamination from the Salt Chuck Mine site, the results will be included as a line of evidence in the definition of nature and extent of contamination.	The sampling design is judgmental, based on a determination of those locations where background sediment and biota (bivalves) were previously sampled, or at additional areas of similar characteristics, as determined during field sampling. Analytical data will meet USEPA specifications for PARCC.	• Sample sediment (three locations) and bivalves (seven locations) in the intertidal zone at the reference areas; analyze samples for metals, PCBs, and PAHs. • Sample sediment from one location in the reference areas; conduct the following bioassays: — 10-day static solid-phase sediment toxicity test using amphipods conducted according to EPA 600/R-94/025 and/or ASTM E-1367. — 20-day static solid-phase tests using polychaetes conducted following procedures described in ASTM E-1611 and/or PSEP protocols (PSEP, 1995). — Embryo-larval development water column test of sediment elutriate (*Mytilus sp.* [preferred], *Crossostrea, Dendraster, or* Strongylocentrotus) (EPA-823-B-98-004). • Sample sediment sample from the co-located bioassay sample and analyze for AVS/SEM. • Conduct qualitative evaluation to compare the new data from adjacent to the Salt Chuck mine with reference area data.

Step 1 Problem Statement	Step 2 Decision to be Made	Step 3 Inputs to the Decision	Step 4 Study Area Boundaries	Step 5 Decision Rule	Step 6 Acceptable Limits on Decision Error	Step 7 Optimize the Design[1]
DQO 4 – Evaluation of Nature and Extent of Contamination						
Background information and CSM: See Section 2.2. Previous investigations, historical records, and visual evidence indicate that releases of environmental contamination from Salt Chuck Mine site to intertidal areas have occurred. Problem Statement: The nature and extent of contamination is not adequately defined to characterize potential risks to human health or the environment and/or to support a remedial decision. Planning Team Members: Project Manager, Jeremy Blei; Risk Assessor, Dennis Shelton; Senior Reviewer, David Bunte; QAO, Artemis Antipas; Task Manager, Joy Chen Resources and Relevant Deadlines: Resources include previous reports including the March 2007 EE/CA. Data will be gathered during the 2011 summer field season.	Key Questions/Decisions: Decide whether the nature and extent of contamination is sufficiently delineated, so that site risks can be characterized to support a remedial decision. Possible Outcomes: If site is sufficiently delineated, no additional delineation is required to support remedial decisions. If site is not sufficiently delineated, additional delineation will be required during the 2012 RI.	Needed information: • CSM • Site reconnaissance records • Historical analytical data for tailing/sediment, water, leachate, and biota from near-shore areas and reference area • New analytical data (see Table 2-1 for analyte lists) for tailing/sediment (including bioassay), water, leachate, and biota from near-shore areas and reference area • Project screening levels for marine tailing/sediment, surface water, leachate, and biota (see Table 2-1) Source of information: Past data as summarized in Section 3.9 and new data to be collected as described in step7 Action levels: See Table 2-1. Methods: Appropriate methods available and shown in Table 2-2.	Lateral extent for site: Area defined as the Marine Operable Unit, including areas below high tide extending towards Salt Chuck Bay where previous sampling was conducted, or beyond if necessary (see Figure 2-3 and 2-4). Lateral extent for reference areas: Areas below high tide where previous sampling was conducted (see Figure 2-3 and 2-4). Vertical extent: Surface sediment will be collected from the top 6 inches where wildlife and human exposure is most likely. Deeper samples may be collected when confirming thickness of contamination. Bivalves (and co-located sediment samples) will be collected at the shallowest depths where they occur (see Figure 2-3 and 2-4). Temporal boundaries: The planned 2011 sampling will be the primary focus of the nature and extent evaluation, and will be supplemented with historical data (as determined from the outcome of DQO 1). Decision will apply till 2012 study.	If tailing/sediment, water, leachate, and biota samples indicate concentrations of target analytes that are consistent with background levels (and/or screening levels), then the lateral and vertical extent of contamination has been determined. Otherwise, additional samples are required to define extent.	The sampling design is judgmental, based on a determination of those locations where previously sampled sediment, water, and biota (bivalves) have not been fully delineated. Analytical data will meet USEPA specifications for PARCC.	• Sample tailing (1 location), sediment (18 locations), water (1 location), and bivalves (5 locations) in the intertidal zone adjacent to the Salt Chuck mine site; analyze samples for analytes listed in Table 2-1. • Sample sediment (8 locations) and bivalves (6 locations) in the intertidal zone at the reference areas; analyze samples for analytes listed in Table 2-1. • Sample subsurface samples at 2 locations at the intertidal tailing; analyze samples for analytes listed in Table 2-1. • Sample both saturated and unsaturated tailings at 8 locations at the site; conduct modified SPLP[2] test using site water; analyze leachate for metals listed in Table 2-1. • Conduct qualitative evaluation to compare the new data from adjacent to the Salt Chuck mine with reference area data and to screening levels.
DQO 5 – Characterization of IDW						
Background information and CSM: Previous investigations, historical records, and visual evidence indicate that releases of environmental contamination from Salt Chuck Mine site to intertidal areas have occurred. Problem Statement: IDW must be characterized for disposal. Planning Team Members: Project manager, Jeremy Blei, risk assessor, Dennis Shelton, senior review, David Bunte, QAO, Artemis Antipas, task manager, Joy Chen Resources and Relevant Deadlines: IDW must be characterized prior to disposal.	Key Questions/Decisions: Determine whether the types of IDW generated require characterization, and if so, characterize appropriately for disposal purposes. Possible Outcomes: Generated IDW will be limited to PPE and disposable sampling equipment, therefore no characterization is required.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

Notes:

ASTM	American Society for Testing and Materials
AVS/SEM	acid volatile sulfide and simultaneously extracted metals
CSM	conceptual site model
EE/CA	Engineering Evaluation/Cost Analysis
GPS	Global Positioning System
DQO	data quality objective
PAH	polynuclear aromatic hydrocarbon
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCB	polychlorinated biphenyl
PSEP	Puget Sound Estuary Program
QAO	Quality Assurance Officer
RI	remedial investigation
SPLP	synthetic precipitate leaching procedure
SRE	streamlined risk evaluation
USEPA	U.S. Environmental Protection Agency

[1] Refer to Table B-1, Figure 2-3, and Figure 2-4 for detailed sampled locations; the proposed sediment sample at historical location are historical locations that were sampled but did not evaluate the analytes included in the preremedial intertidal investigation.

[2] SPLP will be completed as a modified approach by using site water as the extraction fluid, a 20:1 liquid to solid ratio, and continuous agitation for 18 hrs at room temperature at a rate of 30 revolutions per minute.

Appendix B
Field Procedures

APPENDIX B

Field Procedures

The Field Procedures (FPs) were prepared to guide the preremedial intertidal investigation for the Salt Chuck Mine at Tongass National Forest, Alaska. A project location map and a site conceptual model is presented on Figure 2-3, Figure 2-4 and Figure 2-5 of the main Quality Assurance Project Plan (QAPP) text, respectively. Figure 2-3 and Figure 2-4 also includes the proposed sample locations. The proposed sediment sample at historical location are historical locations that were sampled but did not evaluate the analytes included in the preremedial intertidal investigation. The purpose of this FSP is to provide detailed FPs for the preremedial intertidal investigation, designed to collect data to aid the Remedial Investigation/Feasibility Study (RI/FS) effort to be performed starting in 2012. The rationale for the field investigation approach is described in the QAPP and associated DQOs (Appendix A).

B.1 Site Description

The preremedial intertidal investigation includes sampling locations at the intertidal area near the mill as well as sampling locations at the reference areas. An extensive tailings deposit is located primarily in the intertidal zone southeast of the mill, which is exposed and bordered by two waterbodies (an unnamed creek and Lake Ellen Creek) during low tide. Detailed description of these waterbodies, tailings, and the intertidal area is included in Section 2.2.2 of the QAPP.

B.2 Project Overview

B.2.1 Objectives

Uncertainty exists with regard to the usability of previous investigation data and whether alternative characterization methodologies could improve evaluation of potential risks at the site. The nature and extent of potential contamination at the site and an evaluation of background concentration data is also not complete. The objective of this FSP is to provide detailed sampling procedures to enable gathering of preremedial field investigation data to support a more extensive RI/FS effort to be performed starting in 2012.

B.2.2 Field Investigation Approach

This section provides information regarding the design of the preremedial intertidal investigation fieldwork. A description of the sampling design is provided in Section B.2.2.1, coordination with other sampling programs is outlined in Section B.2.2.2, and the rationale for sampling locations is provided in Section B.2.2.3. A general description of the field methods, including sample collection and discharge measurement procedures, is provided in Section B.4.

B.2.2.1 General Overview

The field effort will consist of sampling and analysis of sediment, surface water, and bivalves at the intertidal and background areas, as well as tailings at the intertidal area. The field activities are anticipated to occur in late August and early September 2011. The sampling approach presented here is based solely on historical data and observations from the initial site visit conducted on June 6 and 7, 2011. All changes to the sampling approach will be documented as appropriate.

B.2.2.2 Monitoring Program Coordination

No routine monitoring is currently required at Salt Chuck Mine, and as such no coordination with monitoring program is necessary.

B.2.2.3 Rationale for Sample Locations

Figure 2-3 and Figure 2-4 of the QAPP and Table B-1 present the locations planned for sampling during the preremedial intertidal investigation (tables are located at the end of this appendix). Sample locations were selected to verify previous investigation results, investigate methods for characterization of risk to marine aquatic and benthic resources, evaluate background concentrations, and evaluate the nature and extent of contamination. Detailed rationale for these sample locations is included in Table B-1 and Appendix A of the QAPP. Locations were selected that are situated upstream and downstream from major source areas. Different types of samples were co-located, to the extent possible to provide multiple lines of evidence for the nature and extent of contamination.

B.2.2.4 Rationale for Analyte List

The list of analytes for the preremedial intertidal investigation is included in Table 2-1 of the QAPP. In generally, the list follows those included in the EE/CA (URS 2007) to allow for direct comparison of the preremedial investigation to historical data as described in DQO 1 of Appendix A of the QAPP. Additional EPA TAL metals and TCL PCBs not included in the EE/CA (URS 2007) are included in the preremedial intertidal investigation to evaluate the nature and extent of these constituents. PAHs and PCBs analyses are not included for the surface water and leachate analyses because a review of the results from the EE/CA (URS 2007) indicates that these analytes were generally not detected or exceeding the screening levels. Similarly, DRO and RRO were generally not detected or exceeding the screening levels with the exception of sample locationSCSD-106, therefore these analyses will only be analyzed for this sample location. Total Organic Carbon is included for all sediment samples to allow for better evaluation of bioavailability of organic analytes. Additional bioassay tests are included in the preremedial intertidal investigation to evaluate whether these methods can be used to better characterize risks to marine aquatic and benthic resources and/or to support a remedial decision, as stated in DQO 2 of Appendix A of the QAPP. Grain size analysis is included to support selection of bioassay species and interpretation of bioassay results. Similarly, to assist in the evaluation of potential bioavailability of the divalent metals (cadmium, copper, nickel, lead, and zinc), AVS/SEM data will be collected at the surface tailing/sediment samples co-located with the bioassay samples. When insufficient H2S is available, the excess metals are available to organisms and may be expressed in measurable toxicity. AVS/SEM will be run on the proposed samples listed in Table B-1 and B-2.

B.3 Field Documentation

This section describes the methods that will be used to document sample collection and is specific to the preremedial intertidal investigation sampling effort for the Salt Chuck Mine.

B.3.1 Project Communication

Daily progress reports will be submitted by the CH2M HILL Field Team Leaders (FTL) to the CH2M HILL Project Manager (PM). Daily progress reports will include the work performed, problems identified and associated corrective actions taken, and other appropriate, comments. Periodic progress reports will be submitted to EPA's Task Order Project Officer PM by CH2M HILL's PM during the field sampling event.

B.3.2 Sample Designation

A sample numbering scheme was developed that allows each sample to be uniquely identified and provides a means of tracking the sample from collection through analysis. The numbering scheme indicates the location and sample type. The unique sample number will be entered in the field notebook, field tracking sheets, chain-of-custody forms, and other records documenting sampling activities.

Sample identifications are included in Table B-1 of the QAPP. In instances where an alternate location is sampled for samples with predetermined coordinates, in lieu of an original location, an altered sampling site ID will be used. Alternative sampling location IDs are preceded by an "A" (e.g., if an alternative location for SD-101 were used, the sampling location would be listed as ASD-101). The spatial coordinates of alternate sampling locations will be measured via a hand-held global positioning system (GPS) and recorded in the logbook.

Sample identification will need to be updated for the tissue samples to indicate the type of species sampled and to reflect any alteration to the co-located tailing/sediment sample location. The sample identification system for bivalve tissue samples will have four components, as follows:

SCMatrix-Species-ID

Where:

SC = Salt Chuck
Matrix = TISS
Species = bivalve species
- SC = softshell clams
- BC = butter clams
- LN = littleneck clams
- BM = blue mussels

ID = Sampling location designation in Table B-1

For example, the sample identification for a softshell clams tissue sample from SCTISS-101 will be SCTISS-101-SC. To provide the laboratory with blind field duplicates, duplicate samples will be labeled with the same sample identification system as for the field sample as above except the field duplicate sample will use the next applicable sequential ID number.

For example, if the first duplicate tissue sample is collected from SCTISS-102 for butter clams, the sample identification for the duplicate sample will be SCTISS-156. The sample identification and sampling location will be recorded in the logbook and on the Tissue Sample Collection Data Sheet provided in Attachment B-1.

Similarly, the sample identification system for duplicate samples for tailing, sediment and surface water sample will have three components, as follows:

SCMatrix-ID

Where:

SC = Salt Chuck
Matrix = Sample Type
SD = intertidal tailing/sediment

SW = surface water
ID = Next applicable sequential sampling location designation number

For example, if the first sediment sample will be SCSD-156. Sample designation number for intertidal tailing and sediment should not be duplicated. The sample identification and sampling location will be recorded in the logbook and on the Sediment Sample Collection Log provided in Attachment B-1.

Sample identification will be as follows for the equipment blanks and filter blanks:

SCMatrix-ID

Where:

SC = Salt Chuck
Matrix = Sample Type
FB = filter blank
EB = equipment blank
ID = tailing/sediment/surface water sample location identification where the QC sample was collected

For example, an equipment blank sample collected from SCSD-105 will be identified as SCEB-SCSD-105 and a filter blank sample collected from SCSW-101 will be identified as SCFB-SCSW-101.

Sample identification for site water to be used for the modified SPLP will be SC-SiteWater.

B.3.3 Field Documentation

The following sections provide information regarding field documentation procedures.

B.3.3.1 Field Forms

All sampling and associated activities will be documented on activity-specific field logs, where present. Standardized field logs will be produced to measure and record sample location, field parameter measurements, logging of digital photographs, and sample collection (see Attachment B-1 for field forms).

B.3.3.2 Field Logbook

Daily field activities will be documented through journal entries in a bound field logbook, which is dedicated to each field team for the preremedial intertidal investigation sampling effort. Field logbook entry and custody procedures will follow National Enforcement Investigation Center policies and procedures of EPA. The field logbook will be water-resistant, and all entries will be made in indelible ink. The field logbook will contain all pertinent information about sampling activities, site conditions, field methods used, general observations, and other pertinent technical information. Language used will be objective, factual, and free of personal opinions. Hypotheses for observed phenomena may be recorded; however, they must be clearly identified as such and only relate to the subject of observation. Field logbooks will become part of the permanent project record. Examples of typical field logbook entries include the following:

- Personnel present
- Subcontractors' names and companies
- Time of arrival and departure at each site
- Daily temperature and other climatic conditions
- Field measurements, activities, and observations, including discussions resulting in pertinent field decisions
- Referenced sampling location description (in relation to a stationary landmark) and maps
- Sample collection methods and equipment
- Date and time of sample collection
- Types of sample containers used, sample identification and cross-referencing, sample types and preservatives used, and analytical parameters
- Quality control (QC) sample (duplicate or blank) sample location and sampling method
- Field instrument calibration information
- Documentation of equipment decontamination
- Site sketches and or reference to photographs taken
- Name, address, and telephone number of the contracted analytical laboratory
- Instrument calibration procedures and frequency
- Visitors to the site

The FTL or designee will be responsible for the daily maintenance of all field records. Each page of the field logbook will be sequentially numbered, dated, and signed by the person making the entry. Corrections to the field logbook will be made by using a single strike mark through the entry to be corrected, then recording and initialing the correct entry. For corrections made later, the date of the correction will be noted. Unused portions of the pages will be crossed out, signed, and dated at the end of each day.

B.3.3.3 Chain-of-Custody Procedures

Because samples collected during any investigation could be used as evidence, their possession must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. Chain-of-custody procedures should be followed to document sample possession as follows.

Definition of Custody

A sample is under custody if one or more of the following criteria are met:

- The sample is in a person's physical possession
- The sample is in a person's view after being in his or her physical possession
- The sample was in a person's physical possession and was then locked up or sealed to prevent tampering
- The sample is kept in a designated secured area

Field Custody

To collect samples for evidence, only enough material to provide a good representation of the media being sampled will be collected. To the extent possible, the quantity and types of samples and sample locations are determined before the actual fieldwork. As few people as possible should handle samples.

The field sampler is personally responsible for the care and custody of the samples collected until they are transferred or dispatched properly.

The PM will determine whether proper custody procedures were followed during the fieldwork, and will decide whether additional samples are required.

Transfer of Custody and Shipment

Samples should be accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving the samples should sign, date, and note the time on the record. This record documents custody transfer from the sampler, often through another person, to the analyst at the laboratory.

Samples should be packaged properly for shipment and dispatched to the appropriate laboratory for analysis with a separate chain-of-custody record accompanying each shipping container (one for each field laboratory, and one for samples driven to the laboratory). Courier names and other pertinent information are entered in the "Received by" section of the chain-of-custody record.

All shipments should be accompanied by the chain-of-custody record identifying its contents. The original record and one copy should accompany the shipment to the laboratory, and a second copy will be retained by the PM.

Freight bills, postal service receipts, and bills of lading should be retained as part of the permanent documentation.

Laboratory Custody Procedures

A designated sample custodian should accept custody of the shipped samples and verify that the sample numbers match those on the chain-of-custody records. Pertinent information regarding shipment, pickup, and courier should be in the "Remarks" section. The custodian should enter the sample numbers into a bound notebook. The laboratory custodian will use the sample identification number or assign a unique laboratory number to each sample, and will be responsible for ensuring that all samples are transferred to the proper analyst or stored in the appropriate secure area.

The custodian will distribute samples to the appropriate analysts. Laboratory personnel are responsible for the care and custody of samples from the time they are received, until the sample is exhausted or returned to the custodian. The data from sample analyses should be recorded on the laboratory report form.

When sample analyses and necessary QC checks have been completed in the laboratory, the unused portion of the sample will be disposed of properly. All identifying sample tie tags, data sheets, and laboratory records will be retained as part of the documentation. Sample containers and remaining samples should be disposed of by the laboratory in compliance with all federal, state, and local regulatory requirements.

B.3.4 Digital Pictures

Color digital pictures taken during sampling activities will be numbered to correspond to photo log entries. The name of the photographer, date, time, site location, and photograph number will be documented in the field logbook. Photo number and scene description will be entered sequentially in the photo log as photographs are taken. Adequate field logbook notations and receipts will be retained to account for custody during film processing. At a minimum, one digital photo will be taken of each sample location at the time of sampling. A dry-erase white board bearing the location identification, date, and time, will be held in the photograph by a field team member.

B.3.5 Sample Management

The following section discusses various sample management procedures that will be followed during the preremedial investigation. Included in these sections are procedures for sample packaging and transportation, sample labeling, and sample documentation.

B.3.5.1 Sample Labeling and Containers

Each sample container will be labeled using labels generated with the Forms II Lite software. One label will be attached to the sample container. The sample label will be completed using indelible ink and will include the following:

- Sample number
- Case number
- Analysis requested (including specific constituents requested)
- Preservative used ("NA" if not applicable)
- Date and time of sample collection
- Sampler's initials

Sample labels will be affixed to the sample containers and covered with clear packaging tape, then placed in a resealable bag. All sample numbers and locations (including blanks and duplicates) will be recorded in the field notebook.

B.3.5.2 Sample Containers

After sample collection into a properly preserved container, the sample containers will be placed in re-sealable bags and stored in an ice-filled cooler for temporary storage prior to, and during, shipment to the laboratory. All samples will be packaged and labeled for shipment in compliance with current regulations.

B.3.5.3 Preparation of Sample Coolers

Only plastic ice chests will be used for shipping samples. The following steps will be followed to prepare sample coolers:

- All previous labels will be removed from the cooler.
- All drain plugs will be sealed with tape (inside and outside).
- A cushioning layer of recyclable cornstarch popcorn or bubble wrap will be placed at the bottom of the cooler.
- If ice is used in the coolers for the laboratory, it will be placed in double, 1-gallon re-sealable bags.

B.3.5.4 Preparation of Sample Packing

The following steps will be followed for packing samples in coolers:

- The chain-of-custody form will be placed in a resealable plastic bag.
- Samples will be placed in an upright position in the cooler.
- The void space between samples will be filled with recyclable cornstarch popcorn (or equivalent), double-bagged ice, or bubble wrap.
- Ice will be placed on top of and between the samples.
- The remaining voids will be filled with recyclable cornstarch popcorn (or equivalent) or double-bagged ice.

B.3.5.5 Sealing the Cooler

Coolers will be filled with packing material surrounding the bottles to prevent breakage during transport. Ice will be sealed in plastic bags to prevent melt water from soaking the packing material and compromising sample labels and integrity. Sample documentation will be enclosed in sealed plastic bags taped to the underside of the cooler lid. Coolers will be secured with packing tape and custody seals as follows:

- The cooler lid will be secured with strapping tape, encircling the cooler several times.
- Custody seals will be placed on two sides of the lid (one in front, and one on the side) and covered with tape to prevent inadvertent breaking of the seals.
- Arrows indicating "This Side Up" will be placed on the sides of the cooler.
- The shipping air bill will be securely attached to the exterior of the cooler.

B.3.5.6 Shipping the Cooler

The coolers will be shipped to CH2M HILL personnel in Ketchikan, Alaska, where arrangements will be made to ship coolers to the appropriate laboratory by overnight courier. Ice will be replaced in the coolers, as needed by the CH2M HILL personnel in Ketchikan, Alaska. If possible, samples will be shipped on the day of sample collection. Samples collected late in the day may be shipped on the following day.

If laboratory services are arranged through the EPA's Quality Assurance Officer, the Region 10 Regional Sample Control Coordinator must be contacted within 24 hours of sample shipment and be provided the following information:

- Sampling contractor's name
- Site name and/or case number

- Total number(s) by concentration and matrix of samples shipped to each laboratory
- Carrier, air bill number(s), method of shipment (priority next day)
- Shipment date and intended laboratory receipt date
- Irregularities or anticipated problems associated with the samples
- Whether the current shipment is the final shipment or if additional samples will be shipped under the same case number

For Friday shipments, the Regional Sample Control Coordinator or subcontract laboratory must be contacted prior to noon Friday to coordinate sample shipments that will arrive on Saturday. Samples will only be shipped on Friday if the laboratory provides assurance that analytical holding times will not be exceeded.

B.4 Sampling Equipment and Procedures

This section describes the required sampling equipment, procedures for equipment calibration, procedures for collection of surface samples, procedures for the collection of field parameters, and procedures for measuring surface-water discharge.

B.4.1 Field Equipment Calibration and Field Equipment Needs

B.4.1.1 Equipment Calibration

Field measurements include GPS readings, dissolved oxygen, temperature, pH, conductivity, and salinity. No manual calibration is required for the GPS unit; self-testing is performed automatically each time the unit is turned on. The water meter (e.g., Horiba and YSI) used to obtain these measurements will be rented for use on the project, and contain manufacturer-supplied calibration solution that will calibrate the meter over the full instrument range of pH, conductivity, and salinity. Prior to field mobilization, the range of previous field measurements for these parameters will be discussed with the manufacturer/ equipment rental firm to ensure that the calibration solution reflects the field situations likely to be encountered. The meters will be maintained, calibrated, and operated per manufacturer instructions. Manufacturer instructions will be kept within each meter case and brought with the equipment to the sites. Calibration solutions will be checked prior to the field investigation to ensure sufficient fluid is available onsite.

The meter will be zeroed, if applicable, before the start of work according to the instrument manual. Any instrument "drift" from prior zeroing should be recorded in the field notebook. Instrument zeroing will be in accordance with procedures and schedules outlined in the particular instrument's operations and maintenance manual.

Scheduled periodic calibration of testing equipments does not relieve field personnel of the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, the device must be removed from service and tagged so that it is not inadvertently used, and appropriate personnel notified so that a recalibration can be performed or a substitute piece of equipment can be obtained.

Equipment that fails calibration or becomes inoperable during use will be removed from service and either segregated to prevent inadvertent use or tagged to indicate it is out of calibration. Such equipment will be repaired and satisfactorily recalibrated. Equipment that cannot be repaired will be replaced.

Results of activities performed using equipment that has failed recalibration will be evaluated. If the activity results are adversely affected, the results of the evaluation will be documented, and the PM and data users will be notified.

Field Equipment List

- FSP
- Field logbook and forms
- Site maps
- Boat or canoe (optional)
- Digital camera
- Health and safety equipment and applicable personal protective equipment
- GPS
- Dry erase white board and markers
- Weatherproof pens
- Pencil
- Permanent markers
- Sample coolers
- Chain-of-custody forms and sample container labels
- Ice
- Resealable plastic bags for sample containers (1-quart and 1-pint) and ice (1-gallon)
- Garbage bags
- Plastic sheets
- Paper towels
- Shipping containers
- Strapping tape
- Transparent tape
- Shipping airbills
- Decontamination supplies
- Prepreserved sample containers
- Shovel
- Hand trowel/scoop/spoon/ladle
- Hand auger/hand corer
- PVC pipe, 2 inch diameter with caps
- Utility knife
- Rubber boots/waders
- Siphon tubing
- Dedicated stainless steel spoons and bowls for sample collection
- Thermally treated (baked) aluminum foil
- Petite Ponar grab sampler
- Decontamination supplies
- Core liners
- Disposable 0.45-micron filters
- Field parameter measurement equipment and associated calibration solutions (YSI Model 63, Horiba U-22, or equivalent)
- Engineering tape

B.4.2 Tailing and Sediment Sampling

This section summarizes the field methods and procedures applicable to tailing/sediment sampling locations (Table B-1). Tailing/sediment samples will generally be collected from the surface (0 to 6 inches) with the exception of location 3-7 and 3-8, where subsurface samples will also be collected (See Table B-1 for specific sampling depth intervals). Samples for the modified SPLP and bioassay analyses will be collected using the same methods as the tailing/sediment samples. Sampling method for surface and subsurface samples will be different, as described in the following sections. Sediment samples will be stored on ice under custody control before they are delivered to the laboratory.

To the extent possible, thickness of the tailings at each tailing sampling locations will be estimated. Hand Auger and probes should be attempted at low tide to estimate the thickness of the tailings deposit. It is possible that porewater near the base of the tailings will interfere with thickness measurements. The tailings are described as mostly olive green and black sand, with thin gray clay interbeds. In areas near the edge of the tailings Zone A through C, previous sampling efforts describe material below the tailings as stream sands and gravels.

For the modified SPLP samples, site water will be collected during higher tide. Sample location for site water will be determined by the FTL depending on site conditions such as site access. With minimum surface disturbance, site water will be collected by submerging a clean unpreserved sample container (1 L) and allow site water to flow gently into the bottle. Two liters of site water per sample will be collected for the SPLP analysis.

B.4.2.1 Surface Samples

Surface sediment samples will be collected in the top 6 inches of the sediment. Bulk surface sediment grab samples will be collected using either a Petite Ponar dredge sampler or a sampling spoon, depending on the depth of the water at the time of sampling. The sample locations will be accessed by wading or by a small water craft such as a canoe, depending on site access and the depth of water at the sample location.

If the sediments have no overlying water the samples will be collected with a stainless steel sampling spoon as described below:

1. On arrival at the site, set up and organize sampling equipment near the first sample location.
2. Cut a section of plastic sheet to be placed on the ground to use as a clean staging area for sampling equipment.
3. Arrange sample containers, sampling equipment, and decontaminated equipment on the plastic sheet. Exercise caution not to step on, or otherwise contaminate this clean working surface.
4. Locate the geographic position using GPS and record this and other parameters identified in the field log in Attachment B-1. Photograph and describe each location in the photo log.
5. If surface water sampling or bivalves sampling is required, collect surface water or bivalve samples prior to sediment sample collection.

6. Label each sample container properly, cover label with clear tape, fill out appropriate chain of custody information, wipe outside of container with paper towel or Kim wipe, and place in iced cooler.
7. Insert the spoon into the sediment at the selected sampling point and slowly remove the sample.
8. Slowly decant excess water.
9. For locations requiring AVS/SEM samples, observe materials to determine if sample is anoxic (i.e. not sandy). Do not collect AVS/SEM sample if the material if anerobic (i.e. sandy). Transfer the sample into the AVS/SEM sample containers using a stainless steel laboratory spoon (or equivalent device).
10. Deposit the remaining sample into a stainless steel tray or bowl lined with clean foil paper.
11. Homogenized the sample in the foil-lined bowl using a stainless steel spoon (or equivalent device) prior to placement into sample containers.
12. Decontaminate equipment prior to collecting sample from next location.

In deeper water conditions and/or where it is not safe to wade, surface sediment samples will be collected with a stainless steel Petite Ponar dredge grab sampler. A Ponar grab sampler has a jaw-type mechanism that is tripped from above in order to close the jaws and collect the sample. The dredge is lowered slowly through the water to the sediment with the jaws in the open position. As the dredge is retrieved, the jaws close and the isolated sediment is brought to the surface.

1. Decant if appropriate and necessary.
2. Deposit the Ponar contents onto a stainless steel bowl.
3. Transfer the sample into sample containers using a stainless steel laboratory spoon (or equivalent device). The transfer equipment may be disposable to avoid decontamination costs, and the risk of cross-contamination.
4. Remove large organisms and pieces of debris and record on the sample log sheet.
5. Homogenized the sample in a bowl using a stainless steel spoon (or equivalent device) prior to placement into sample containers. It is possible that samples collected with the Petite Ponar sampler may require multiple grabs to meet the sample volume required for analysis; therefore, multiple grabs at a sampling location will be composited by placing the additional grabs in the stainless steel mixing bowl prior to homogenization.
6. Label each sample container properly, cover label with clear tape, fill out appropriate chain of custody information, wipe outside of container with paper towel or Kim wipe, and place in iced cooler.
7. Decontaminate equipment prior to collecting sample from next location.
8. Record sample information such as sample coordinates, number of grabs and grab penetration depth (to the nearest cm) in the field notebook and sample logs.

In shallower water conditions or if the sediment bed is above the water line at the time of sampling, sediment samples will be collected using a hand corer, shovel, scoop or other simple hand implement. The following are the sampling procedures for the hand corer.

1. Label each sample container properly, cover label with clear tape, fill out appropriate chain of custody information, wipe outside of container with paper towel or Kim wipe, and place in iced cooler.
2. Ensure that the corers and (optional) liners are properly decontaminated prior to initiation of sampling and between each sample location.
3. Gently push the corer into the sediment with a smooth continuous motion to a depth of approximately 6 inches.
4. Twist the corer to detach the sample; then withdraw the corer in a single smooth motion.
5. Remove top of corer and slowly decant excess water.
6. Remove the nosepiece and deposit the sample onto a stainless steel bowl.
7. Decant, if appropriate and necessary.
8. Transfer the sample into sample containers (VOCs first) using a stainless steel laboratory spoon (or equivalent device). The transfer equipment may be disposable to avoid decontamination costs, and the risk of cross-contamination.
9. Homogenized the sample in a bowl using a stainless steel spoon (or equivalent device) prior to placement into sample containers.
10. Decontaminate equipment prior to collecting sample from next location.

B.4.2.2 Subsurface Tailing Samples

Subsurface samples will be collected using the hand corer or the PVC Pipe Method (for very soft material only). The following are the sampling procedures for the PVC Pipe Method:

1. Label each sample container properly, cover label with clear tape, fill out appropriate chain of custody information, wipe outside of container with paper towel or Kim wipe, and place in iced cooler.
2. Gently push pipe into sediment with a smooth continuous motion to the prespecified depth.
3. Cap the pipe, forming an airtight seal, to create a vacuum as it is withdrawn from the sediment.
4. Slowly decant excess water.
5. Deposit the sample onto a stainless steel bowl.
6. Decant if appropriate and necessary.
7. Transfer the sample into sample containers (VOCs first) using a stainless steel laboratory spoon (or equivalent device). The transfer equipment may be disposable to avoid decontamination costs, and the risk of cross-contamination.

8. Homogenized the sample in a bowl using a stainless steel spoon (or equivalent device) prior to placement into sample containers.
9. Decontaminate equipment prior to collecting sample from next location.
10. Record sample information such as sample coordinates, number of cores, refusal, sampling depth in the field notebook and sediment sampling and coring logs.

B.4.3 Surface Water Sampling

Water quality samples will be collected from the stream at locations shown in Tables B-1 of the QAPP. A list of surface water analytes and analytical method is included in Table B-2 and Table 2-1 of the QAPP.

Surface water samples will be collected only during low tides to minimize influence from the intertidal water. The FTL will determine whether or not the surface water depth and/or velocity of the waterbodies will provide a safe entry.

On arrival at the site, set up and organize sampling equipment near the first (farthest downstream) sampling location. Cut a section of plastic sheeting and place it on the ground as a clean staging area for sampling equipment. Arrange sample containers, sampling equipment, and decontaminated equipment on the plastic sheet. Be careful not to step on or otherwise contaminate this clean working surface. Use the following procedures for direct grab method sample collection:

1. Label the sample bottle with appropriate label and cover with clear waterproof sealing tape. Record all applicable information in the field logbook and complete the chain-of-custody form.
2. With minimum surface disturbance, submerge the unpreserved sample bottle (at least 500 mL) with the mouth of the container facing upstream and allow sample stream to flow gently into the bottle.
3. Filter the samples prior to transfer to the sample container with preservatives. A new filter shall be used for each water sample.
4. Fill the container approximately two-thirds full, leaving adequate space to allow for expansion.
5. After sample collection is completed, measure field parameters in Table B-2 using the associated water meter and procedures in the manufacturer's manual.
6. Record sample coordinates and other observations in the field notebook.
7. Decontaminate equipment prior to collecting sample from next location.

B.4.4 Bivalves Sampling

Bivalves will be collected in the intertidal zone when the tide is out and the area is exposed. Same species of bivalves from each sample location will be placed in two layers of resealable plastic bags and store on ice prior to shucking to minimize the possibility of cross contamination. Each sample will include an adequate number of individual species to achieve a total tissue weight of at least 300 grams. Samples will be discrete species (e.g., blue

mussels and softshell clams will not be mixed). Only two species will be collected for tissue analysis and priority for species selection is as follows: softshell clams, butter clams, littleneck clams, and blue mussels. For example, if softshell clams and butter clams are not available or with insufficient sample volume, a tissue sample for and littleneck clams and a separate tissue sample for blue mussels will be collected. Information on species identification is included in Attachment B-2. All tissue from the clams and/or mussels (i.e. not just specific tissue portions) will be extracted, frozen, and then shipped to the lab for digestion for analyses.

A reasonable effort will be spent at each location to sample for the bivalves. Bivalves will be collected from ±2 m from the co-located sediment sample location. In the event insufficient sample volume is available at the proposed location, an alternative location may be selected. If insufficient sample volume is available in the proposed or alternative locations, only one sample, or no sample may be collected. The following are the procedures for collecting tissue samples:

1. Locate the geographic position using GPS and record this and other parameters identified in the field log in Attachment B-1. Photograph and describe each location in the photo log.
2. If sediment sampling is required, collect tissue samples prior to sediment sample collection to minimize disturbance to the bivalves.
3. Label each sample container properly, cover label with clear tape, fill out appropriate chain of custody information, wipe outside of container with paper towel or Kim wipe, and place in iced cooler.
4. Insert the clean shuffle/hand trowel into the sediment at the selected sampling point and carefully remove the sediment to reveal the bivalve.
5. Using clean latex or nitrile gloves, collect appropriate amount of mussels or clams, rinse excess sediment off outside of shells with intertidal water, place samples in two resealable plastic bags, and place on ice in a cooler until tissue sample processing.
6. Line the bivalve tissue processing area with clean paper cloth. Pre-weigh the sample container on the scale. Using a clam shucking knife, carefully open the shell while minimizing damage to the tissue. Remove all tissue from the shell and place in the plastic container.
7. Weigh the container with tissue sample on the scale to ensure the minimum sample volume is met. Keep the tissue sample frozen prior to shipping.
8. Place the sample (inside the container) in a plastic bag, label, and place in a cooler with ice. The sample should be transferred to a freezer at the earliest possible time. Once frozen, the sample should not be allowed to thaw prior to receipt by the laboratory. Sample tissue will be removed from the shell and prepared by the laboratory.
9. Record sample collection information such as depth of sample, density of mussel or clam community, estimated size range of the species in the tissue sample log.
10. Decontaminate equipment prior to collecting sample from next location.

B.4.5 Field Quality Control Samples

Quality control (QC) samples collected in the field will be used to assess the overall quality of the project data. Field QC samples will include FDs, matrix spike/matrix spike duplicates (MS/MSD), equipment rinsate blanks, filter blanks, and temperature blanks. Duplicate discharge measurements and field parameters will be collected at a frequency of 10 percent of all samples.

B.4.5.1 Blind Field Duplicate Samples

FDs are duplicate samples collected immediately adjacent to the sample location (i.e. composited separately from the test sample and not a split sample) to evaluate the variability of concentrations in the media being collected. FDs will be collected and analyzed at a frequency of at least 10 percent of all sediment/tailings, surface-water, and bivalve samples. Duplicate samples will be collected as a separate sample and submitted to the laboratories blind. Analyses will be the same as those required by the parent sample.

B.4.5.2 Matrix Spike/Matrix Spike Duplicates Samples

MS/MSDs will be collected and analyzed at a frequency of at least 5 percent of total samples for sediment/tailings, surface water, and bivalve. MS/MSD samples will be designated as such on the chain-of-custody form. Analyses will be the same as those required by the parent sample.

B.4.5.3 Equipment Rinsate Blank

Equipment rinsate blanks are used to evaluate sampling device cleanliness and potential carryover of target contaminants from equipment contribution. Equipment rinsate blanks are collected after a sample collection device is subjected to standard decontamination procedures. ASTM Type II water (purchased and certified from a commercial vendor) will be poured over or through the sampling device and collected in a sample container for analysis. Equipment rinsate blanks will be collected at a minimum frequency of 1 per 20 samples collected or 1 per day. Additional equipment rinsate samples may be collected at the discretion of the FTL, according to field conditions. Rinsate samples will be analyzed for the same parameters as the corresponding field or primary samples.

B.4.5.4 Filter Blank

One filter blank will be collected for the project per lot of filters to be used in the field for dissolved metals analysis. ASTM Type II water (purchased and certified from a commercial vendor) will be poured over or through the sampling device and collected in a sample container for analysis. The filter blank will be collected prior to field mobilization to insure the filters are appropriate for use in the field. The lot number of the filters will be recorded.

B.4.5.5 Temperature Blanks

All coolers shall contain at least one temperature blank. The temperature blank should be a 40-milliliter volatile organic analysis vial filled with water and placed in a representative position inside the cooler. Each vial shall be clearly marked “TEMPERATURE.” If the temperature blank is positioned inappropriately or is not representative of the cooler temperature measurement, the project laboratory shall document the deficiency and notify the Project Chemist.

B.4.5.6 Site Water for Modified SPLP

A subsample of site water used for the modified SPLP will be analyzed for metals prior to extractions to allow for determination of any contributions introduced from the water.

B.4.6 Equipment Decontamination

Sampling equipment must be decontaminated consistently to ensure the quality of the samples collected. All equipment that comes into contact with potentially contaminated samples will be decontaminated. Disposal equipment intended for one-time use that is factory-wrapped generally does not need to be decontaminated before it is used unless there is evidence of contamination present. All one-time use, disposable sampling equipment and accessories will be discarded once used, and a new set of equipment will be used for each subsequent sample.

Reusable sampling equipment will be decontaminated in a decontamination zone established near the equipment storage container or in the field near the sampling location. All reusable sampling equipment will be decontaminated prior to use and in between each sample to reduce the potential for cross-contamination. Stainless steel bowls will be covered with two layers of aluminum foil (dull side up) and new aluminum foil will be used for each sample location. Therefore no decontamination will be necessary for stainless steel bowls. New disposable nitrile gloves will be worn when handling clean sampling equipment to ensure that the equipment is not contaminated. Equipment decontamination procedures are as follows:

- Prewash with site water
- Wash with solution of tap water and Alconox® soap and brush
- Rinse with site water
- Rinse the brush with site water to remove any visible dirt
- Rewash with solution of tap water and Alconox® soap and brush
- Rinse with site water
- Double rinse with distilled water
- Repeat as necessary
- Cover (no contact) all decontaminated items with clean aluminum foil

B.4.7 Containment and Disposal of Investigation-derived Wastes

Waste generated during fieldwork includes PPE, disposable items (such as stainless-steel spoons), excess sediment samples, and decontamination wash water. All general refuse (such as PPE, gloves, paper towels, and plastic sheeting) that would not likely contain hazardous material will be disposed of as municipal waste. Excess tailing, sediment, surface water, and bivalves encountered during the sampling activities will be left onsite at the sampling locations that they are collected. The volume of decontamination fluids generated during the project is expected to be small. These fluids will also be left onsite at the sampling locations that they are generated. Excess tailing, sediment, surface water, and bivalves sent to the laboratory that are not analyzed and/or archived will be disposed of by the laboratory in accordance with its stand operating procedure for sample disposal.

B.5 References

URS Group, Inc. (URS). 2007. *Draft Report Engineering Evaluation/Cost Analysis (EE/CA) Salt Chuck Mine Tongass National Forest, Alaska*. Prepared for U.S. Department of Agriculture Forest Service – Alaska Region. March.

Tables

Table B-1. Proposed Sampling Scheme

Media	Sample Location	Sampling Depth (feet)	Sample Identification	Sample Coordinates (Latitude, Longitude)	Number of Samples	Sample Rationale	Associated DQO
Tailings	3-3*	0-0.5	SCSD-102	55.62594, -132.55803	1	Verify previous investigation result (copper concentration Evaluation of nature and extent	1
	3-4*	0-0.5	SCSD-104	55.62586, -132.5574	1		1
	3-8*	0-0.5	SCSD-105	55.62559, -132.55741	1		1
		2-3	SCSD-105-2-3	55.62559, -132.55741	1		4
		4-5	SCSD-105-4-5	55.62559, -132.55741	1		4
	3-5*	0-0.5	SCSD-106	55.6258, -132.55653	1	Verify previous investigation result	1
	3-7*	0-0.5	SCSD-107	55.62567, -132.55521	1		1
		2-3	SCSD-107-2-3	55.62567, -132.55521	1	Evaluation of nature and extent	4
		4-5	SCSD-107-4-5	55.62567, -132.55521	1		4
	SCIT-4*	0-0.5	SCSD-109	55.62426, -132.55701	1	Verify previous investigation result (copper concentration ≥1,000 mg/kg)	1
	3-30*	0-0.5	SCSD-111	55.62448, -132.55471	1		1
	3-32*	0-0.5	SCSD-112	55.62423, -132.55558	1		1
	SCIT-7/8*	0-0.5	SCSD-119	55.62322, -132.55171	1		1
	3-1*	0-0.5	SCSD-101	55.62635, -132.55837	1	Verify previous investigation result (100 mg/kg ≤ copper concentration <1,000 mg/kg)	1
	3-22*	0-0.5	SCSD-108	55.62475, -132.55631	1		1
	SCSD-9/10*	0-0.5	SCSD-118	55.62372, -132.55121	1		1
	SCIT-13*	0-0.5	SCSD-121	55.62329, -132.55016	1		1
Sediment	SCSD-11*	0-0.5	SCSD-103	55.62486, -132.56069	1		1
	3-25*	0-0.5	SCSD-110	55.62486, -132.55425	1		1
	SCSD-4*	0-0.5	SCSD-113	55.62331, -132.55768	1		1
	3-37*	0-0.5	SCSD-114	55.62305, -132.55661	1		1
	3-35*	0-0.5	SCSD-117	55.62334, -132.55359	1		1
	SCSD-1*	0-0.5	SCSD-130	55.6156, -132.55195	1		1
	SCSD-8*	0-0.5	SCSD-115	55.62288, -132.55592	1	Verify previous investigation result (copper concentration < 100mg/kg)	1
	3-38*	0-0.5	SCSD-120	55.62181, -132.5563	1		1
	3-40*	0-0.5	SCSD-122	55.62196, -132.55375	1		1
	3-41*	0-0.5	SCSD-124	55.62108, -132.55479	1		1
	SCSD-27*	0-0.5	SCSD-125	55.62175, -132.54771	1		1
	SCSD-20*	0-0.5	SCSD-128	55.61988, -132.54638	1		1
	SCSD-12*	0-0.5	SCSD-150	55.58913, -132.54836	1	Verify background concentrations from previous investigation	1 and 3
	SCSD-22*	0-0.5	SCSD-154	55.58565, -132.54492	1		1 and 3
Tailings	Tailing Zone D Northern Boundary	0-0.5	SCSD-116	55.62427, -132.55084	1	Evaluation of nature and extent	4
Sediment	South of Grass Strip	0-0.5	SCSD-123	55.62091, -132.55669			
			SCSD-127	55.61899, -132.55207			
			SCSD-133	55.61508, -132.54763			
			SCSD-134	55.61388, -132.55081			
			SCSD-138	55.6094, -132.54753	5		4
	SCSD-17*	0-0.5	SCSD-132	55.61257, -132.55734	1		4
	SCSD-15*	0-0.5	SCSD-139	55.6116, -132.53678	1		4
	SCSD-16*	0-0.5	SCSD-143	55.60391, -132.54394	1		4
	Southern Salt Chuck Bay	0-0.5	SCSD-140	55.60592, -132.55463			
			SCSD-141	55.60785, -132.5411			
			SCSD-142	55.60681, -132.54409	3		4
	North of Unnamed Island	0-0.5	SCSD-126	55.62064, -132.54796			
			SCSD-129	55.6189, -132.5434			
			SCSD-131	55.61729, -132.54559			
			SCSD-135	55.61537, -132.54304	4		4
	South of Unnamed Island	0-0.5	SCSD-136	55.61247, -132.54363			4
			SCSD-137	55.612, -132.54069	2		
	Lindeman Cove (SCSD-24)*	0-0.5	SCSD-144	55.6072, -132.52959	1		4
	Browns Bay (SCSD-23)*	0-0.5	SCSD-145	55.59924, -132.5361	1		4
	Southwestern Browns Bay	0-0.5	SCSD-146	55.59284, -132.54587		Evaluation of background concentrations	
			SCSD-147	55.59072, -132.55002			
			SCSD-148	55.59147, -132.54599			
			SCSD-148	55.59147, -132.54599			
			SCSD-149	55.5903, -132.54517			
			SCSD-151	55.58812, -132.54778			
			SCSD-152	55.58871, -132.54401			
			SCSD-153	55.58679, -132.54628			
			SCSD-155	55.58522, -132.54535	8		3 and 4
Bioassay (amphipods)	3-5*	0-0.5	SCSD-106	55.6258, -132.55653	1	Evaluated characterization method and characterize risk to marine aquatic and benthic resources	2
	3-8*	0-0.5	SCSD-105	55.62559, -132.55741	1		2
	Southwestern Browns Bay (co-located with sample location for chemistry and tissue)	0-0.5	SCSD-153	55.58679, -132.54628	1	Provide baseline for interpreting site bioassay data	2 and 3

Media	Sample Location	Sampling Depth (feet)	Sample Identification	Sample Coordinates (Latitude, Longitude)	Number of Samples	Sample Rationale	Associated DQO
Bioassay (polychaetes)	3-5*	0-0.5	SCSD-106	55.6258, -132.55653	1	Evaluated characterization method and characterize risk to marine aquatic and benthic resources	2
	3-8*	0-0.5	SCSD-105	55.62559, -132.55741	1		2
	Southwestern Browns Bay	0-0.5	SCSD-153	55.58679, -132.54628	1	Provide baseline for interpreting site bioassay data	2 and 3
Bioassay (bivalves)	3-5*	0-0.5	SCSD-106	55.6258, -132.55653	1	Evaluated characterization method and characterize risk to marine aquatic and benthic resources	2
	3-8*	0-0.5	SCSD-105	55.62559, -132.55741	1		2
	Southwestern Browns Bay	0-0.5	SCSD-153	55.58679, -132.54628	1	Provide baseline for interpreting site bioassay data	2 and 3
Modified SPLP	3-3*	0-0.5	SCSD-102	55.62594, -132.55803	1	Evaluation of nature and extent	4
	3-4*	0-0.5	SCSD-104	55.62586, -132.5574	1		4
	3-8*	0-0.5	SCSD-105	55.62559, -132.55741	1		4
	3-5*	0-0.5	SCSD-106	55.6258, -132.55653	1		4
	3-7*	0-0.5	SCSD-107	55.62567, -132.55521	1		4
	Tailing Zone D Northern Boundary	0-0.5	SCSD-116	55.62427, -132.55084	1		4
	SCIT-13*	0-0.5	SCSD-121	55.62329, -132.55016	1		4
	SCSD-1*	0-0.5	SCSD-130	55.6156, -132.55195	1		4
AVS/SEM	3-5*	0-0.5	SCSD-106	55.6258, -132.55653	1	Determine Bioavailability of divalent metals in site sediments	2 and 4
	3-8*	0-0.5	SCSD-105	55.62559, -132.55741	1		2 and 4
	Southwestern Browns Bay	0-0.5	SCSD-153	55.58679, -132.54628	1		2 and 4
Surface Water	WA05*	TBD	SCSW-101	55.62522, -132.56167	1	Verify previous investigation results	1
	Unnamed Creek near 3-1	TBD	SCSW-102	55.62621, -132.55812	1	Evaluation of nature and extent	4
Bivalves (Tissue)	SCTISS-11*	TBD	SCTISS-109	55.62426, -132.55701	1		1
	SCTISS-8*	TBD	SCTISS-115	55.62288, -132.55592	1	Verify previous investigation results	1
	SCTISS-9/10*	TBD	SCTISS-118	55.62372, -132.55121	1		1
	SCTISS-12*	TBD	SCTISS-150	55.58913, -132.54836	1	Verify background concentrations from previous investigation	1 and 3
	Tailing Zone D Northern Boundary (co-located with SCSD-101)	TBD	SCTISS-116	55.62427, -132.55084	1	Evaluation of nature and extent	4
	South of Grass Strip (co-located with SCSD-102, SCSD-103, and SCSD-106 respectively)	TBD	SCTISS-123	55.62091, -132.55669	6		4
			SCTISS-127	55.61899, -132.55207			
			SCTISS-130	55.6156, -132.55195			
			SCTISS-132	55.61257, -132.55734			
			SCTISS-133	55.61508, -132.54763			
			SCTISS-134	55.61388, -132.55081			
	North of Unnamed Island (Co-located with SCSD-20)*	TBD	SCTISS-128	55.61988, -132.54638	1		4
	South of Unnamed Island (Co-located with SCSD-113)	TBD	SCTISS-136	55.61247, -132.54363	1		4
	Southwestern Browns Bay (co-located with sediment sample location)	TBD	SCTISS-147	55.59072, -132.55002	6	Evaluation of background concentrations	3 and 4
			SCTISS-148	55.59147, -132.54599			
			SCTISS-149	55.5903, -132.54517			
			SCTISS-151	55.58812, -132.54778			
			SCTISS-152	55.58871, -132.54401			
			SCTISS-153	55.58679, -132.54628			

NOTE:

* = Sample identification from previous investigations

AVS/SEM = Acid Volatile Sulfide and Simultaneously Extracted Metals

Modified SPLP = Modified Synthetic precipitation leaching procedure; this will be completed as a modified approach by using site water as the extraction fluid, a 20:1 liquid to solid ratio, and continuous agitation for 18 hrs at room temperature at a rate of 30 revolutions per minute.

TBD = To Be Determined

Table B-2. Summary of Analytical Analyses and Field Measurements

				ANALYTICAL PROTOCOL																				FIELD MEASUREMENTS				
				TAILING/SEDIMENT											SURFACE WATER				LEACHATE**		TISSUE***							
Media	Sample Identification	Sample Depth (feet)	Sample Coordinates (Latitude, Longitude)	TAL Metals except Hg (6010/6020 or CLP)	Hg (7000 Series)	DRO (AK-102)	RRO (AK-103)	TCL PAHs (8270-SIM or CLP)	TCL PCBs (8082 or CLP)	Bioassay (EPA 600/R-94/025/ASTM E-1367; ASTM E-1611/PSEP [1995]; EPA-823-B-98-004)	Grain Size (D422)	Modified SPLP (SW1312)*	AVS/SEM (PSEP)	TOC (PSEP)	TAL Metals except Hg (Total) (6010/6020 or CLP)	Total Hg (7000 Series)	TAL Metals except Hg (Dissolved) (6010/6020 or CLP)	Dissolved Hg (7000 Series)	TAL Metals except Hg (Dissolved) (6010/6020 or CLP)	Dissolved Hg (7000 Series)	Percent Lipids (EPA 3550C Mod)	TAL Metals except Hg (6010/6020 or CLP)	Hg (7000 Series)	TCL PAHs (8270-SIM or CLP)	TCL PCBs (8082 or CLP)	pH	Conducivity	Temperature	Salinity	Dissolved Oxygen
Tailings	SCSD-101	0-0.5	55.62635, -132.55837	x	x			x	x					x																
Tailings	SCSD-102	0-0.5	55.62594, -132.55803	x	x			x	x			x		x					x	x										
Sediment	SCSD-103	0-0.5	55.62486, -132.56069	x	x			x	x					x																
Tailings	SCSD-104	0-0.5	55.62586, -132.5574	x	x			x	x			x		x					x	x										
Tailings	SCSD-105	0-0.5	55.62559, -132.55741	x	x			x	x	x	x	x	x	x					x	x										
Tailings	SCSD-105-2-3	2-3	55.62559, -132.55741	x	x			x	x					x																
Tailings	SCSD-105-4-5	4-5	55.62559, -132.55741	x	x			x	x					x																
Tailings	SCSD-106	0-0.5	55.6258, -132.55653	x	x	x	x	x	x	x	x	x	x	x					x	x										
Tailings	SCSD-107	0-0.5	55.62567, -132.55521	x	x			x	x			x		x					x	x										
Tailings	SCSD-107-2-3	2-3	55.62567, -132.55521	x	x			x	x					x																
Tailings	SCSD-107-4-5	4-5	55.62567, -132.55521	x	x			x	x					x																
Tailings	SCSD-108	0-0.5	55.62475, -132.55631	x	x			x	x					x																
Tailings	SCSD-109	0-0.5	55.62426, -132.55701	x	x			x	x					x																
Sediment	SCSD-110	0-0.5	55.62486, -132.55425	x	x			x	x					x																
Tailings	SCSD-111	0-0.5	55.62448, -132.55471	x	x			x	x					x																
Tailings	SCSD-112	0-0.5	55.62423, -132.55558	x	x			x	x					x																
Sediment	SCSD-113	0-0.5	55.62331, -132.55768	x	x			x	x					x																
Sediment	SCSD-114	0-0.5	55.62305, -132.55661	x	x			x	x					x																
Sediment	SCSD-115	0-0.5	55.62288, -132.55592	x	x			x	x					x																
Tailings	SCSD-116	0-0.5	55.62427, -132.55084	x	x			x	x			x		x					x	x										
Sediment	SCSD-117	0-0.5	55.62334, -132.55359	x	x			x	x					x																
Tailings	SCSD-118	0-0.5	55.62372, -132.55121	x	x			x	x					x																
Tailings	SCSD-119	0-0.5	55.62322, -132.55171	x	x			x	x					x																
Sediment	SCSD-120	0-0.5	55.62181, -132.5563	x	x			x	x					x																
Tailings	SCSD-121	0-0.5	55.62329, -132.55016	x	x			x	x			x		x					x	x										
Sediment	SCSD-122	0-0.5	55.62196, -132.55375	x	x			x	x					x																
Sediment	SCSD-123	0-0.5	55.62091, -132.55669	x	x			x	x					x																
Sediment	SCSD-124	0-0.5	55.62108, -132.55479	x	x			x	x					x																
Sediment	SCSD-125	0-0.5	55.62175, -132.54771	x	x			x	x					x																
Sediment	SCSD-126	0-0.5	55.62064, -132.54796	x	x			x	x					x																
Sediment	SCSD-127	0-0.5	55.61899, -132.55207	x	x			x	x					x																
Sediment	SCSD-128	0-0.5	55.61988, -132.54638	x	x			x	x					x																
Sediment	SCSD-129	0-0.5	55.6189, -132.5434	x	x			x	x					x																
Sediment	SCSD-130	0-0.5	55.6156, -132.55195	x	x			x	x			x		x					x	x										
Sediment	SCSD-131	0-0.5	55.61729, -132.54559	x	x			x	x					x																
Sediment	SCSD-132	0-0.5	55.61257, -132.55734	x	x			x	x					x																
Sediment	SCSD-133	0-0.5	55.61508, -132.54763	x	x			x	x					x																
Sediment	SCSD-134	0-0.5	55.61388, -132.55081	x	x			x	x					x																
Sediment	SCSD-135	0-0.5	55.61537, -132.54304	x	x			x	x					x																

				ANALYTICAL PROTOCOL																													
				TAILING/SEDIMENT												SURFACE WATER				LEACHATE**		TISSUE***					FIELD MEASUREMENTS					
Media	Sample Identification	Sample Depth (feet)	Sample Coordinates (Latitude, Longitude)	TAL Metals except Hg (6010/6020 or CLP)	Hg (7000 Series)	DRO (AK-102)	RRO (AK-103)	TCL PAHs (8270-SIM or CLP)	TCL PCBs (8082 or CLP)	Bioassay (EPA 600/R-94/025/ASTM E-1367; ASTM E-1611/PSEP [1995]; EPA-823-B-98-004)	Grain Size (D422)	Modified SPLP (SW1312)*	AVS/SEM (PSEP)	TOC (PSEP)	TAL Metals except Hg (Total) (6010/6020 or CLP)	Total Hg (7000 Series)	TAL Metals except Hg (Dissolved) (6010/6020 or CLP)	Dissolved Hg (7000 Series)	TAL Metals except Hg (Dissolved) (6010/6020 or CLP)	Dissolved Hg (7000 Series)	Percent Lipids (EPA 3550C Mod)	TAL Metals except Hg (6010/6020 or CLP)	Hg (7000 Series)	TCL PAHs (8270-SIM or CLP)	TCL PCBs (8082 or CLP)	pH	Conducivity	Temperature	Salinity	Dissolved Oxygen
Sediment	SCSD-136	0-0.5	55.61247, -132.54363	x	x			x	x					x																	
Sediment	SCSD-137	0-0.5	55.612, -132.54069	x	x			x	x					x																	
Sediment	SCSD-138	0-0.5	55.6094, -132.54753	x	x			x	x					x																	
Sediment	SCSD-139	0-0.5	55.6116, -132.53678	x	x			x	x					x																	
Sediment	SCSD-140	0-0.5	55.60592, -132.55463	x	x			x	x					x																	
Sediment	SCSD-141	0-0.5	55.60785, -132.5411	x	x			x	x					x																	
Sediment	SCSD-142	0-0.5	55.60681, -132.54409	x	x			x	x					x																	
Sediment	SCSD-143	0-0.5	55.60391, -132.54394	x	x			x	x					x																	
Sediment	SCSD-144	0-0.5	55.6072, -132.52959	x	x			x	x					x																	
Sediment	SCSD-145	0-0.5	55.59924, -132.5361	x	x			x	x					x																	
Sediment	SCSD-146	0-0.5	55.59284, -132.54587	x	x			x	x					x																	
Sediment	SCSD-147	0-0.5	55.59072, -132.55002	x	x			x	x					x																	
Sediment	SCSD-148	0-0.5	55.59147, -132.54599	x	x			x	x					x																	
Sediment	SCSD-149	0-0.5	55.5903, -132.54517	x	x			x	x					x																	
Sediment	SCSD-150	0-0.5	55.58913, -132.54836	x	x			x	x					x																	
Sediment	SCSD-151	0-0.5	55.58812, -132.54778	x	x			x	x					x																	
Sediment	SCSD-152	0-0.5	55.58871, -132.54401	x	x			x	x					x																	
Sediment	SCSD-153	0-0.5	55.58679, -132.54628	x	x			x	x	x	x		x	x																	
Sediment	SCSD-154	0-0.5	55.58565, -132.54492	x	x			x	x					x																	
Sediment	SCSD-155	0-0.5	55.58522, -132.54535	x	x			x	x					x																	
Surface Water	SCSW-101	TBD	55.62522, -132.56167												x	x	x	x								x	x	x	x	x
Surface Water	SCSW-102	TBD	55.62621, -132.55812												x	x	x	x								x	x	x	x	x
Bivalves (Tissue)	SCTISS-109	TBD	55.62426, -132.55701																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-115	TBD	55.62288, -132.55592																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-116	TBD	55.62427, -132.55084																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-118	TBD	55.62372, -132.55121																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-123	TBD	55.62091, -132.55669																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-127	TBD	55.61899, -132.55207																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-128	TBD	55.61988, -132.54638																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-130	TBD	55.6156, -132.55195																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-132	TBD	55.61257, -132.55734																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-133	TBD	55.61508, -132.54763																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-134	TBD	55.61388, -132.55081																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-136	TBD	55.61247, -132.54363																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-147	TBD	55.59072, -132.55002																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-148	TBD	55.59147, -132.54599																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-149	TBD	55.5903, -132.54517																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-150	TBD	55.58913, -132.54836																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-151	TBD	55.58812, -132.54778																		x	x	x	x	x					
Bivalves (Tissue)	SCTISS-152	TBD	55.58871, -132.54401																		x	x	x	x	x					

				ANALYTICAL PROTOCOL																						FIELD MEASUREMENTS				
				TAILING/SEDIMENT											SURFACE WATER				LEACHATE**		TISSUE***									
Media	Sample Identification	Sample Depth (feet)	Sample Coordinates (Latitude, Longitude)	TAL Metals except Hg (6010/6020 or CLP)	Hg (7000 Series)	DRO (AK-102)	RRO (AK-103)	TCL PAHs (8270-SIM or CLP)	TCL PCBs (8082 or CLP)	Bioassay (EPA 600/R-94/025/ASTM E-1367; ASTM E-1611/PSEP [1995]; EPA-823-B-98-004)	Grain Size (D422)	Modified SPLP (SW1312)*	AVS/SEM (PSEP)	TOC (PSEP)	TAL Metals except Hg (Total) (6010/6020 or CLP)	Total Hg (7000 Series)	TAL Metals except Hg (Dissolved) (6010/6020 or CLP)	Dissolved Hg (7000 Series)	TAL Metals except Hg (Dissolved) (6010/6020 or CLP)	Dissolved Hg (7000 Series)	Percent Lipids (EPA 3550C Mod)	TAL Metals except Hg (6010/6020 or CLP)	Hg (7000 Series)	TCL PAHs (8270-SIM or CLP)	TCL PCBs (8082 or CLP)	pH	Conducivity	Temperature	Salinity	Dissolved Oxygen
Bivalves (Tissue)	SCTISS-153	TBD	55.58679, -132.54628																		x	x	x	x	x					

NOTE:

*Modified SPLP = Modified Synthetic precipitation leaching procedure using site water

**A subsample of site water for SPLP will be analyzed for both total and dissolved metals

***2 samples per location, one for each of 2 species; species will be prioritize in the following order: butter clams, littleneck, softshell clams, and blue mussels

ASTM = American Society for testing and materials

AVS/SEM = Acid Volatile Sulfide and Simultaneously Extracted Metals

DRO = Diesel range organics

EPA = U.S. Environmental Protection Agency

Hg = Mercury

PAHS = Polynuclear aromatic hydrocarbons

PCBs = Polychlorinated biphenyls

RRO = Residual range organics

TAL = Target analyte list

TCL = Target compound list

TBD = To Be Determined

TOC = Total organic carbon

MS/MSD Sample

Table B-3. Sample Volume, Containers, Preservatives, and Holding Times

Media	Analyses*	Method	Minimum Sample Volume	Container	Preservative	Maximum Holding Time
Tailing/Sediment	Total TAL Metals (except Hg)	6010/6020 or CLP	8 oz	8 oz wide mouth Glass Teflon lined cap	Cool, 4°C	180 days
	Total Hg	7000 Series			Cool, 4°C	28 days
	DRO	AK102	4 oz	4 oz wide mouth Glass Teflon lined cap	Cool, 4°C	14 days until extraction; 40 days after extraction
	RRO	AK103				
	TCL PAHs	8270-SIM or CLP	8 oz	8 oz wide mouth Glass Teflon lined cap	Cool, 4°C	
	TCL PCBs	8082 or CLP				
	10-day static solid-phase sediment toxicity test using amphipods	EPA 600/R-94/025 and/or American Society for Testing and Materials (ASTM) E-1367	3 gallons	1 gallon wide mouth Polyethylene	Cool, 4°C	8 weeks
	20-day static solid-phase tests using polychaetes	ASTM E-1611 and/or Puget Sound Estuary Program (PSEP) protocols (PSEP, 1995)			Cool, 4°C	8 weeks
	Embryo-larvel development test of sediment elutriate, 5 concentrations plus a control	EPA-823-B-98-004			Cool, 4°C	8 weeks
	Grain Size	ASTM D422	2/3 of a gallon	1 gallon ziploc, fill 2/3 full	NA	No limit
	Modified SPLP	SW1312	8 oz	8 oz wide mouth Glass Teflon lined cap	Cool, 4°C	28 days or 180 days for Hg and metals, respectively after extraction
	AVS/SEM	PSEP	4 oz	4 oz wide mouth Glass Teflon lined cap	Cool, 4°C, no head space	14 days
	TOC	PSEP	2 oz	2 oz wide mouth Glass Teflon lined cap	Cool, 4°C	28 days
Site Water for the Modified SPLP	Total TAL Metals (except Hg)	6010/6020 or CLP	8 oz	8 oz Polyethylene	Cool, 4°C, HNO_3 to pH < 2	180 days
	Total Hg	7000 Series			Cool, 4°C, HNO_3 to pH < 2	28 days
	Dissolved TAL Metals (except Hg)	6010/6020 or CLP	8 oz	8 oz Polyethylene	Cool, 4°C, HNO_3 to pH < 2	180 days
	Dissolved Hg	SW7470A			Cool, 4°C, HNO_3 to pH < 2	28 days
	For use in the SPLP extract	--	2 L	1L Polyethylene	Cool, 4°C	NE
Surface Water	Total TAL Metals (except Hg)	6010/6020 or CLP	8 oz	8 oz Polyethylene	Cool, 4°C, HNO_3 to pH < 2	180 days
	Total Hg	7000 Series			Cool, 4°C, HNO_3 to pH < 2	28 days
	Dissolved TAL Metals (except Hg)	6010/6020 or CLP	8 oz	8 oz Polyethylene	Cool, 4°C, HNO_3 to pH < 2	180 days
	Dissolved Hg	SW7470A			Cool, 4°C, HNO_3 to pH < 2	28 days
Filter Blank	Total TAL Metals (except Hg)	6010/6020 or CLP	8 oz	8 oz Polyethylene	Cool, 4°C, HNO_3 to pH < 2	180 days
	Total Hg	7000 Series			Cool, 4°C, HNO_3 to pH < 2	28 days
	Dissolved TAL Metals (except Hg)	6010/6020 or CLP	8 oz	8 oz Polyethylene	Cool, 4°C, HNO_3 to pH < 2	180 days
	Dissolved Hg	SW7470A			Cool, 4°C, HNO_3 to pH < 2	28 days

Media	Analyses*	Method	Minimum Sample Volume	Container	Preservative	Maximum Holding Time
Tissue	Total TAL Metals (except Hg)	6010/6020 or CLP	300 g	1-pint Plastic Container and 1-gallon Bag	Freeze	1 year if frozen
	Total Hg	7000 Series				
	TCL PAHs	8270-SIM or CLP				
	TCL PCBs	8082 or CLP				
	Percent Lipids	EPA 3550C Mod				
Equipment Blank	Total TAL Metals (except Hg)	6010/6020 or CLP	8 oz	8 oz Polyethylene	Cool, 4°C, HNO_3 to pH < 2	180 days
	Total Hg	7000 Series			Cool, 4°C, HNO_3 to pH < 2	28 days
	DRO	AK101	2 L	1000 ml NM amber Glass Teflon lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
	RRO	AK102			Cool, 4°C	
	TCL PAHs	8270-SIM or CLP	2 L	1000 ml NM amber Glass Teflon lined cap	Cool, 4°C	
	TCL PCBs	8082 or CLP	2 L	1000 ml NM amber Glass Teflon lined cap	Cool, 4ºC	
Equipment Decon Water	NA	NA	4 L	1L Polyethylene	NA	NA

Note:

*See Table 2-1 for detailed list of analytes

°C = degree Celsius

ASTM = American Society for testing and materials

AVS/SEM = Acid Volatile Sulfide and Simultaneously Extracted Metals

DRO = Diesel range organics

EPA = U.S. Environmental Protection Agency

Hg = Mercury

NE = Not established

TBD = To be determined

Attachment B-1

CH2MHILL

PROJECT NUMBER _____ **CORE NUMBER** _____

SHEET OF

TAILING CORING LOG

PROJECT : SALT CHUCK PRE-REMEDIAL INTERTIDAL INVESTIGATION LOCATION :

CORIING FIELD TEAM MEMBER:

CORING METHOD AND EQUIPMENT USED : START:

DEPTH OF WATER: END : LOGGER :

DEPTH BELOW SURFACE (INCH)	INTERVAL (INCH)	RECOVERY (INCH/INCH)	#/TYPE	USCS	SIZE DISTRIBUTION %G	%S	%F	SEDIMENT DESCRIPTION SOIL NAME (USCS SYMBOL): COLOR; GRAIN SIZE (COARSE-GRAINED SOIL ONLY); GRADING (COARSE-GRAINED SOIL ONLY); ANGULARITY (COARSE-GRAINED SOIL ONLY); DENSITY (COARSE-GRAINED)/CONSISTENCY (FINE-GRAINED); MOISTURE; PLASTICITY (FINE-GRAINED SOIL ONLY); DILATANCY; ORGANICS (WOOD, ETC.)	PID (ppm): BREATHING ZONE	HEAD SPACE	COMMENTS (e.g.: ODOR, DEBRIS, SHEEN, BIOLOGICAL ACTIVITY, ETC.)
12											
24											
36											
48											
60											

Field Record for Salt Chuck Mine Pre-RI Investigation

Project Number: _____ Sampling Date and Time:_____

SITE LOCATION

Site Name/Number:_____

County/Parish:_____ Lat/Long:_____

Water Body Name:_____

Site
Description:_____

Collection
Method:_____

Collector
Name:_____
(print and sign)

SHELLFISH COLLECTED

Bivalve Species
Name:_____

Composite Sample ID#:_____ Number of Individuals:_____

Bivalve #	Size (mm)	Bivalve #	Size (mm)	Bivalve #	Size (mm)
001		013		025	
002		014		026	
003		015		027	
004		016		028	
005		017		029	
006		018		030	
007		019		031	
008		020		032	
009		021		033	
010		022		034	
011		023		035	
012		024		036	

Minimum Size/Maximum Size x 100=_____ Composite mean size _____mm

Notes: (e.g. morphological anomalies)

:_____

_____

CH2MHILL

Tailing/Sediment Sample Collection Data Sheet
SALT CHUCK PRE-REMEDIAL INTERTIDAL INVESTIGATION

Date (mm/dd/yy)	Time (hh:mm)	Location	Sample ID	Name of Sampling Team Member(s)

Field Team Leader (FTL):

Coordinates		Weather			
Latitude (°N)	Longitude (°W)	Air temp:	Tidal condition:	Rain:	Other:

Sampling Equipment Used:
Other Equipment Used:

Water Depth (ft):
Number of Sampling Attempts:
Refusal:
Estimated Tailing Thickness (feet):
Sampling Depth Interval (inches):

Sediment Characteristics:	Description
Color	
Consistency	
Type	

Presence of:	Y / N	Description and Quantity
Organisms		
Debris		
Sheen		
Odor		
Vegetation		
Other		

Deviations from Study Plan:

Sketch (as needed):

Comments:

FTL Signature: **Date & Time:**

PROJECT NUMBER	DATE
	SHEET 1 OF

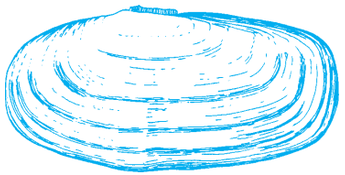
PHOTOGRAPH LOG

PROJECT: Salt Chuck Pre-Remedial Intertidal Investigation **LOCATION:**

PHOTO NO.	SCENE DESCRIPTION

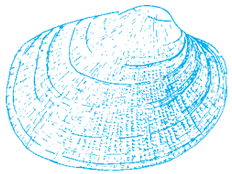
Attachment B-2

Common Clams, Cockles, Scallops, Oysters of Alaska



Pacific Razor Clam

Siliqua patula
Distribution: Bristol Bay to southern California
Habitat: Intertidal zone, open coasts in sand
Size: Up to 8"
Identification: Long narrow shell, thin and brittle, olive green to brown color

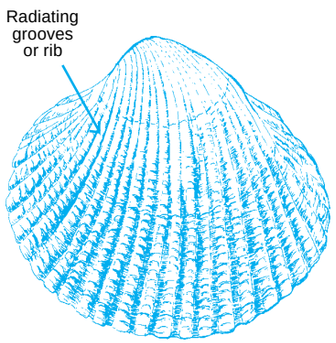


Pacific Littleneck Clam

Protothaca staminea
Distribution: Aleutian Islands to mid-California
Habitat: Midtidal to subtidal zone, mud to coarse gravel beaches
Size: Up to 2½"
Identification: External surface of shell with radiating and concentric grooves

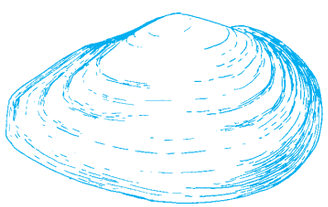
Blue Mussel

Mytilus edulis
Distribution: Northern Hemisphere
Habitat: Rocky intertidal areas of exposed and protected coastline
Size: Up to 4"
Identification: Blue-black to brownish shell, shell pointed at one end and round at the other, has a thread-like structure to attach to substrate



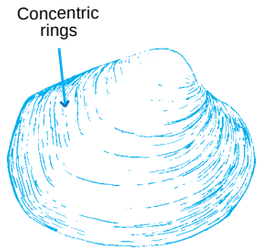
Cockle

Clinocardium nuttalli
Distribution: Bering Sea to southern California
Habitat: Intertidal zone to 90 feet, mud to sand beaches
Size: Up to 6"
Identification: Thick cupped shells, up to 35 strong ribs spreading from the hinge to shell margin



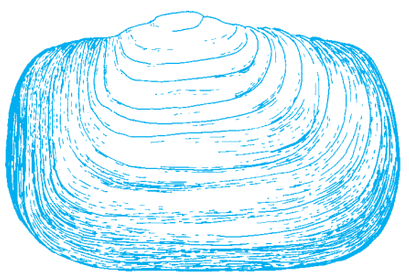
Softshell Clam

Mya arenaria
Distribution: Worldwide north of mid-California
Habitat: Upper tidal level mud flats
Size: Up to 6"
Identification: Shell soft, easily broken, one end of shell rounded, other end pointed, concentric rings only



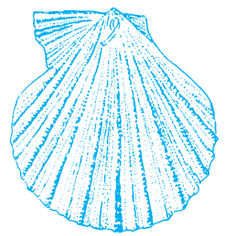
Butter Clam

Saxidomus giganteus
Distribution: Aleutian Islands to mid-California
Habitat: Intertidal zone to 120 feet depth, on protected gravel, sandy beaches
Size: Up to 5"
Identification: Dense shell, external surface with concentric rings, prominent growth rings



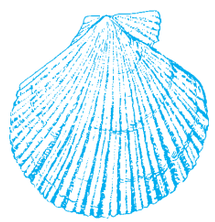
Geoduck

Panopea abrupta
Distribution: Sitka, Alaska to Gulf of California
Habitat: Intertidal to deep water, buried deeply in sand and mud bottom
Size: Shell up to 8"
Identification: Shells heavy, one end of shell rounded the other end flat, rough concentric grooves on shell surface



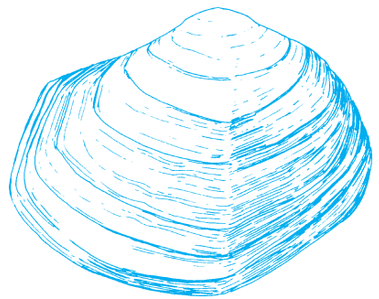
Spiny Scallop

Chlamys hastata
Distribution: Gulf of Alaska to California
Habitat: Low intertidal area to 400 feet depth
Size: Up to 3½"
Identification: Shell thin and flattened, auricles uneven size, 20-30 ribs on each shell, ribs spiny textured



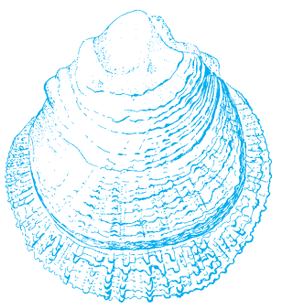
Pink Scallop

Chlamys rubida
Distribution: Bering Sea to mid-California
Habitat: Low tidal area to 900 feet depth, rocky shoreline
Size: Up to 2½"
Identification: Shell thin and flattened, 20-30 ribs on each shell, auricles uneven size, red-pink on one shell, opposite shell color pale



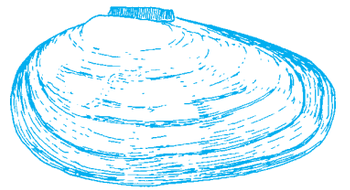
Horse (Gaper) Clam

Tresus capax
Distribution: Shumagin Islands, Alaska to California
Habitat: Intertidal zone, imbedded deeply
Size: Up to 8"
Identification: Shell large and thick, wide gape between shells at posterior end when held together, dark covering on shell surface often partially worn off



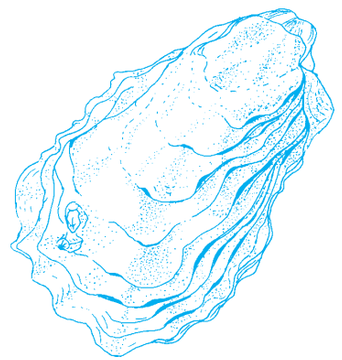
Purple Hinge Rock Scallop

Crassadoma gigantea
Distribution: Aleutian Islands to southern California
Habitat: Low tidal area to 200 feet depth, attached to rocks and in crevices
Size: Up to 10"
Identification: Very heavy rough shell, purple color hinge area when shell open



Alaska Razor Clam

Siliqua alta
Distribution: Bering Sea to Cook Inlet
Habitat: Intertidal zone to 30 feet on open sandy beaches
Size: Up to 6"
Identification: Long narrow shaped shell, shell thin and brittle, brown to olive green color



Pacific Oyster

Crassostrea gigas
Distribution: Kachemak Bay to California
Habitat: Intertidal in mud to rocky beaches. In Alaska only on aquatic farms, but may be a few small populations in southern southeastern Alaska. Does not reproduce in Alaska waters
Size: Up to 8"
Identification: Shell irregular shape, rough surface, upper shell cupped while lower shell flat

Shellfish drawings from *Intertidal Bivalves: A Guide to Common Marine Bivalves of Alaska*, Nora R. Foster. 1991. University of Alaska Press.

This information was taken from the Alaska Sea Grant Marine Advisory publication, *Alaska's Marine Resources: Paralytic Shellfish Poisoning, the Alaska Problem*. The entire 20-page booklet is available in PDF format from the Alaska Sea Grant web site at http://www.uaf.alaska.edu/seagrant/issues/PSP/ psp_page.html

Appendix C
Health and Safety Plan

Health and Safety Plan

Salt Chuck Mine Site Investigation

Prepared for

EPA, AES 10

August 2011

Contents

ATTACHMENTS

Approval

This site-specific Health and Safety Plan (HSP) has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions and identified scope(s) of work and must be amended if those conditions or scope(s) of work change.

By approving this HSP, the Responsible Health and Safety Manager (RHSM) certifies that the personal protective equipment has been selected based on the project-specific hazard assessment.

Original Plan

RHSM Approval: **John Culley/SPK, CIH** **Date**: August 23, 2011

Field Operations Manager Approval: **Date: 8/24/2011**

Revisions

Revisions Made By: **Date:**

Description of Revisions to Plan:

Revisions Approved By: **Date:**

Emergency Contacts

24-hour CH2M HILL Injury Reporting– 1-866-893-2514
24-hour CH2M HILL Serious Incident Reporting Contact – 720-286-4911

Medical Emergency – 911 **Facility Medical Response #:** **Local Ambulance #:** 907-828-3399	**CH2M HILL- Medical Consultant** WorkCare Dr. Peter Greaney M.D. 300 S. Harbor Blvd, Suite 600 Anaheim , CA 92805 800-455-6155 714-978-7488
Local Medical Clinic	**CH2M HILL Director – Health, Safety, Security & Environment** Andy Strickland/DEN (720) 480-0685 (cell) or (720) 286-2393 (office)
Fire/Spill Emergency – 911 **Facility Fire Response #:** **Local Fire Dept #:** 907-828-3399	**Responsible Health and Safety Manager (RHSM)** Name: John Culley/SPK Phone: 206/660-3367
Security & Police – 911 **Facility Security #:** **Local Police #:** 907-828-3399	**Human Resources Department** Employee Connect 720/286-4411
Utilities Emergency Phone Numbers Water: Gas: Electric:	**Worker's Compensation:** Contact Business Group HR dept. to have form completed or contact Jennifer Rindahl after hours: (720)891-5382
Safety Coordinator (SC-HW) Name: Nathan Williams or Heather Rectenwald Cellular Number: 509-999-2292, 503-367-3160	**Media Inquiries Corporate Strategic Communications** Name: John Corsi Phone: (720) 286-2087
Project Manager Name: Jeremy Blei/ANC Cellular Number: 907/854-6362	**Automobile Accidents**: Rental: Jennifer Rindahl/DEN (720) 286-2449 CH2M HILL owned vehicle: Teleplus Claim Reporting service – **1-800-753-6737**
Federal Express Dangerous Goods Shipping Phone: 800/238-5355	**CHEMTEL (hazardous material spills)** **Phone: 800/255-3924**

Hospital Name/Address: Thorne Bay Medical Clinic **Hospital Phone #:** 907-828-3399

Or

Alicia Roberts Medical Center, Klawok, AK

Directions to Hospital

Directions:

To be determined once onsite

Hospital Route Map

Incident Notification and Reporting

- Notify and submit reports to client as required in contract.
- Serious Incidents must be reported in accordance with CH2M HILL Standard of Practice, *Serious Incident Reporting Process*, immediately. Serious incidents are those that involve any of the following:
  - Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or public
  - Kidnap/missing person
  - Acts or threats of terrorism
  - Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage.
  - Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

In the event of an emergency, immediately call….. **911.**

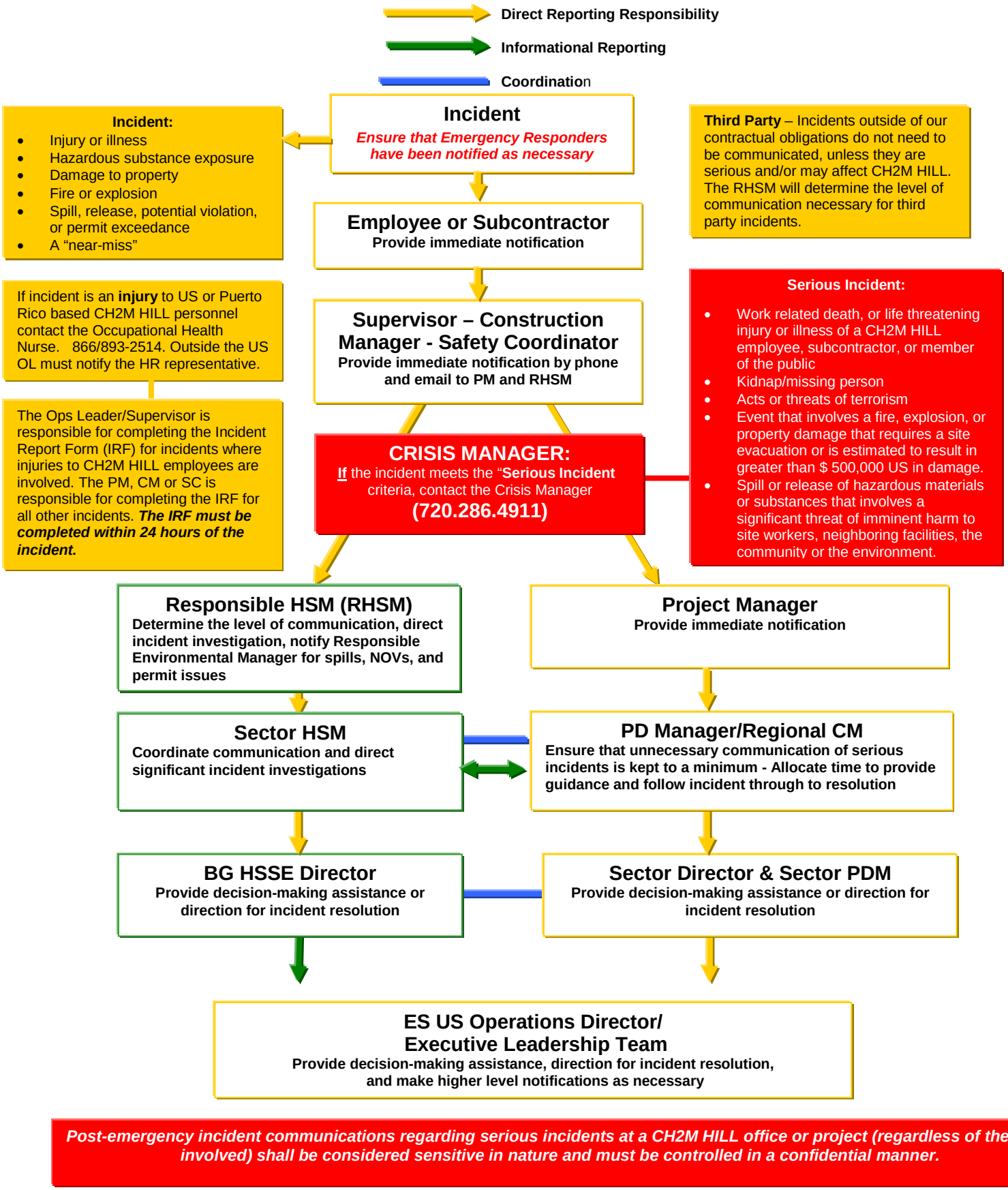
  - Severe Bleeding
  - Loss of consciousness
  - Chest Pain
  - Broken bones
- All other injuries or illness' (even those that are minor and may only require First Aid) which occur at work, while on business travel or commute must be reported to your supervisor immediately.
- **After informing their supervisor, the injured employee calls CH2M HILL's contracted Occupational Nurse**.

24-hour CH2M HILL Emergency Nurse Assistance
1-866-893-2514

- The Occupational Injury Nurse listens to the injured employee to understand the injury/illness.
- Employee is provided guidance on appropriate treatment options (triage).
- Appropriate treatment details are handled by the Occupational Injury Nurse, and HR Groups.
- Nurse communicates and troubleshoots with and for employee through full recovery.
- Complete a HITS report and notify the HSM.

ESBG Incident Reporting Flow Diagram

Individual Programs may have additional or alternate reporting procedures



Post-emergency incident communications regarding serious incidents at a CH2M HILL office or project (regardless of the party involved) shall be considered sensitive in nature and must be controlled in a confidential manner.

1.0 Introduction

CH2MHILL

HSSE Target Zero World-Class Performance

Health, Safety, Security, and Environment Policy

Protection of people and the environment is a CH2M HILL core value. It is our vision to create a culture within CH2M HILL that empowers employees to drive this value into all global operations and achieve excellence in health, safety, security, and environment (HSSE) performance. CH2M HILL deploys an integrated, enterprise-wide behavior-based HSSE management system to fulfill our mission and the expectations of our clients, staff, and communities based on the following principles:

- We require all management and supervisory personnel to provide the leadership and resources to inspire and empower our employees to take responsibility for their actions and for the actions of their fellow employees to create a safe, healthy, secure, and environmentally-responsible workplace.
- We provide value to clients by tailoring HSSE processes to customer needs and requiring all CH2M HILL employees and subcontractors to deliver projects with agility, personal service, and responsiveness and in compliance with HSSE requirements and company standards to achieve health, safety, security, and pollution prevention excellence. Our performance will aspire to influence others and continually redefine world-class HSSE excellence.
- We systematically evaluate our design engineering and physical work environment to verify safe and secure work conditions and practices are established, consistently followed, and timely corrected.
- We continually assess and improve our HSSE program to achieve and maintain world-class performance by setting and reviewing objectives and targets, reporting performance metrics, and routinely reviewing our progress.
- We care about the safety and security of every CH2M HILL employee and expect all employees to embrace our culture, share our core value for the protection of people and the environment, understand their obligations, actively participate, take responsibility, and "walk the talk" on and off the job.

The undersigned pledge our leadership, commitment, and accountability for making this policy a reality at CH2M HILL.

Dated the 1st day of October 2009.

Lee A. McIntire
Chief Executive Officer

Garry Higdem
President, Energy Division

Jacqueline Rast
President, Major Programs Group

Robert C. Allen
Chief Human Resources Officer

Mark Lasswell
President, Transportation Business Group

Catherine Santee
Chief Financial Officer

Bob Card
President, Facilities & Infrastructure Division

Margaret McLean
Chief Legal Officer

Thomas G. Searle
President, International Division

Bill Dehn
Senior Vice President, Special Projects

Michael E. McKelvy
President, Government, Environment, and Nuclear Division

Nancy R. Tuor
Vice-Chair, International

Keith Christopher
Senior Vice President, Health, Safety, Security, and Environment

1.1 CH2M HILL Policy and Commitment

1.1.1 Safe Work Policy

It is the policy of CH2M HILL to perform work in the safest manner possible. Safety must never be compromised. To fulfill the requirements of this policy, an organized and effective safety program must be carried out at each location where work is performed.

CH2M HILL believes that all injuries are preventable, and we are dedicated to the goal of a safe work environment. To achieve this goal, every employee on the project must assume responsibility for safety.

Every employee is empowered to:

- Conduct their work in a safe manner;
- Stop work immediately to correct any unsafe condition that is encountered; and
- Take corrective actions so that work may proceed in a safe manner.

Safety, occupational health, and environmental protection will not be sacrificed for production. These elements are integrated into quality control, cost reduction, and job performance, and are crucial to our success.

1.1.2 Health and Safety Commitment

CH2M HILL has embraced a philosophy for health and safety excellence. The primary driving force behind this commitment to health and safety is simple: employees are CH2M HILL's most significant asset and CH2M HILL management values their safety, health, and welfare. Also, top management believes that all injuries are preventable. CH2M HILL's safety culture empowers employees at all levels to accept ownership for safety and take whatever actions are necessary to eliminate injury. Our company is committed to world-class performance in health and safety and also understands that world-class performance in health and safety is a critical element in overall business success.

CH2M HILL is committed to the prevention of personal injuries, occupational illnesses, and damage to equipment and property in all of its operations; to the protection of the general public whenever it comes in contact with the Company's work; and to the prevention of pollution and environmental degradation.

Company management, field supervisors, and employees plan safety into each work task in order to prevent occupational injuries and illnesses. The ultimate success of CH2M HILL's safety program depends on the full cooperation and participation of each employee.

CH2M HILL management extends its full commitment to health and safety excellence.

1.1.3 Project-Specific Health, Safety, and the Environment Goals

All management and employees are to strive to meet the project-specific Health, Safety, and the Environment (HSE) goals outlined below. The team will be successful only if everyone makes a concerted effort to accomplish these goals. The goals allow the project to stay focused on optimizing the health and safety of all project personnel and, therefore, making the project a great success.

The Project has established eleven specific goals and objectives:

- Create an injury-free environment;
- Have zero injuries or incidents;
- Provide management leadership for HSE by communicating performance expectations, reviewing and tracking performance, and leading by example;
- Ensure effective implementation of the HSP through education, delegation, and team work;

- Ensure 100 percent participation in HSE compliance;
- Continuously improve our safety performance;
- Maintain free and open lines of communication;
- Make a personal commitment to safety as a value;
- Focus safety improvements on high-risk groups;
- Continue strong employee involvement initiatives; and
- Achieve health and safety excellence.

2.0 Applicability

This HSP applies to:

- All CH2M HILL staff, including subcontractors and tiered subcontractors of CH2M HILL working on the site; and
- All visitors to the construction site in the custody of CH2M HILL (including visitors from the Client, the Government, the public, and other staff of any CH2M HILL company).

This HSP does not apply to the third-party contractors, their workers, their subcontractors, their visitors, or any other persons not under the direct control or custody of CH2M HILL.

This HSP defines the procedures and requirements for the health and safety of CH2M HILL staff and visitors when they are physically on the work site. The work site includes the project area (as defined by the contract documents) and the project offices, trailers, and facilities thereon.

This HSP will be kept onsite during field activities and will be reviewed as necessary. The HSP will be amended or revised as project activities or conditions change or when supplemental information becomes available. The HSP adopts, by reference, the Enterprise-wide Core Standards and Standard Operating Procedures (SOPs), as appropriate. In addition, the HSP may adopt procedures from the project Work Plan and any governing regulations. If there is a contradiction between this HSP and any governing regulation, the more stringent and protective requirement shall apply.

All CH2M HILL staff and subcontractors must sign the employee sign-off form included in this document as Attachment 1 to acknowledge review of this document. Copies of the signature page will be maintained onsite by the Safety Coordinator (SC).

3.0 General Project Information

3.1 Project Information and Background

Project Number: 421566

Client: EPA, AES 10

Project/Site Name: Salt Chuck Mine Site Investigation

Site Address: Prince of Wales Island, Kasaan Bay, Alaska

CH2M HILL Project Manager: Jeremy Blei/ANC

DATE HSP Prepared: August 2011

Date(s) of Site Work: August 27, 2011 through December 31, 2012

3.2 Site Background and Setting

Inactive gold, silver, and copper mine; mine waste rock and tailings present

3.3 Description of Tasks

All CH2M HILL and Subcontractor employees engaging in hazardous waste operations (HAZWOPER) or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65 (or if required by Subcontract). Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities. See the following tasks that fall under HAZWOPER requirements.

3.3.1 HAZWOPER-Regulated Tasks

- Sediment Sampling
- Surface water sampling
- Clam tissue sampling

3.3.2 Non-HAZWOPER-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. The following tasks do not involve exposure to safety or health hazards associated with the hazardous waste operations. Hazwoper training or medical requirements do not apply for the tasks listed below.

TASKS	CONTROLS
• Site surveying	• Brief on hazards, limits of access, and emergency procedures. • Post areas of contamination as appropriate. • Wear task appropriate PPE as specified in Section 14.0 of this HSP.

Site Map

4.0 Project Organization and Responsibilities

4.1 Client

Contact Name: Jacques Gusmano
Phone: 907/271-1271

4.2 CH2M HILL

4.2.1 Project Manager

PM Name: Jeremy Blei
CH2M HILL Office: ANC
Cellular Number: 907/854-6362

The project manager (PM) is responsible for providing adequate resources (budget and staff) for project-specific implementation of the HSE management process. The PM has overall management responsibility for the tasks listed below. The PM may explicitly delegate specific tasks to other staff, as described in sections that follow, but retains ultimate responsibility for completion of the following in accordance with this document:

- Incorporate standard terms and conditions, and contract-specific HSE roles and responsibilities in contract and subcontract agreements (including flow-down requirements to lower-tier subcontractors).
- Select safe and competent subcontractors by:
  - Choosing potential subcontractors based on technical ability and HSE performance;
  - Implementing the subcontractor prequalification process;
  - Ensuring that acceptable certificates of insurance, including CH2M HILL as named additional insured, are secured as a condition of subcontract award; and
  - Ensuring HSE submittals, subcontract agreements, and appropriate site-specific safety procedures are in place and accepted prior field mobilization.
- Ensure copies of training and medical monitoring records, and site-specific safety procedures are being maintained in the project file accessible to site personnel.
- Provide oversight of subcontractor HSE practices per the site-specific safety plans and procedures.
- Manage the site and interfacing with 3rd parties in a manner consistent with the contract and subcontract agreements and the applicable standard of reasonable care.
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented.
- Support and implement use of stop-work orders when subcontractor safety performance is not adequate.

4.2.2 CH2M HILL Responsible Health and Safety Manager

RHSM Name: John Culley
CH2M HILL Office: SPK
Cellular Number: 206/660-3367

The RHSM is responsible for the following:

- Review and evaluate subcontractor HSE performance using the pre-qualification process;
- Approve HSP and its revisions as well as Activity Hazard Analyses (AHA);

- Review and evaluate subcontractor site-specific safety procedures for adequacy prior to start of subcontractor's field operations;
- Support the oversight (or SC's direct oversight) of subcontractor and tiered subcontractor HSE practices;
- Permit upgrades and downgrades in respiratory protection after reviewing analytical data;
- Conduct audits as determined by project schedule and coordination with PM; and
- Participate in incident investigations, lessons learned, loss and near loss reporting.

4.2.3 CH2M HILL Project Environmental Manager

EM Name: Liz Luecker
CH2M HILL Office: SEA
Cellular Number: 425/647-6073

The Project EM is responsible for the following:

- Provide environmental program support in areas such as training, auditing, planning, permit tracking, and subcontractor oversight as needed or as specified in the project environmental plan;
- Review and evaluate qualifications for subcontractors with a history of environmental non-compliance and for waste transportation and disposal subcontractors;
- Evaluate any spills, releases, or environmental permit incidents for appropriate follow-up actions, notifications, and recordkeeping requirements; and
- Provide environmental compliance and environmental management expertise and advice to the project team as needed during the course of the project.

4.2.4 CH2M HILL Safety Coordinator

SC Name: Nathan Williams or Heather Rectenwald
CH2M HILL Office: PDX
Cellular Number: 509/999-2292 or 503/367-3160

The SC is responsible for verifying that the project is conducted in a safe manner including the following specific obligations:

- Verify this HSP is current and amended when project activities or conditions change;
- Verify CH2M HILL site personnel and subcontractor personnel read the HSP and sign the Employee Sign-Off Form, prior to commencing field activities;
- Verify CH2M HILL site personnel have completed any required specialty training (for example, fall protection, confined space entry, among others) and medical surveillance as identified in this HSP;
- Verify that project files available to site personnel include copies of executed subcontracts and subcontractor certificates of insurance (including CH2M HILL as named additional insured), bond, contractor's license, training and medical monitoring records, and accepted site-specific safety procedures prior to start of subcontractor's field operations;
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in the HSP;
- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in the HSP;
- Hold and/or verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (as tasks or hazards change);

- Verify that project health and safety forms and permits are being used as outlined this HSP;
- Perform oversight and assessments of subcontractor HSE practices per the site-specific safety plan and verify that project activity self-assessment checklists are being used as outlined this HSP;
- Coordinate with the RHSM regarding CH2M HILL and subcontractor operational performance, and 3rd party interfaces;
- Verify appropriate personal protective equipment (PPE) use, availability, and training;
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented;
- Conduct accident investigations including root cause analysis;
- Calibrate and conduct air monitoring in accordance with the HSP; maintain all air monitoring records in project file;
- Maintain HSE records and documentation;
- Facilitate OSHA or other government agency inspections including accompanying inspector and providing all necessary documentation and follow-up;
- Deliver field HSE training as needed based on project-specific hazards and activities;
- Contact the RHSM and PM in the event of an incident;
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, stop affected work until adequate corrective measures are implemented, and notify the PM and RHSM as appropriate; and
- Document all oral health and safety-related communications in project field logbook, daily reports, or other records.

4.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HSE-215, *Contracts and Subcontracts)*

Subcontractor: **None at this time**
Subcontractor Contact Name:
Telephone:
Subcontractor Tasks:
Safety Procedures Required:

Subcontractors must comply with the following activities, and are responsible to:

- Comply with all local, state, and federal safety standards;
- Comply with project and owner safety requirements;
- Actively participate in the project safety program and either hold or attend and participate in all required safety meetings;
- Provide a qualified safety representative to interface with CH2M HILL;
- Maintain safety equipment and PPE for their employees;
- Maintain and replace safety protection systems damaged or removed by the subcontractor's operations;
- Notify the SC of any accident, injury, or incident (including spills or releases) immediately and submit reports to CH2M HILL within 24 hours;
- Install contractually required general conditions for safety (for example, handrail, fencing, fall protection systems, floor opening covers);

- Conduct and document weekly safety inspections of project-specific tasks and associated work areas;
- Conduct site-specific and job-specific training for all subcontractor employees, including review of the CH2M HILL HSP, subcontractor HSPs, and subcontractor AHAs and sign appropriate sign-off forms; and
- Determine and implement necessary controls and corrective actions to correct unsafe conditions.

The subcontractors listed above may be required to submit their own site-specific HSP and other plans such as lead or asbestos abatement compliance plans. Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit their plans to CH2M HILL for review and acceptance before the start of field work.

Subcontractors are also required to prepare AHAs before beginning each activity posing hazards to their personnel. The AHA shall identify the principle steps of the activity, potential health and safety hazards for each step and recommended control measures for each identified hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements, and training requirements for the safe operation of the equipment listed must be identified.

4.4 Employee Responsibilities

All personnel are assigned responsibility for safe and healthy operations. This concept is the foundation for involving all employees in identifying hazards and providing solutions. For any operation, individuals have full authority to stop work and initiate immediate corrective action or control. In addition, each worker has a right and responsibility to report unsafe conditions or practices. This right represents a significant facet of worker empowerment and program ownership. Through shared values and a belief that all accidents are preventable, our employees accept personal responsibility for working safely.

Each employee is responsible for the following performance objectives:

- Perform work in a safe manner and produce quality results;
- Perform work in accordance with company policies, and report injuries, illnesses, and unsafe conditions;
- Complete work without injury, illness, or property damage;
- Report all incidents immediately to supervisor, and file proper forms with a human resources representative;
- Report all hazardous conditions and/or hazardous activities immediately to supervisor for corrective action; and
- Complete an HSE orientation prior to being authorized to enter the project work areas.

4.4.1 Employee Authority

Each employee on the project has the obligation and authority to shut down any perceived unsafe work and during employee orientation, each employee will be informed of their authority to do so.

4.5 Client Contractors

(Reference CH2M HILL SOP HSE-215, *Contracts, Subcontracts and HSE Management Practices*)

Contractor: **None at this time**
Contact Name:
Telephone:
Contractor Task(s):

This HSP does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (such as advising on health and safety issues). In addition to these instructions, CH2M HILL team members should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Self-assessment checklists are to be used by the SC and CH2M HILL team members to review the contractor's performance only as it pertains to evaluating CH2M HILL exposure and safety. The RHSM is the only person who is authorized to comment on or approve contractor safety procedures.

Health and safety-related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL team members on the precautions related to the contractor's work;
- When an apparent contractor non-compliance or unsafe condition or practice poses a risk to CH2M HILL team members:
  - Notify the contractor safety representative;
  - Request that the contractor determine and implement corrective actions;
  - If necessary, stop affected CH2M HILL work until contractor corrects the condition or practice; and
  - Notify the client, PM, and RHSM as appropriate.

If apparent contractor non-compliance or unsafe conditions or practices are observed, inform the contractor safety representative (CH2M HILL's obligation is limited strictly to informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative (CH2M HILL's obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

All verbal health and safety-related communications will be documented in project field logbook, daily reports, or other records.

5.0 Standards of Conduct

All individuals associated with this project must work injury-free and drug-free and must comply with the following standards of conduct, the HSP, and the safety requirements of CH2M HILL. Commonly accepted standards of conduct help maintain good relationships between people. They promote responsibility and self-development. Misunderstandings, frictions, and disciplinary action can be avoided by refraining from thoughtless or wrongful acts.

5.1 Standards of Conduct Violations

All individuals associated with this project are expected to behave in a professional manner. Violations of the standards of conduct would include, but not be limited to:

- Failure to perform work;
- Inefficient performance, incompetence, or neglect of work;
- Willful refusal to perform work as directed (insubordination);
- Negligence in observing safety regulations, poor housekeeping, or failure to report on-the-job injuries or unsafe conditions;
- Unexcused or excessive absence or tardiness;
- Unwillingness or inability to work in harmony with others;
- Discourtesy, irritation, friction, or other conduct that creates disharmony;
- Harassment or discrimination against another individual;
- Failure to be prepared for work by wearing the appropriate construction clothing or bringing the necessary tools; or
- Violation of any other commonly accepted reasonable rule of responsible personal conduct.

5.2 Disciplinary Actions

The Environmental Services (ES) business group employees, employees working on ES business group projects, and subcontractor employees are subject to disciplinary action for not following HSE rules and requirements. Potential disciplinary action is equally applicable to all employees including management and supervision. Disciplinary action may include denial of access to the worksite, warnings, reprimands, and other actions up to and including termination depending on the specific circumstances.

5.3 Subcontractor Safety Performance

CH2M HILL should continuously endeavor to observe subcontractors' safety performance and adherence to their plans and AHAs. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. CH2M HILL oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

5.3.1 Observed Hazard Form

When apparent non-compliance or unsafe conditions or practices are observed, notify the subcontractor's supervisor or safety representative verbally, and document using the Observed Hazard Form, included as an attachment to this HSP, and require corrective action.

If necessary, stop subcontractor's work using the Stop Work Order Form until corrective actions is implemented for observed serious hazards or conditions. Update the Observed Hazard Form to document corrective actions have been taken. The subcontractor is responsible for determining and implementing necessary controls and corrective actions.

5.3.2 Stop Work Order

CH2M HILL has the authority, as specified in the contract, and the responsibility to stop work in the event any CH2M HILL employee observes unsafe conditions or failure of the subcontractor to adhere to its safe-work practices, or observes a condition or practice that may result in a release or violation of an environmental requirement. This authority and action does not in any way relieve the subcontractor of its responsibilities for the means and methods of the work or, therefore, of any corrective actions. Failure to comply with safe work practices can be the basis for restriction or removal of the subcontractor staff from the job site, termination of the subcontract, restriction from future work, or all three.

When an apparent imminent danger is observed, immediately stop work and alert all affected individuals. Remove all affected CH2M HILL employees and subcontractor staff from the danger, notify the subcontractor's supervisor or safety representative, and do not allow work to resume until adequate corrective measures are implemented. Notify the PM, Contract Administrator (KA) and RHSM.

When repeated non-compliance or unsafe conditions are observed, notify the subcontractor's supervisor or safety representative and stop affected work by completing and delivering the Stop Work Order Form (attached to this HSP) until adequate corrective measures are implemented. Consult the KA to determine what the contract dictates for actions to pursue in event of subcontractor non-compliance including work stoppage, back charges, progress payments, removal of subcontractor manager, monetary penalties, or termination of subcontractor for cause.

5.4 Incentive Program

Each project is encouraged to implement a safety incentive program that rewards workers for exhibiting exemplary safety behaviors. Actions that qualify are those that go above and beyond what is expected. Actions that will be rewarded include spotting and correcting a hazard, bringing a hazard to the attention of your foreman, telling your foreman about an incident, coming up with a safer way to get the work done, or stopping a crew member from doing something unsafe. The program will operate throughout the project, covering all workers. The incentive program will be communicated to all employees during the project employee orientation and project safety meetings.

5.5 Reporting Unsafe Conditions/Practices

Responsibility for effective health and safety management extends to all levels of the project and requires good communication between employees, supervisors, and management. Accident prevention requires a pro-active policy on near misses, close calls, unsafe conditions, and unsafe practices. All personnel must report any situation, practice, or condition which might jeopardize the

safety of our projects. All unsafe conditions or unsafe practices will be corrected immediately. CH2M HILL has zero tolerance of unsafe conditions or unsafe practices.

No employee or supervisor will be disciplined for reporting unsafe conditions or practices. Individuals involved in reporting the unsafe conditions or practices will remain anonymous.

The following reporting procedures will be followed by all project employees:

- Upon detection of any unsafe condition or practice, the responsible employee will attempt to safely correct the condition;
- The unsafe condition or practice will be brought to the attention of the worker's direct supervisor, unless the unsafe condition or practice involves the employee's direct supervisor. If so, the SC needs to be notified at once by the responsible employee;
- Either the responsible employee or responsible employee's direct supervisor is responsible for immediately reporting the unsafe condition or practice to the SC;
- The SC will act promptly to correct the unsafe condition or practice; and
- Details of the incident or situation will be recorded by the SC in the field logbook or use the Observed Hazard Form if subcontractor was involved.

6.0 Safety Planning and Change Management

6.1 Daily Safety Meetings and Pre-Task Safety Plans

Daily safety meetings are to be held with all project personnel in attendance to review the hazards posed and required HSE procedures and AHAs that apply for each day's project activities. The Pre-Task Safety Plans (PTSPs) serve the same purpose as these general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews.

At the start of each day's activities, the crew supervisor completes the PTSP, provided as an attachment to this HSP, with input from the work crew, during their daily safety meeting. The day's tasks, personnel, tools and equipment that will be used to perform these tasks are listed, along with the hazards posed and required HSE procedures, as identified in the HSP and AHA. The use of PTSPs promotes worker participation in the hazard recognition and control process while reinforcing the task-specific hazard and required HSE procedures with the crew each day.

6.2 Change Management

This HSP addresses all known activities and associated hazards. As work progresses, if significant changes are identified which could affect health and safety at the site, coordinate with the RHSM to determine whether a HSP update is necessary.

The following are examples of changes that may require a revision to the plan:

- Change in CH2M HILL staff;
- New subcontractor to perform work;
- New chemicals brought to site for use;
- Change in scope or addition of new tasks;
- Change in contaminants of concern (COCs) or change in concentrations of COCs; and
- New hazards or hazards not previously identified that are not addressed in this HSP.

7.0 Project Hazard Analysis

A health and safety risk analysis (Table 1) has been performed for each task. In the order listed below, the RHSM considers the various methods for mitigating the hazards. Employees are trained on this hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects:

- Elimination of the hazards (use remote sampling methodology to avoid going into a confined space);
- Substitution (reduce exposure to vapors by using of a geoprobe instead of test pitting);
- Engineering controls (ventilate a confined space to improve air quality);
- Warnings (establish exclusion zones to keep untrained people away from hazardous waste work);
- Administrative controls (implement a work-rest schedule to reduce chance of heat stress); or
- Use of PPE (use of respirators when action levels are exceeded).

The hazard controls and safe work practices are summarized in the following sections of this HSP:

- General hazards and controls;
- Project-specific hazards and controls;
- Physical hazards and controls;
- Biological hazards and controls; and
- Contaminants of concern.

7.1 Activity Hazard Analysis

An AHA must be developed for each CH2M HILL job activity. The AHA shall define the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements to be performed and training requirements for the safe operation of the equipment listed must be identified. Workers are briefed on the AHA before performing the work and their input is solicited prior, during, and after the performance of work to further identify the hazards posed and control measures required. The AHA shall identify the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard.

The following hazard controls and applicable CH2M HILL core standards and SOPs should be used as a basis for preparing AHAs.

AHAs prepared for CH2M HILL activities are included as an attachment to this HSP.

7.2 Subcontractor Activity Hazard Analysis

CH2M HILL subcontractors are required to provide AHAs specific to their scope of work on the project for acceptance by CH2M HILL. Each subcontractor shall submit AHAs for their field activities, as defined in their scope of work, along with their project-specific safety plan and procedures. Additions or changes in field activities, equipment, tools, or material used to perform work or hazards not addressed in existing AHAs requires either a new AHA to be prepared or an existing AHA to be revised.

Table 1 – General Activity Hazard Analysis

Project Activity / Potential Hazard	Sediment Sampling; Water Sampling; Clam tissue sampling	Surveying
Biological Hazards	X	X
Boating	X	X
Compressed Gas Cylinders		
Earthmoving Equipment		
Field Vehicles	X	X
Fire Prevention	X	
Hand & Power Tools	X	
Haul Truck Operations		
Hoists		
Knife Use	X	
Manual Lifting	X	X
Noise		
Portable Generators		
Pressurized Lines/Equipment		
Pressure Washing Equipment/ Decontamination	X	
Rigging		
Stairways and Ladders		
Temperature Extremes	X	X
Ultraviolet Light exposure (sunburn)	X	X
Utilities (underground/overhead)		
Working around Material Handling Equipment		
Work Over Water	X	

8.0 General Hazards and Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. It is a summarized list of requirements. Always consult the appropriate CH2M HILL SOP to ensure all requirements are implemented.

8.1 Bloodborne Pathogens

(Reference CH2M HILL SOP HSE-202, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or cardiopulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material (PIM).

Employees trained in first-aid/CPR or those exposed to PIM must complete CH2M HILL's 1-hour bloodborne pathogens computer-based training module annually. When performing first-aid/CPR the following shall apply:

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials;
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes; and
- If necessary, decontaminate all potentially contaminated equipment and surfaces with chlorine bleach as soon as possible. Use one part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area.

CH2M HILL will provide exposed employees with a confidential medical examination should an exposure to PIM occur. This examination includes the following procedures:

- Documenting the exposure;
- Testing the exposed employee's and the source individual's blood (with consent); and
- Administering post-exposure prophylaxis.

8.2 Driving Safety

Follow the guidelines below when operating a vehicle:

- Refrain from using a cellular phone while driving. Pull off the road, put the vehicle in park and turn on flashers before talking on a cellular phone;
- Never operate a personal digital assistant (PDA), or other device with e-mail, internet, or text messaging function while driving a vehicle;
- Obey speed limits; be aware of blind spots or other hazards associated with low visibility. Practice defensive driving techniques, such as leaving plenty of room between your vehicle and the one ahead of you;
- Do no drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep;
- Maintain focus on driving. Eating, drinking, smoking, adjusting controls can divert attention from the road. Take the time to park and perform these tasks when parked rather than while driving; and

- Ensure vehicle drivers are familiar with the safe operation of vehicles of the type and size to be operated. Large vehicles such as full size vans and pick-ups have different vision challenges and handling characteristics than smaller vehicles.

8.3 Electrical Safety

(Reference CH2M HILL SOP HSE-206, *Electrical Safety*)

Below are the hazard controls and safe work practices to follow when using electrical tools, extension cords, and/or other electrical-powered equipment or when exposed to electrical hazards. Ensure the requirements of the referenced SOP are followed:

- Only qualified personnel are permitted to work on unprotected energized electrical systems;
- Only authorized personnel are permitted to enter high-voltage areas;
- CH2M HILL employees who might from time to time work in an environment influenced by the presence of electrical energy must complete Awareness Level Electrical Safety Training located on the CH2M HILL Virtual Office;
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented;
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service;
- CH2M HILL has selected Ground Fault Circuit Interrupters (GFCIs) as the standard method for protecting employees from the hazards associated with electric shock;
    - GFCIs shall be used on all 120-volt, single phase 15 and 20-amphere receptacle outlets which are not part of the permanent wiring of the building or structure.
- An assured equipment grounding conductor program may be required under the following scenarios:
    - GFCIs can not be utilized;
    - Client requires such a program to be implemented; or
    - Business group decides to implement program in addition to GFCI protection.
- Extension cords must be equipped with third-wire grounding. Cords passing through work areas must be covered, elevated or protected from damage. Cords should not be routed through doorways unless protected from pinching. Cords should not be fastened with staples, hung from nails, or suspended with wire;
- Electrical power tools and equipment must be effectively grounded or double-insulated and Underwriters Laboratory (UL) approved;
- Operate and maintain electric power tools and equipment according to manufacturers' instructions;
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus ½ inch (1.27 cm) (for every 1 kV over 50 kV;
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage; and
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

8.4 Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles, or project vehicles.
- Maintain a first aid kit, bloodborne pathogen kit, and fire extinguisher in the field vehicle at all times.
- Utilize a rotary beacon on vehicle if working adjacent to active roadway.
- Familiarize yourself with rental vehicle features prior to operating the vehicle:
  - Vision Fields and Blind Spots
  - Vehicle Size
  - Mirror adjustments
  - Seat adjustments
  - Cruise control features, if offered
  - Pre-program radio stations and Global Positioning System (GPS), if equipped
- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.
- Tie down loose items if utilizing a van or pick-up truck.
- Close car doors slowly and carefully. Fingers can get pinched in doors.
- Park vehicle in a location where it can be accessed easily in the event of an emergency. If not possible, carry a phone.
- Have a designated place for storing the field vehicle keys when not in use.
- Ensure back-up alarms are functioning, if equipped. Before backing a vehicle, take a walk around the vehicle to identify obstructions or hazards. Use a spotter when necessary to back into or out of an area.
- See the Vehicle Accident Guidance attached to this HSP, if a vehicle incident is experienced in a rental or fleet vehicle.

8.5 Fire Prevention

(Reference CH2M HILL SOP HSE-403, *Hazardous Material Handling*)

Follow the fire prevention and control procedures listed below.

8.5.1 Fire Extinguishers and General Fire Prevention Practices

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet (30.5 meters). When 5 gallons (19 liters) or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet (15.2 meters). Extinguishers must:
  - be maintained in a fully charged and operable condition;
  - be visually inspected each month; and
  - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet (3 meters) from any building.

- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Keep areas neat. Housekeeping is important.

8.5.2 Storage of Flammable/Combustible Liquids

- Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids.
- Approved safety cans shall be used for the handling and use of flammable liquids in quantities of 5 gallons (22.7 liters) or less. Do not use plastic gas cans.
- For quantities of 1 gallon (4.5 liters) or less, the original container may be used for storage and use of flammable liquids.
- Flammable or combustible liquids shall not be stored in areas used for stairways or normally used for the passage of people.

8.5.3 Indoor Storage of Flammable/Combustible Liquids

- No more than 25 gallons (113.7 liters) of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet.
- Quantities of flammable and combustible liquids in excess of 25 gallons (113.7 liters) shall be stored in an acceptable or approved cabinet.
- Cabinets shall be conspicuously lettered: "FLAMMABLE: KEEP FIRE AWAY."
- Not more than 60 gallons (272.8 liters) of flammable or 120 gallons (545.5 liters) of combustible liquids shall be stored in any one storage cabinet. Not more than three such cabinets may be located in a single storage area.

8.5.4 Outside Storage of Flammable/Combustible Liquids

- Storage of containers (not more than 60 gallons [272.8 liters] each) shall not exceed 1,100 gallons (5000 liters) in any one area. No area shall be within 20 feet (6.1 meters) of any building.
- Storage areas shall be graded to divert spills away from buildings and surrounded by an earthen dike.
- Storage areas may not be located near a storm drain. Overflow and spills must be diverted away from storm drains or surface waters.
- Storage areas shall be free from weeds, debris, and other combustible materials.
- Outdoor portable tanks shall be provided with emergency vent devices and shall not be closer than 20 feet (6.1 meters) to any building.
- Signs indicating no smoking shall be posted around the storage area.

8.5.5 Dispensing of Flammable/Combustible Liquids

- Areas in which flammable or combustible liquids are dispensed in quantities greater than 5 gallons (22.7 liters) (shall be separated from other operations by at least 25 feet (7.6 meters).
- Drainage away from storm drains or surface waters or other means of containment shall be provided to control spills.
- Adequate natural or mechanical ventilation shall be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.
- Dispensing of flammable liquids from one container to another shall be done only when containers are electrically interconnected (bonded).

- Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks is prohibited.
- Dispensing devices and nozzles for flammable liquids shall be of an approved type.

8.5.6 Storage of Hazardous Waste

- All facilities storing ignitable and combustible liquids and hazardous wastes must be designed, constructed, maintained, and operated to minimize the possibility of a fire, explosion, or any release of hazardous constituents.
- Flammable wastes should be stored more than 50 feet from the property line.

8.6 General Practices and Housekeeping

The following are general requirements applicable to all portions of the work:

- Site work should be performed during daylight hours whenever possible;
- Good housekeeping must be maintained at all times in all project work areas;
- Common paths of travel should be established and kept free from the accumulation of materials;
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions;
- Provide slip-resistant surfaces, ropes, or other devices to be used;
- Specific areas should be designated for the proper storage of materials;
- Tools, equipment, materials, and supplies shall be stored in an orderly manner;
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area;
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals;
- All spills shall be quickly cleaned up; oil and grease shall be cleaned from walking and working surfaces;
- Review the safety requirements of each job you are assigned to with your supervisor. You are not expected to perform a job that may result in injury or illness to yourself or to others;
- Familiarize yourself with, understand, and follow jobsite emergency procedures;
- Do not fight or horseplay while conducting the firm's business;
- Do not use or possess firearms or other weapons while conducting the firm's business;
- Report unsafe conditions or unsafe acts to your supervisor immediately;
- Report emergencies, occupational illnesses, injuries, vehicle accidents, and near misses immediately;
- Do not remove or make ineffective safeguards or safety devices attached to any piece of equipment;
- Report unsafe equipment, defective or frayed electrical cords, and unguarded machinery to your supervisor;
- Shut down and lock out machinery and equipment before cleaning, adjustment, or repair. Do not lubricate or repair moving parts of machinery while the parts are in motion;
- Do not run in the workplace;
- When ascending or descending stairways, use the handrail and take one step at a time;
- Do not apply compressed air to any person or clothing;

- Do not wear steel taps or shoes with metal exposed to the sole at any CH2M HILL project location;
- Do not wear finger rings, loose clothing, wristwatches, and other loose accessories when within arm's reach of moving machinery;
- Remove waste and debris from the workplace and dispose of in accordance with federal, state, and local regulations;
- Note the correct way to lift heavy objects (secure footing, firm grip, straight back, lift with legs), and get help if needed. Use mechanical lifting devices whenever possible; and
- Check the work area to determine what problems or hazards may exist.

8.7 Hazard Communication

(Reference CH2M HILL SOPs HSE-107, *Hazard Communication* and HSE-403, *Hazardous Material Handling*)

The hazard communication coordinator is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using the chemical inventory form included as an attachment to this HSP;
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available;
- Request or confirm locations of material safety data sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed;
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical and include on the chemical inventory sheet (attached to this HSP) and add the MSDS to the MSDS attachment section of this HSP;
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly;
- Give employees required chemical-specific HAZCOM training using the chemical-specific training form included as an attachment to this HSP; and
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

The following are general guidelines for storing chemicals and other hazardous materials:

- Keep acids away from bases;
- Keep oxidizers (nitric acid, nitrates, peroxides, chlorates) and organics away from inorganic reducing agents (metals);
- Keep flammables and corrosives in appropriate storage cabinets;
- Do not store paper or other combustibles near flammables;
- Use secondary containment and lipped shelving that is secured; and
- Have a fire suppression system available.

8.8 Knife Use

Open-bladed knives (for example, box cutters, utility knives, pocket knives, machetes, and multi-purpose tools with fixed blades such as a Leatherman™) are prohibited at worksites except where the following three conditions are met:

- The open-bladed knife is determined to be the best tool for the job;

- An approved Activity Hazard Analysis (AHA) or written procedure is in place that covers the necessary safety precautions (work practices, PPE, and training); and
- Knife users have been trained and follow the AHA.

8.9 Lighting

Lighting shall be evaluated when conducting work inside buildings, confined spaces, or other areas/instances where supplemental light may be needed (e.g., work before sunrise or after sunset). A light meter can be used to evaluate the adequacy of lighting. The following are common requirements for lighting and the conditions/type of work being performed:

- While work is in progress outside construction areas shall have at least 33 lux (lx);
- Construction work conducted inside buildings should be provided with at least 55 lux light;
- The means of egress shall be illuminated with emergency and non-emergency lighting to provide a minimum 11 lx measured at the floor. Egress illumination shall be arranged so that the failure of any single lighting unit, including the burning out of an electric bulb will not leave any area in total darkness.

8.10 Manual Lifting

(Reference CH2M HILL SOP HSE-112, *Manual Lifting*)

Back injuries are the leading cause of disabling work and most back injuries are the result of improper lifting techniques or overexertion. Use the following to mitigate the hazards associated with lifting:

- When possible, the task should be modified to minimize manual lifting hazards;
- Lifting of loads weighing more than 40 pounds (18 kilograms) shall be evaluated by the SC using the Lifting Evaluation Form contained in SOP HSE-112;
- Using mechanical lifting devices is the preferred means of lifting heavy objects such as forklifts; cranes, hoists, and rigging; hand trucks; and trolleys;
- Personnel shall seek assistance when performing manual lifting tasks that appear beyond their physical capabilities;
- In general, the following steps must be practiced when planning and performing manual lifts: Assess the situation before you lift; ensure good lifting and body positioning practices; ensure good carrying and setting down practices; and
- All CH2M HILL workers must have training in proper manual lifting training either through the New Employee Orientation or through Manual Lifting module located on the VO.

8.11 Personal Hygiene

Good hygiene is essential for personal health and to reduce the potential of cross-contamination when working on a hazardous waste site. Implement the following:

- Keep hands away from nose, mouth, and eyes during work;
- Keep areas of broken skin (chapped, burned, etc.) covered; and
- Wash hands with soap and water prior to eating, smoking, or applying cosmetics.

8.12 Shipping and Transportation of Hazardous Materials

(Reference CH2M HILL SOP HSE-417, *Hazardous Materials Transportation*)

The U.S. Department of Transportation (DOT) has specific regulations governing shipping of hazardous materials (also called dangerous goods). Chemicals brought to the site might be defined as hazardous

materials by the U.S DOT. Hazardous wastes that may be shipped offsite are also defined as hazardous materials by U.S. DOT. Other wastes may also be U.S. DOT hazardous materials. To confirm whether a material or a waste is a U.S. DOT hazardous material, check with the ESBG Waste Coordinator (Lisa Schwan/ATL), the project EM, or the CH2M HILL Dangerous Goods Shipping Coordinators (John Blasco/BAO or Rob Strehlow/MKW).

All staff who affect shipment of hazardous materials, including receiving hazardous materials, preparing profiles or manifests, packaging hazardous wastes, labeling, or transporting hazardous materials by road, are called HazMat employees (note CH2M HILL cannot transport hazardous wastes by public road). HazMat employees must receive CH2M HILL online training in shipping dangerous goods. CH2M HILL's online Dangerous Goods Shipping course can be found on the CH2M HILL HSSE website.

All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. If the material is a product that is being shipped (e.g., calibration gas), use the HazMat ShipRight tool on the CH2M HILL virtual office (under Company Resources – Online Shipping). Contact the Dangerous Goods Shipping coordinators, the ESBG Waste Coordinator or the project EM for additional information.

49 CFR 172 requires that all hazmat employees be aware of potential transportation security concerns. Hazardous materials security is addressed in CH2M HILL's Hazardous Materials SOP (HSE-403). The following points are provided as an overview of security measures to increase awareness of this important matter:

- It is essential that each employee understand the security risks involved with transporting hazardous materials;
- All transporters of hazardous materials must be prequalified by a Contracts Administrator who evaluate the carrier's safety rating, security measures, and employee screening procedures;
- When shipping hazardous materials, check driver credentials and ask about shipping details;
- When receiving a hazardous materials shipment, inspect packages for signs of tampering or damage to the contents. Verify the drivers and company information on the form with the driver; and
- If there is suspicious or unusual behavior (e.g., driver without credentials, evasive answers) or any discrepancies identified, do not offer or accept the shipment, and immediately notify the project manager or the RHSM.

Employees responsible for shipping hazard materials must also review the CH2M HILL Transportation Security Plan (HSE-417 Appendix A).

8.13 Substance Abuse

(Reference CH2M HILL SOP HSE-105, *Drug-Free Workplace*)

Employees who work under the influence of controlled substances, drugs, or alcohol may prove to be dangerous or otherwise harmful to themselves, other employees, clients, the company, the company's assets and interests, or the public. CH2M HILL does not tolerate illegal drug use, or any use of drugs, controlled substances, or alcohol that impairs an employee's work performance or behavior.

Prohibitions onsite include:

- Use or possession of intoxicating beverages while performing CH2M HILL work;
- Abuse of prescription or nonprescription drugs;
- Use or possession of illegal drugs or drugs obtained illegally;

- Sale, purchase, or transfer of legal, illegal or illegally obtained drugs; and
- Arrival at work under the influence of legal or illegal drugs or alcohol.

Drug and/or alcohol testing is applicable under CH2M HILL Constructors, Inc. and munitions response projects performed in the United States. In addition, employees may be required to submit to drug and/or alcohol testing as required by clients. When required, this testing is performed in accordance with SOP HSE-105, Drug-Free Workplace. Employees who are enrolled in drug or alcohol testing are required to complete annual training located on the CH2M HILL Virtual Office (VO).

9.0 Project-Specific Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the work or the particular hazard. Each person onsite is required to abide by the hazard controls. Always consult the appropriate CH2M HILL SOP to ensure all requirements are implemented. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the RHSM for clarification.

9.1 Boating Safety

Personnel who will operate a boat during the course of a project shall first demonstrate to the site manager that they are experienced in operating boats similar to those used for the project and that they are knowledgeable of the U.S. Coast Guard Boating Safety requirements (33 CFR Subchapter S). Project boats shall be operated by experienced boat operators only. Boat operators shall also possess basic mechanical knowledge necessary to troubleshoot common mechanical problems that can and do occur. The boat operator shall be responsible for the safety of all personnel on board the boat he or she is operating and for the integrity of all boat and safety equipment.

Each designated boat operator shall give a safety briefing to all occupants of the boat prior to leaving the shore. Boats are to be occupied during use by not less than one qualified operator plus one additional person.

The boat captain has the final authority with regard to boat safety and navigational safety.

Use the attached boat safety checklist to evaluate and verify necessary equipment prior to leaving shore.

Marine Vessel or Inflatable Raft Checklist		
	Yes	**N/A**
Personal Flotation Devices (PFDs)		
Visual Distress Signals (e.g., spotlight, flag)		
Anchor and Anchor Line		
Sound-Producing Devices (e.g., whistle, airhorn)		
Navigation Lights		
Fire Extinguishers		
Alternative Propulsion (e.g., paddles)		
Overall Vessel Condition Satisfactory		
State/Coast Guard Requirements met		
Spill Kit		
Marine Sanitation Device		
Ropes and Bumpers		
First Aid Kit and Bloodborne Pathogen Kit		
Nonslip Deck		
Emergency Access Ladder		

Boat Requirements

All project boats will meet or exceed U.S. Coast Guard requirements for safety equipment, as applicable to the operation and type of boat. These requirements are summarized below for small craft (less than forty feet [12 meters] in length).

Flame Arresters

All gasoline engines, except outboard motors, installed in a boat must have an approved flame arrestor (backfire preventer) fitted to the carburetor.

Sound Signaling Devices

Boats shall carry at least one air horn or similar sound-signaling device. Radio or cell-phone communication must be in place as well.

Personal Flotation Devices

All personnel and passengers shall wear an approved personal flotation device (PFD) at all times when operating or being transported in a boat. A positively buoyant wet suit or dry suit may be substituted for a PFD. PFDs shall be Type II or higher (capable of turning its wearer in a vertical or slightly backward position in the water). In addition, each boat shall be equipped with at least one Type IV PFD, designed to be thrown to a person in the water and grasped and held by the user until rescued. A buoyant boat cushion equipped with straps and a float ring are two common examples of a Type IV PFD.

Fire Extinguishers

Each boat shall carry at least one Type B-I or B-II fire extinguisher (for use in gasoline, oil and grease fires) approved by Underwriters Laboratories (UL). Each fire extinguisher shall be inspected to ensure that it is sufficiently charged and that the nozzles are free and clear. Discharged fire extinguishers shall be replaced or recharged immediately.

Emergency Planning

As part of the project HSP and AHAs, emergencies and response actions must be addressed for potential emergencies such at fire, sinking, flooding, severe weather, man over-board, hazardous material incidents, etc.

Load Capacity

Boats shall not be loaded (passengers and gear) beyond the weight capacity printed on the U.S. Coast Guard information plate attached to the stern. In addition, several factors must be considered when loading a boat: distribute the load evenly, keep the load low, do not stand up in a small boat or canoe, and do not overload the boat.

Tool Kit

All motorized boats shall carry a tool kit sufficient for the boat operator to troubleshoot common mechanical problems such as fouled spark plugs, flooded carburetor, electrical shorts, etc. Boats operated in remote areas shall also carry appropriate spare parts (propellers, shear pins, patch kits, air pumps, etc). The tool kit shall be maintained by the boat operator and supplies used up shall be replaced immediately.

Communications

All boats operated shall carry a two-way radio or cellular telephone that enables communication back to the field camp or other pre-established location.

Good Housekeeping

Personnel using a boat shall properly stow and secure all gear and equipment against unexpected shifts when underway. Decks and open spaces must be kept clear and free from clutter and trash to minimize slip, trip, and fall hazards.

Fuel Management

Personnel shall utilize the "one-third rule" in boating fuel management. Use one-third of the fuel to get to the destination, one-third to return, and keep one-third in reserve.

No smoking is permitted on board vessels or during refueling operations.

Pollution Control

The Clean Water Act prohibits the discharge of oil, hazardous substances, or other materials or wastes in quantities that may be harmful into U.S. navigable waters. No person may intentionally drain oil or oily wastes from any source into the bilge of any vessel. Larger vessels equipped with toilet facilities must be equipped with a U.S. Coast Guard-approved marine sanitation device.

Employees shall report any significant oil spills to water to the SC and/or supervisor and the RHSM. The procedure for incident reporting and investigation shall be followed when reporting the spill.

Training

All operators and passengers shall be trained on the requirements outlined above, as well as trained on the HSP/AHA(s), including emergency response actions.

9.2 Dry ice Handling

HANDLING
Dry ice temperature is extremely cold at -109.3°F or -78.5°C. Always handle dry ice with care and wear protective cloth or leather gloves whenever touching it. An oven mitt or towel will work. Prolonged contact with the skin will freeze cells and cause injury similar to a burn. DO NOT eat dry ice.

STORAGE
Store dry ice in an insulated container. The thicker the insulation, the slower it will sublimate. Do not store dry ice in a completely airtight container. The sublimation of Dry ice to Carbon Dioxide gas will cause any airtight container to expand or possibly explode. Keep proper air ventilation wherever dry ice is stored. Do not store dry ice in unventilated rooms, cellars, autos or boat holds. The sublimated Carbon Dioxide gas will sink to low areas and replace oxygenated air. This could cause suffocation if breathed exclusively. Do not store dry ice in a refrigerator freezer. The extremely cold temperature will cause your thermostat to turn off the freezer. It will keep everything frozen in the freezer but it will be used up at a faster rate.

BURN TREATMENT
Treat dry ice burns the same as a regular heat burns. See a doctor if the skin blisters or comes off. Otherwise if only red it will heal in time as any other burn. Apply antibiotic ointment to prevent infection and bandage only if the burned skin area needs to be protected. DO NOT leave dry ice unattended around children.

9.3 Hand and Power Tools

(Reference CH2M HILL, SOP HSE-210, *Hand and Power Tools*)

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are using hand and power tools. Ensure the requirements in the referenced SOP are followed:

- Tools shall be inspected prior to use and damaged tools will be tagged and removed from service;
- Hand tools will be used for their intended use and operated in accordance with manufacturer's instructions and design limitations;
- Maintain all hand and power tools in a safe condition;
- Use PPE (such as gloves, safety glasses, earplugs, and face shields) when exposed to a hazard from a tool;
- Do not carry or lower a power tool by its cord or hose;
- Portable power tools will be plugged into GFCI protected outlets;
- Portable power tools will be Underwriters Laboratories (UL) listed and have a three-wire grounded plug or be double insulated;
- Disconnect tools from energy sources when they are not in use, before servicing and cleaning them, and when changing accessories (such as blades, bits, and cutters);
- Safety guards on tools must remain installed while the tool is in use and must be promptly replaced after repair or maintenance has been performed;
- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials;
- If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer's specifications;
- Tools used in an explosive environment must be rated for work in that environment (that is, intrinsically safe, spark-proof, etc.); and
- Working with manual and pistol-grip hand tools may involve highly repetitive movement, extended elevation, constrained postures, and/or awkward positioning of body members (for example, hand, wrist, arm, shoulder, neck, etc.). Consider alternative tool designs, improved posture, the selection of appropriate materials, changing work organization, and sequencing to prevent muscular, skeletal, repetitive motion, and cumulative trauma stressors.

Machine Guarding

- Ensure that all machine guards are in place to prevent contact with drive lines, belts, chains, pinch points or any other sources of mechanical injury.
- Unplugging jammed equipment will only be performed when equipment has been shut down, all sources of energy have been isolated and equipment has been locked/tagged and tested.
- Maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk requires lockout of that equipment prior to work.

9.4 Portable Generator Hazards

(Reference CH2M HILL SOP HSE-206, Electrical Safety)

- Portable generators are useful when temporary or remote electric power is needed, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, and fire.

- NEVER use a generator indoors or in similar enclosed or partially-enclosed spaces. Generators can produce high levels of carbon monoxide (CO) very quickly. When you use a portable generator, remember that you cannot smell or see CO. Even if you can't smell exhaust fumes, you may still be exposed to CO.
- If you start to feel sick, dizzy, or weak while using a generator, get to fresh air RIGHT AWAY. DO NOT DELAY. The CO from generators can rapidly lead to full incapacitation and death.
- If you experience serious symptoms, get medical attention immediately. Inform project staff that CO poisoning is suspected. If you experienced symptoms while indoors have someone call the fire department to determine when it is safe to re-enter the building.
- Follow the instructions that come with your generator. Locate the unit outdoors and away from doors, windows, and vents that could allow CO to come indoors.
- Keep the generator dry and do not use in rain or wet conditions. To protect from moisture, operate it on a dry surface under an open, canopy-like structure. Dry your hands if wet before touching the generator.
- Plug appliances directly into the generator. Or, use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads. Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin.
- Most generators come with Ground Fault Circuit Interrupters (GFCI). Test the GFCIs daily to determine whether they are working
- If the generator is not equipped with GFCI protected circuits plug a portable GFCI into the generator and plug appliances, tools and lights into the portable GFCI.
- Never store fuel near the generator or near any sources of ignition.
- Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite.

9.5 Pressure Washing Operations

Below are the hazard controls and safe work practices to follow when working around or performing pressure washing.

- Only trained, authorized personnel may operate the high-pressure washer.
- Follow manufacturer's safety and operating instructions.
- Inspect pressure washer before use and confirm deadman trigger is fully operational
- The wand must always be pointed at the work area.
- The trigger should never be tied down
- Never point the wand at yourself or another worker.
- The wand must be at least 42 inches (1.1 meter) from the trigger to the tip and utilize greater than 10 degree tips.
- Non-operators must remain a safe distance from the operator.
- No unauthorized attachment may be made to the unit.
- Do not modify the wand.
- All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.
- Polycoated Tyvek or equivalent, 16-inch-high steel-toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves will be worn, at a minimum.

9.6 Working Over Water

If any activities pose a risk to drowning implement the following during the activity:

- Fall protection should be provided to prevent personnel from falling into water. Where fall protection systems are not provided and the danger of drowning exists, U.S. Coast Guard-approved personal flotation devices (PFDs), or a life jacket, shall be worn.
- Provide employees with an approved (USCG for U.S. operations) life jacket or buoyant work vest.
  - Employees should inspect life jackets or work vests daily before use for defects. Do not use defective jackets or vests.
- Post ring buoys with at least 90 feet (27.4 meters) of 3/8-inch solid-braid polypropylene (or equal) line next to the work area. If the work area is large, post extra buoys 200 feet (61 meters) or less from each other.
- Provide at least one life saving skiff, immediately available at locations where employees are working over or adjacent to water.
  - Ensure the skiff is in the water and capable of being launched by one person and is equipped with both motor and oars.
- Designate at least one employee on site to respond to water emergencies and operate the skiff at times when there are employees above water.
  - If the designated skiff operator is not within visual range of the water, provide him or her with a radio or provide some form of communication to inform them of an emergency.
  - Designated employee should be able to reach a victim in the water within three to four minutes.
- Ensure at least one employee trained in CPR and first aid is on site during work activities.

10.0 Physical Hazards and Controls

Physical hazards include exposure to temperature extremes, sun, noise, and radiation. If you encounter a physical hazard that has not been identified in this plan, contact the RHSM so that a revision to this plan can be made.

10.1 Noise

(Reference CH2M HILL SOP HSE-108, *Hearing Conservation*)

CH2M HILL is required to control employee exposure to occupational noise levels of 85 decibels, A-weighted, (dBA) and above by implementing a hearing conservation program that meets the requirements of the OSHA Occupational Noise Exposure standard, 29 CFR 1910.95. A noise assessment may be conducted by the RHSM or designee based on potential to emit noise above 85 dBA and also considering the frequency and duration of the task.

- Areas or equipment emitting noise at or above 90dBA shall be evaluated to determine feasible engineering controls. When engineering controls are not feasible, administrative controls can be developed and appropriate hearing protection will be provided.
- Areas or equipment emitting noise levels at or above 85 dBA, hearing protection must be worn.
- Employees exposed to 85 dBA or a noise dose of 50% must participate in the Hearing Conservation program including initial and annual (as required) audiograms.

- The RHSM will evaluate appropriate controls measures and work practices for employees who have experienced a standard threshold shift (STS) in their hearing.
- Employees who are exposed at or above the action level of 85 dBA are required to complete the online Noise Training Module located on CH2M HILL's virtual office.
- Hearing protection will be maintained in a clean and reliable condition, inspected prior to use and after any occurrence to identify any deterioration or damage, and damaged or deteriorated hearing protection repaired or discarded.
- In work areas where actual or potential high noise levels are present at any time, hearing protection must be worn by employees working or walking through the area.
- Areas where tasks requiring hearing protection are taking place may become hearing protection required areas as long as that specific task is taking place.
- High noise areas requiring hearing protection should be posted or employees must be informed of the requirements in an equivalent manner.

10.2 Ultraviolet Radiation (sun exposure)

Health effects regarding ultraviolet (UV) radiation are confined to the skin and eyes. Overexposure can result in many skin conditions, including erythema (redness or sunburn), photoallergy (skin rash), phototoxicity (extreme sunburn acquired during short exposures to UV radiation while on certain medications), premature skin aging, and numerous types of skin cancer. Implement the following controls to avoid sunburn.

Limit Exposure Time

- Rotate staff so the same personnel are not exposed all of the time.
- Limit exposure time when UV radiation is at peak levels (approximately 2 hours before and after the sun is at its highest point in the sky).
- Avoid exposure to the sun, or take extra precautions when the UV index rating is high.

Provide Shade

- Take lunch and breaks in shaded areas.
- Create shade or shelter through the use of umbrellas, tents, and canopies.
- Fabrics such as canvas, sailcloth, awning material and synthetic shade cloth create good UV radiation protection.
- Check the UV protection of the materials before buying them. Seek protection levels of 95 percent or greater, and check the protection levels for different colors.

Clothing

- Reduce UV radiation damage by wearing proper clothing; for example, long sleeved shirts with collars, and long pants. The fabric should be closely woven and should not let light through.
- Head protection should be worn to protect the face, ears, and neck. Wide-brimmed hats with a neck flap or "Foreign Legion" style caps offer added protection.
- Wear UV-protective sunglasses or safety glasses. These should fit closely to the face. Wrap-around style glasses provide the best protection.

Sunscreen

- Apply sunscreen generously to all exposed skin surfaces at least 20 minutes before exposure, allowing time for it to adhere to the skin.
- Re-apply sunscreen at least every 2 hours, and more frequently when sweating or performing activities where sunscreen may be wiped off.
- Choose a sunscreen with a high sun protection factor (SPF). Most dermatologists advocate SPF 30 or higher for significant sun exposure.
- Waterproof sunscreens should be selected for use in or near water, and by those who perspire sufficiently to wash off non-waterproof products.
- Check for expiration dates, because most sunscreens are only good for about 3 years. Store in a cool place out of the sun.
- No sunscreen provides 100 percent protection against UV radiation. Other precautions must be taken to avoid overexposure.

10.3 Temperature Extremes

(Reference CH2M HILL SOP HSE-211, *Heat and Cold Stress*)

Each employee is responsible for the following:

- Recognizing the symptoms of heat or cold stress;
- Taking appropriate precautionary measures to minimize their risk of exposure to temperature extremes (see following sections); and
- Communicating any concerns regarding heat and cold stress to their supervisor or SC.

10.3.1 Heat

Heat illness prevention must be implemented. This includes,

- Having enough water onsite so that each worker can consume at a minimum, **one quart per hour per shift**.
- Frequent reminders and/or water breaks shall be taken so that each person can consume enough water.
- Access to shade (i.e., blockage from direct sunlight) shall be provided at all times and shall be reasonably close to the work area. Keep in mind that a vehicle or other enclosed are with no air conditioning is NOT considered shade. Must be a well ventilated area or have air conditioning.
- Workers suffering from heat illness-related symptoms OR if needed for preventative recovery shall be provided access to shade for at least 5 minutes, or longer, for recovery. (if heat related symptoms are occurring, contact the RHSM).
- Training on risk factors, signs and symptoms of heat illness, importance of hydration and acclimatization, and importance of reporting symptoms and what to do in case of heat illness emergency, and contacting emergency medical services (see sections that follow).

Heat-related illnesses are caused by more than just temperature and humidity factors.

Physical fitness influences a person's ability to perform work under heat loads. At a given level of work, the more fit a person is, the less the physiological strain, the lower the heart rate, the lower the body temperature (indicates less retrained body heat—a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.

Acclimatization is the degree to which a worker's body has physiologically adjusted or acclimatized to working under hot conditions. Acclimatization affects their ability to do work. Acclimatized individuals

sweat sooner and more profusely than un-acclimatized individuals. Acclimatization occurs gradually over 1 to 2 weeks of continuous exposure, but it can be lost in as little as 3 days in a cooler environment.

Dehydration reduces body water volume. This reduces the body's sweating capacity and directly affects its ability to dissipate excess heat.

The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight). **Heat dissipation** is a function of surface area, while heat production depends on body mass. Therefore, overweight individuals (those with a low ratio) are more susceptible to heat-related illnesses because they produce more heat per unit of surface area than if they were thinner. Monitor these persons carefully if heat stress is likely.

When wearing **impermeable clothing**, the weight of an individual is not as important in determining the ability to dissipate excess heat because the primary heat dissipation mechanism, evaporation of sweat, is ineffective.

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool– but not cold– water. Call ambulance, and get medical attention immediately!

Precautions

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°Fahrenheit (10 degrees Celsius [C]) to 60°Fahrenheit (F) (15.6 degrees C) should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shade to protect personnel against radiant heat (sun, flames, hot metal).

- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. PREVENTION and communication is key.

Thermal Stress Monitoring

The following procedures should be implemented when the ambient air temperature exceeds 70° F (21 degrees C), the relative humidity is high (greater than 50 percent), or when the workers exhibit symptoms of heat stress:

- The heart rate should be measured by the radial pulse for 30 seconds, as early as possible in the resting period;
- The heart rate at the beginning of the rest period should not exceed 110 beats per minute, or 20 beats per minute above resting pulse;
- If the heart rate is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same;
- If the pulse rate still exceeds 110 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent;
- Continue this procedure until the rate is maintained below 110 beats per minute, or 20 beats per minute above resting pulse;
- Alternately, the oral temperature can be measured before the workers have something to drink;
- If the oral temperature exceeds 99.6 degrees F (37.6 degrees C) at the beginning of the rest period, the following work cycle should be shortened by 33 percent; and
- Continue this procedure until the oral temperature is maintained below 99.6 degrees F (37.6 degrees C). While an accurate indication of heat stress, oral temperature is difficult to measure in the field.

Procedures for when Heat Illness Symptoms are Experienced

- **Always** contact the RHSM when any heat illness related symptom is experienced so that controls can be evaluated and modified, if needed.
- In the case of cramps, reduce activity, increase fluid intake, move to shade until recovered.
- In the case of all other heat-related symptoms (fainting, heat rash, heat exhaustion), and if the worker is a CH2M HILL worker, contact the occupational physician at 1-866-893-2514 and immediate supervisor.
- In the case of heat stroke symptoms, call 911, have a designee give location and directions to ambulance service if needed, follow precautions under the emergency medical treatment of this HSP.
- Follow the Incident Notification, Reporting, and Investigation section of this HSP.

10.3.2 Cold

General

Low ambient temperatures increase the heat lost from the body to the environment by radiation and convection. In cases where the worker is standing on frozen ground, the heat loss is also due to conduction.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. Thus, the body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing this insulating layer of air increases heat loss by convection.

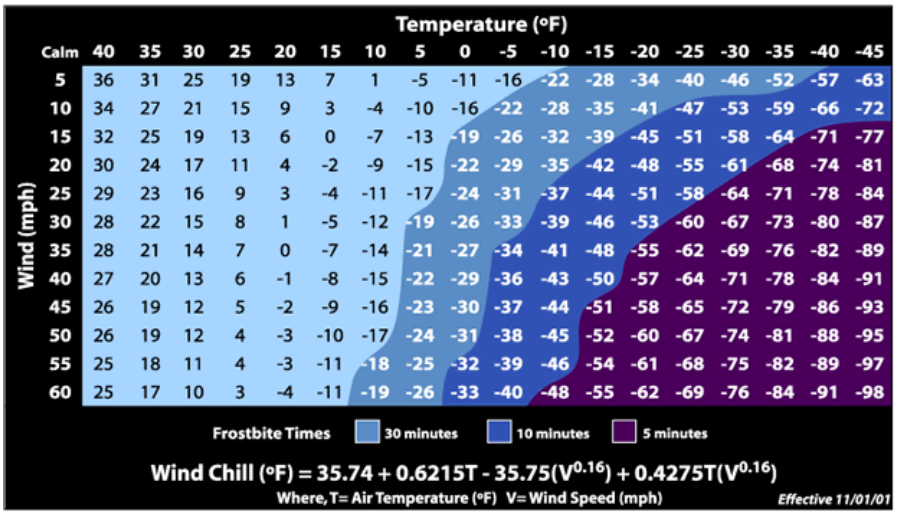
Non-insulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. These chemicals reduce the blood flow to peripheral parts of the body, which are already high-risk areas because of their large surface area to volume ratios. These substances may also aggravate an already hypothermic condition.

Precautions

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.
- Wind-Chill Index (below) is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- Persons who experience initial signs of immersion foot, frostbite, and/or hypothermia should report it immediately to their supervisor/PM to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	**Frostbite**	**Hypothermia**
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.



10.4 Radiological Hazards

Refer to CH2M HILL's Core Standard, Radiological Control and Radiological Controls Manual for additional requirements.

Hazards	Controls
None Known	None Required

11.0 Biological Hazards and Controls

Biological hazards are everywhere and change with the region and season. If you encounter a biological hazard that has not been identified in this plan, contact the RHSM so that a revision to this plan can be made. Whether it is contact with a poisonous plant, a poisonous snake, or a bug bite, do not take bites or stings lightly. If there is a chance of an allergic reaction or infection, or to seek medical advice on how to properly care for the injury, contact the occupational nurse at 1-866-893-2514.

11.1 Bees and Other Stinging Insects

Bees and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform your supervisor and/or a buddy. If you are stung, contact the occupational nurse at 1-866-893-2514. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for an allergic reaction if you have never been stung before. Call 911 if the reaction is severe.

11.2 Bird Droppings

Large amounts of bird droppings may present a disease risk. The best way to prevent exposure to fungus spores in bird droppings is to avoid disturbing it. A brief inhalation exposure to highly contaminated dust may be all that is needed to cause infection and subsequent development of fungal disease.

If disturbing the droppings or if removal is necessary to perform work, follow these controls:

- Use dust control measures (wetting with water or HEPA vacuuming) for all activities that may generate dust from the accumulated droppings.
- Wear Tyvek with hoods, disposable gloves and booties, and air-purifying respirators with a minimum N95 rating.
- Put droppings into plastic/poly bags and preferably into a 55-gallon drum to prevent bag from ripping.

11.3 Feral Dogs

Avoid all dogs – both leashed and stray. Do not disturb a dog while it is sleeping, eating, or caring for puppies. If a dog approaches to sniff you, stay still. An aggressive dog has a tight mouth, flattened ears and a direct stare. If you are threatened by a dog, remain calm, do not scream and avoid eye contact. If you say anything, speak calmly and firmly. Do not turn and run, try to stay still until the dog leaves, or back away slowly until the dog is out of sight or you have reached safety (e.g. vehicle). If attacked, retreat to vehicle or attempt to place something between you and the dog. If you fall or are knocked to the ground, curl into a ball with your hands over your head and neck and protect your face. If bitten, contact the occupational nurse at 1-866-893-2514. Report the incident to the local authorities.

11.4 Mosquito Bites

Due to the recent detection of the West Nile Virus in the southwestern United States it is recommended that preventative measures be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent:

- Stay indoors at dawn, dusk, and in the early evening;
- Wear long-sleeved shirts and long pants whenever you are outdoors;

- Spray clothing with repellents containing permethrin or N,N-diethyl-meta-toluamide (DEET) since mosquitoes may bite through thin clothing;
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET. Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands; and
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

The West Nile Virus incubation period is from 3 to 15 days.

Contact the project RHSM with questions, and immediately report any suspicious symptoms to your supervisor, PM, and contact the occupational nurse at 1-866-893-2514.

11.5 Bears

Bears may inhabit wooded areas where there is scarce continuous human presence.

- Acquire “bear spray” and/or noise-producing devices from SC-HW if deemed necessary
- Make your presence known—especially when vegetation and terrain make it hard to see.
- Make noise, sing, or talk loudly.
- Avoid thick brush.
- Try to walk with the wind at your back so your scent will warn bears of your presence.
- Give bears plenty of room. Every bear has a “personal space”—the distance within which a bear feels threatened—that can be from a few feet to a few hundred feet. If you stray within that zone, a bear may act aggressively. Never approach bears, even if only out of curiosity, and never attempt to feed bears.
- If a bear cannot recognize you, it may come closer or stand on its hind legs for a better view. You may try to back away slowly diagonally, but if the bear follows, stop and stand your ground. If the bear moves closer or acts aggressively, stay close together and wave your arms and shout.
- Do not climb a tree—black bears are good climbers.
- Do not run. Bears have been clocked at speeds of up to 35 miles per hour and, like dogs, will chase fleeing animals. Bears often make bluff charges, sometimes up to 10 feet away, without making contact. Continue waving your arms and shouting. Never imitate bear sounds or use high-pitched squeals.
- If attacked, do not run. Clasp your hands tightly over the back of your neck or, if you are carrying a backpack, use it to protect your head and neck and remain still. For black bears, if the attack lasts for more than a few seconds, respond aggressively—use sticks, rocks, your fists or noise. Black bears will sometimes back off if they are challenged.

11.6 Spiders - Brown Recluse and Widow

The Brown Recluse spider can be found most anywhere in the United States. It varies in size in shape, but the distinguishing mark is the violin shape on its body. They are typically non-aggressive. Keep an eye out for irregular, pattern-less webs that sometimes appear almost tubular built in a protected area such as in a crevice or between two rocks. The spider will retreat to this area of the web when threatened.

The Black Widow, Red Widow and the Brown Widow are all poisonous. Most have globose, shiny abdomens that are predominantly black with red markings (although some may be pale or have lateral stripes), with moderately long, slender legs. These spiders are nocturnal and build a three-dimensional tangled web, often with a conical tent of dense silk in a corner where the spider hides during the day.

Hazard Controls

- Inspect or shake out any clothing, shoes, towels, or equipment before use.
- Wear protective clothing such as a long-sleeved shirt and long pants, hat, gloves, and boots when handling stacked or undisturbed piles of materials.
- Minimize the empty spaces between stacked materials.
- Remove and reduce debris and rubble from around the outdoor work areas.
- Trim or eliminate tall grasses from around outdoor work areas.
- Store apparel and outdoor equipment in tightly closed plastic bags.
- Keep your tetanus boosters up-to-date (every 10 years). Spider bites can become infected with tetanus spores.

If you think you have been bit by a poisonous spider, immediately call the occupational nurse at 1-866-893-2514 and follow the guidance below:

- Remain calm. Too much excitement or movement will increase the flow of venom into the blood;
- Apply a cool, wet cloth to the bite or cover the bite with a cloth and apply an ice bag to the bite;
- Elevate the bitten area, if possible;
- Do not apply a tourniquet, do not try to remove venom; and
- Try to positively identify the spider to confirm its type. If the spider has been killed, collect it in a plastic bag or jar for identification purposes. Do not try to capture a live spider—especially if you think it is a poisonous spider.
-

Black Widow

Red Widow

Brown Widow

Brown Recluse

12.0 Contaminants of Concern

The table below summarizes the potential contaminants of concern (COC) and their occupational exposure limit and signs and symptoms of exposure. The table also includes the maximum concentration of each COC and the associated location and media that was sampled (groundwater, soil boring, surface soil). These concentrations were used to determine engineering and administrative controls described in the "Project-Specific Hazard Controls" section of this HSP, as well as PPE and site monitoring requirements.

Contaminants of Concern

Contaminant	Location and Maximum[a] Concentration	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Arsenic	Potential	0.01 mg/m^3	5 Ca	Ulceration of nasal septum, respiratory irritation; dermatitis; gastrointestinal disturbances; peripheral neuropathy, hyperpigmentation	NA
Cadmium	Potential	0.005 mg/m^3	9 Ca	Pulmonary edema, coughing, chest tightness/pain, headache; chills, muscle aches, nausea, vomiting, diarrhea; difficulty breathing; loss of sense of smell; emphysema; mild anemia	NA
Lead	Potential	0.05 mg/m^3	100	Weakness, lassitude; facial pallor; pal eye; weight loss, malnutrition; abdominal pain, constipation; anemia; gingival lead line; tremors; paralysis of wrist and ankles; encephalopathy; kidney disease; irritated eyes; hypotension	NA
Mercury	Potential	0.05 mg/m^3	10	Skin and eye irritation, cough, chest pain, difficult breathing, bronchitis, pneumontitis, tremors, insomnia, irritability, indecision, headache, fatigue, weakness, GI disturbance	NA
PCBs	Potential	0.5 mg/m^3	5 Ca	Eye and skin irritation, acne-form dermatitis, liver damage, reproductive effects	UK

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water).
[b] Appropriate value of permissible exposure limit (PEL), recommended exposure limit (REL), or threshold limit valute (TLV) listed.
[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.
[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

eV = electron volt
mg/kg = milligram per kilogram
mg/m^3 = milligrams per cubic meter
ug/m^3 = micrograms per cubic meter

Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of PPE.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of respiratory protection when other forms of control do not reduce the potential for exposure.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

13.0 Site Monitoring

(Reference CH2M HILL SOP HSE-207, *Exposure Monitoring for Airborne Chemical Hazards*)

When performing site monitoring, record all the information, such as in a field logbook. Note date and time, describe monitoring location (for example, in breathing zone, at source and site location), and what the reading is. If any action levels are reached, note it in the field logbook and note the action taken. Exposure records (air sampling) must be preserved for the duration of employment plus thirty years. Ensure that copies of the field log book are maintained in the project file. Copies of all project exposure records (e.g., copies of field logbook pages where air monitoring readings are recorded and associated calibration) shall be sent to the regional SPA for retention and maintained in the project files.

13.1 Direct Reading Monitoring Specifications

Instrument	Tasks	Action Levels[a]	Frequency [b]	Calibration

Based on current site conditions, the scope of work, and contaminants of concern, air monitoring is not required at this time. If unusual sites or odors are present, notify the RHSM immediately to reevaluate the need for air monitoring.

13.2 Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method

Not Applicable

Calibrate air monitoring equipment daily (or prior to use) in accordance with the instrument's instructions. Document the calibration in the field logbook (or equivalent) and include the following information:

- Instrument name
- Serial Number
- Owner of instrument (for example, CH2M HILL, HAZCO)
- Calibration gas (including type and lot number)
- Type of regulator (for example, 1.5 lpm)
- Type of tubing (for example, direct or T-tubing)
- Ambient weather condition (for example, temperature and wind direction)
- Calibration/instrument readings
- Operator's name and signature
- Date and time

13.3 Integrated Personal Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the RHSM immediately if these contaminants are encountered.

Method Description: None required at this time

14.0 Personal Protective Equipment

(Reference CH2M HILL- SOP HSE-117, *Personal Protective Equipment*)

14.1 Required Personal Protective Equipment

PPE must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control those hazards. A PPE assessment has been conducted by the RHSM based on project tasks (see PPE specifications below). Verification and certification of assigned PPE by task is completed by the RHSM that approved this plan. Below are items that need to be followed when using any form of PPE:

- Employees must be trained to properly wear and maintain the PPE;
- Employees must be trained in the limitations of the PPE;
- In work areas where actual or potential hazards are present at any time, PPE must be worn by employees working or walking through the area;
- Areas requiring PPE should be posted or employees must be informed of the requirements in an equivalent manner;
- PPE must be inspected prior to use and after any occurrence to identify any deterioration or damage;
- PPE must be maintained in a clean and reliable condition;
- Damaged PPE shall not be used and must either be repaired or discarded; and
- PPE shall not be modified, tampered with, or repaired beyond routine maintenance.

Task	Level	Body	Head	Respirator [b]
• Surveying	NA	Work clothes; steel-toe, leather work boots; work glove.	Hardhat [c] Safety glasses Ear protection [d]	None required
• Sediment sampling • Clam tissue sampling • Water sampling	Modified D	**Coveralls:** Cotton coveralls or rain gear. **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves. Work gloves if handling heavy or sharp metal objects. **Waders:** Worn if wading out into tidal zones during sampling	Hardhat [c] Safety glasses Ear protection [d]	None required

Reasons for Upgrading or Downgrading Level of Protection

Upgrade [e]	Downgrade
Request from individual performing tasks.	New information indicating that situation is less hazardous than originally thought.
Change in work tasks that will increase contact or potential contact with hazardous materials.	Change in site conditions that decreases the hazard.
Occurrence or likely occurrence of gas or vapor emission.	Change in work task that will reduce contact with hazardous materials.
Known or suspected presence of dermal hazards.	
Instrument action levels (Section 5) exceeded.	

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees. (Refer to the *CH2M HILL Personal Protective Equipment Reimbursement Guidelines*)

[b] No facial hair that would interfere with respirator fit is permitted.

[c] Hardhat and splash-shield areas are to be determined by the SC-HW.

[d] Ear protection should be worn when conversations cannot be held at distances of 1 metre (3 feet) or less without shouting.

[e] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SC-HW qualified at that level is present.

15.0 Worker Training and Qualification

15.1 CH2M HILL Worker Training

(Reference CH2M HILL SOP HSE-110, *Training*)

15.1.1 Hazardous Waste Operations Training

All employees engaging in hazardous waste operations or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65. At a minimum, the training shall have consisted of instruction in the topics outlined in 29 CFR 1910.120 and 29 CFR 1926.65. Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities.

15.1.1.1 Initial Training

General site workers engaged in hazardous waste operations shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations, unless otherwise noted in the above-referenced standards.

Employees who may be exposed to health hazards or hazardous substances at treatment, storage, and disposal (TSD) operations shall receive a minimum of 24 hours of initial training to enable the employee to perform their assigned duties and functions in a safe and healthful manner.

Employees engaged in emergency response operations shall be trained to the level of required competence in accordance with 29 CFR 1910.120.

15.1.1.2 Three-Day Actual Field Experience

General site workers for hazardous waste operations shall have received three days of actual experience (on-the-job training) under the direct supervision of a trained, qualified supervisor and shall be documented. If the field experience has not already been received and documented at a similar site, this supervised experience shall be accomplished and documented at the beginning of the assignment of the project.

15.1.1.3 Refresher Training

General site workers and TSD workers shall receive 8-hours of refresher training annually (within the previous 12-month period) to maintain qualifications for fieldwork. Employees engaged in emergency response operations shall receive annual refresher training of sufficient content and duration to maintain their competencies or shall demonstrate competency in those areas at least annually.

15.1.1.4 Eight-Hour Supervisory Training

On site management or supervisors who will be directly responsible for, or supervise employees engaged in hazardous waste site operations, will have received at least 8 hours of additional specialized training on managing such operations. Employees designated as Safety Coordinator – Hazardous Waste are considered 8-hour HAZWOPER Site Safety Supervisor trained.

15.1.2 First Aid/Cardiopulmonary Resuscitation

First aid and CPR training consistent with the requirements of a nationally recognized organization such as the American Red Cross Association or National Safety Council shall be administered by a certified trainer. A minimum of two personnel per active field operation will have first aid and CPR

training. Bloodborne pathogen training located on CH2M HILL's Virtual Office is also required for those designated as first aid/CPR trained.

15.1.3 Safety Coordinator Training

SCs are trained to implement the HSE program on CH2M HILL field projects. A qualified SC is required to be identified in the site-specific HSP for CH2M HILL field projects. SCs must also meet the requirements of the worker category appropriate to the type of field project (construction or hazardous waste). In addition, the SCs shall have completed additional safety training required by the specific work activity on the project that qualifies them to implement the HSE program (for example, fall protection, excavation).

15.1.4 Site-Specific Training

Prior to commencement of field activities, all field personnel assigned to the project will have completed site-specific training that will address the contents of applicable HSPs, including the activities, procedures, monitoring, and equipment used in the site operations. Site-specific training will also include site and facility layout, potential hazards, risks associated with identified emergency response actions, and available emergency services. This training allows field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and work operations for their particular activity.

15.1.5 Project-Specific Training Requirements

Project-specific training for this project includes:

Safety Coordinator Training – CH2M HILL SC-HW must have current SC- Haz Waste
FA/CPR - The assigned SC-HW onsite must have current FA/CPR training.
Fire Extinguisher - The assigned SC-HW onsite must take the on-line fire extinguisher training course.
Waste Management - The assigned SC-HW onsite must take the on-line waste management training course.
Blood-borne Pathogen - The assigned SC-HW must take the CH2M HILL on-line BBP training course.
Behavior-based Loss Prevention - The SC-HW must take the CH2M HILL on-line BBLPS training course.
Dangerous Goods Shipping Training - The SC-HW onsite must take the on-line DG training course

16.0 Medical Surveillance and Qualification

(Reference CH2M HILL SOP HSE-113, *Medical Surveillance*

All site workers participating in hazardous waste operations or emergency response (HAZWOPER) will maintain an adequate medical surveillance program in accordance with 29 CFR 1910.120 or 29 CFR 1926.65 and other applicable OSHA standards. Documentation of employee medical qualification (e.g., physician's written opinion) will be maintained in the project files and made available for inspection.

16.1 Hazardous Waste Operations and Emergency Response

CH2M HILL personnel expected to participate in on site HAZWOPER tasks are required to have a current medical qualification for performing this work. Medical qualification shall consist of a qualified physician's written opinion regarding fitness for duty at a hazardous waste site, including any recommended limitations on the employee's assigned work. The physician's written opinion shall state whether the employee has any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.

16.2 Job or Site-Specific Medical Surveillance

Due to the nature of hazards for a particular job or work site, specialized medical surveillance may be necessary. This surveillance could include biological monitoring for specific compounds, or specialized medical examinations.

Site-specific medical surveillance includes:

- None at this time

16.3 Respirator User Qualification

Personnel required to wear respirators must have a current medical qualification to wear respirators. Medical qualification shall consist of a qualified physician's written opinion regarding the employee's ability to safely wear a respirator in accordance with 29 CFR 1910.134.

16.4 Hearing Conservation

Personnel working in hazardous waste operations or operations that fall under 29 CFR 1910.95 and exposed to noise levels in excess of the 85dBA time-weighted average shall be included in a hearing conservation program that includes annual audiometric testing.

17.0 Site-Control Plan

17.1 Site-Control Procedures

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations)*

Site control is established to prevent the spread of contamination throughout the site and to ensure that only authorized individuals are permitted into potentially hazardous areas.

The SC will implement site control procedures including the following bulleted items.

- Establish support, contamination reduction, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals;
  - Air horn; and
  - Two-way radio or cellular telephone if available.
- Establish offsite communication.
- Establish and maintain the "buddy system."

17.2 Remediation Work Area Zones

(Reference CH2M HILL SOP HSE-218 Hazardous Waste Operations)

A three-zone approach will be used to control areas where site contaminants exist. Access will be allowed only after verification of appropriate training and medical qualification. The three-zone approach shall include an EZ, Contamination Reduction Zone (CRZ) and a Support Zone (SZ). The three-zone approach is not required for construction work performed outside contaminated areas where control of site contamination is not a concern.

Specific work control zones shall be established as necessary during task planning. Site work zones should be modified in the field as necessary, based on such factors as equipment used, air monitoring results, environmental conditions, or alteration of work plans. The following guidelines shall be used for establishing and revising these preliminary zone designations.

17.2.1 Support Zone

The SZ is an uncontaminated area (trailers, offices, field vehicles, etc.) that will serve as the field support area for most operations. The SZ provides field team communications and staging for emergency response. Appropriate sanitary facilities and safety and emergency response equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged and decontaminated materials, or personnel with medical emergencies that cannot be decontaminated.

17.2.2 Contamination Reduction Zone

The CRZ is established between the EZ and the SZ, upwind of the contaminated area where possible. The CRZ provides an area for decontamination of personnel, portable handheld equipment and tools, and heavy equipment. In addition, the CRZ serves as access for heavy equipment and emergency support services.

17.2.3 Exclusion Zone

The EZ is where activities take place that may involve exposure to site contaminants and/or hazardous materials or conditions. This zone shall be demarcated to prevent unauthorized entry. More than one EZ may be established if there are different levels of protection to be employed or different hazards that exist in the same work area. The EZ shall be large enough to allow adequate space for the activity to be completed, including field personnel and equipment, as well as necessary emergency equipment.

The EZ shall be demarcated with some form of physical barrier or signage. The physical barrier or signage shall be placed so that they are visible to personnel approaching or working in the area. Barriers and boundary markers shall be removed when no longer needed.

17.2.4 Other Controlled Areas

Other work areas may need to be controlled due to the presence of an uncontrolled hazard, to warn workers of requirements, or to prevent unauthorized entry. Examples include general construction work areas, open excavations, high noise areas, vehicle access areas, and similar activities or limited access locations. These areas shall be clearly demarcated with physical barriers (fencing, cones, reinforced caution tape or rope) as necessary and posted with appropriate signage.

18.0 Decontamination

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations*)

Decontamination areas will be established for work in potentially contaminated areas to prevent the spread of contamination. Decontamination areas should be located upwind of the exclusion zone where possible and should consider any adjacent or nearby projects and personnel. The SC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SC. The SC must ensure that procedures are established for disposing of materials generated on the site.

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC should establish areas for eating, drinking, and smoking.

18.1 Contamination Prevention

Preventing or avoiding contamination of personnel, tools, and equipment will be considered in planning work activities at all field locations. Good contamination prevention and avoidance practices will assist in preventing worker exposure and result in a more efficient decontamination process. Procedures for contamination prevention and avoidance include the following:

- Do not walk through areas of obvious or known contamination;
- Do not directly handle or touch contaminated materials;
- Make sure there are no cuts or tears in PPE;
- Fasten all closures in suits and cover them with duct tape, if appropriate;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contamination, where possible;
- Do not eat or drink in contaminated work areas;
- Do not carry food, beverages, tobacco, or flame-producing equipment into contaminated work areas;
- Minimize the number of personnel and amount of equipment in contaminated areas to that necessary for accomplishing the work;
- Choose tools and equipment with nonporous exterior surfaces that can be easily cleaned and decontaminated;
- Cover monitoring and sampling equipment with clear plastic, leaving openings for the sampling ports, as necessary; and
- Minimize the amount of tools and equipment necessary in contaminated areas.

18.2 Personnel and Equipment Decontamination

Personnel exiting an EZ must ensure that they are not spreading potential contamination into clean areas or increasing their potential for ingesting or inhaling potential contaminants. Personal decontamination may range from removing outer gloves as exiting the EZ, to proceeding through an outer layer doffing station including a boot and glove wash and rinse, washing equipment, etc. Equipment that has come into contact with contaminated media must also be cleaned/decontaminated when it is brought out of the EZ.

18.3 Decontamination During Medical Emergencies

Standard personnel decontamination practices will be followed whenever possible. For emergency life saving first aid and/or medical treatment, normal decontamination procedures may need to be abbreviated or omitted. In this situation, site personnel shall accompany contaminated victims to advise emergency response personnel on potential contamination present and proper decontamination procedures.

Outer garments may be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Protective clothing can be cut away. If the outer garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances or medical personnel. Outer garments can then be removed at the medical facility.

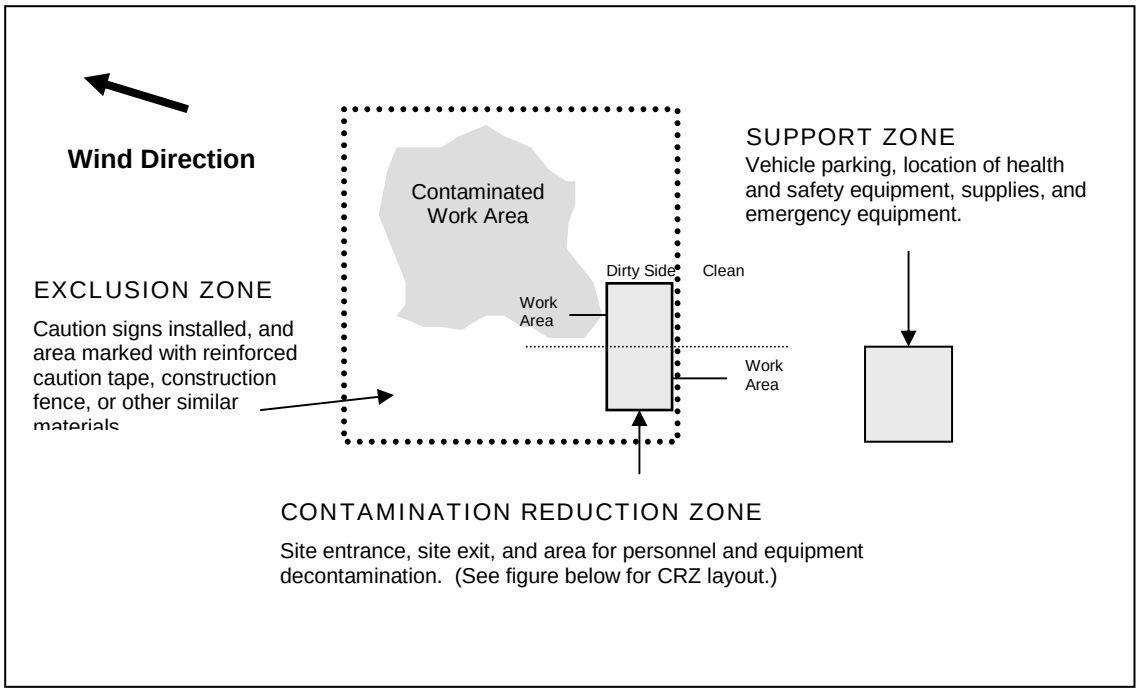
18.4 Waste Collection and Disposal

All contaminated material generated through the personnel and equipment decontamination processes (e.g., contaminated disposable items, gross debris, liquids, sludges) will be properly containerized and labeled, stored at a secure location, and disposed in accordance with the project plans.

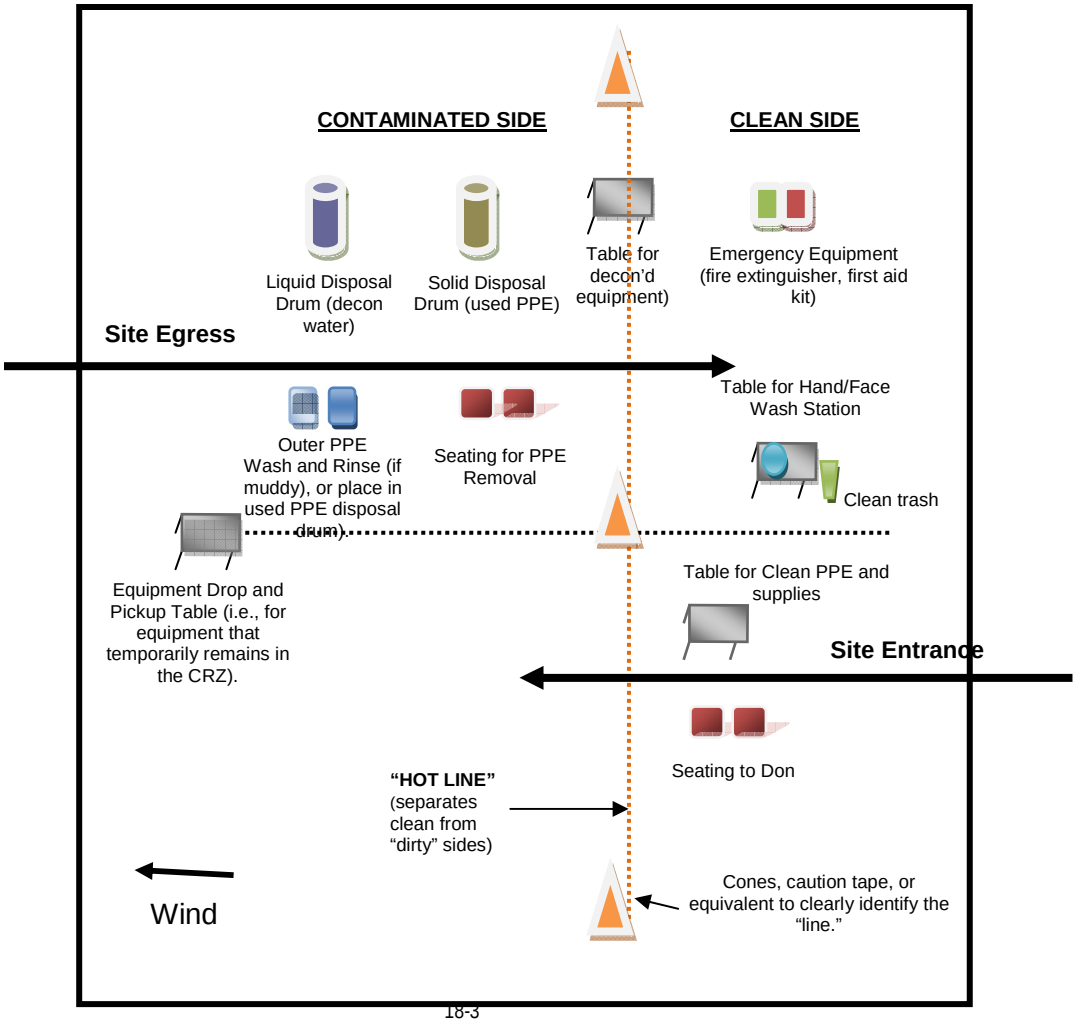
18.5 Diagram of Personnel-Decontamination Line

The following figure illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SC to accommodate task-specific requirements.

Work Area - Set up appropriately based on wind direction



Typical Contamination Reduction Zone



19.0 Emergency Response Plan

(Reference CH2M HILL SOP HSE-106, *Emergency Planning*)

19.1 Pre-Emergency Planning

The Emergency Response Coordinator (ERC), typically the SC or designee, performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate. Pre-Emergency Planning activities performed by the ERC include:

- Review the facility emergency and contingency plans where applicable;
- Determine what onsite communication equipment is available (two-way radio, air horn);
- Determine what offsite communication equipment is needed (nearest telephone, cell phone);
- Confirm and post the "Emergency Contacts" page and route to the hospital located in this section in project trailer(s) and keep a copy in field vehicles along with evacuation routes and assembly areas. Communicate the information to onsite personnel and keep it updated;
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear;
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures;
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies;
- Inventory and check site emergency equipment, supplies, and potable water;
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases;
- Rehearse the emergency response plan before site activities begin. This may include a "tabletop" exercise or an actual drill depending on the nature and complexity of the project. Drills should take place periodically but no less than once a year;
- Brief new workers on the emergency response plan; and
- The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

19.2 Emergency Equipment and Supplies

The ERC shall ensure the following emergency equipment is on the site. Verify and update the locations of this equipment as needed. The equipment will be inspected in accordance with manufacturer's recommendations. The inspection shall be documented in a field logbook or similar means to be kept in the project files.

Emergency Equipment and Supplies	Location
20 (or two 10) class A,B,C fire extinguisher	Field vehicle or boat
First aid kit	Field vehicle or boat
Potable water	Field vehicle or boat
Bloodborne-pathogen kit	Field vehicle or boat
Additional equipment (specify): Cellular phone	Field vehicle or boat

19.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Notify appropriate response personnel;
- Shut down CH2M HILL operations and evacuate the immediate work area;
- Account for personnel at the designated assembly area(s);
- Assess the need for site evacuation, and evacuate the site as warranted;
- Implement HSE-111, Incident Notification, Reporting and Investigation; and
- Notify and submit reports to clients as required in contract.

Small fires or spills posing minimal safety or health hazards may be controlled with onsite spill kits or fire extinguishers without evacuating the site. When in doubt evacuate. Follow the incident reporting procedures in the "Incident Notification, Reporting, and Investigation" section of this HSP.

19.4 Emergency Medical Treatment

Emergency medical treatment is needed when there is a life-threatening injury (such as severe bleeding, loss of consciousness, breathing or heart has stopped). When in doubt if an injury is life-threatening or not, treat it as needing emergency medical treatment.

- Notify 911 or other appropriate emergency response authorities as listed in the "Emergency Contacts" page located in this section.
- The ERC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury, perform decontamination (if applicable) where feasible; lifesaving and first aid or medical treatment takes priority.
- Initiate first aid and CPR where feasible.
- Notify supervisor and if the injured person is a CH2M HILL employee, the supervisor will call the occupational nurse at 1-866-893-2514 and make other notifications as required by HSE SOP-111, *Incident Notification, Reporting and Investigation*.
- Make certain that the injured person is accompanied to the emergency room.
- Follow the Serious Incident Reporting process in HSE SOP-111, Incident Notification, Reporting and Investigation, and complete incident report using the HITS system on the VO or if not feasible, use the hard copy forms provided as an attachment to this HSP.
- Notify and submit reports to client as required in contract.

19.5 Evacuation

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) are to be specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The ERC and a "buddy" will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The ERC will account for all personnel in the onsite assembly area.

- A designated person will account for personnel at alternate assembly area(s).
- The ERC will follow the incident reporting procedures in the "Incident Notification, Reporting and Investigation" section of this HSP.

19.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

19.7 Inclement Weather

Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Field crew members performing work outdoors should carry clothing appropriate for inclement weather. Personnel are to take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop--seek low areas); staying away from open water, metal equipment, railroad tracks, wire fences, and metal pipes; and positioning people several yards apart. Some other general precautions include:

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area;
- The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers;
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding;
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands; and
- Do not use telephones during electrical storms, except in the case of emergency.

Remember that lightning may strike several miles from the parent cloud, so work should be stopped and restarted accordingly. The lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap.

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

20.0 Spill Containment Procedures

CH2M HILL and subcontractor personnel working at the project site shall be knowledgeable of the potential health, safety and environmental concerns associated with petroleum and other substances that could potentially be released at the project site.

The following is a list of criteria that must be addressed in CH2M HILL's or the subcontractor's plans in the event of a spill or release. In the event of a large quantity spill notify emergency services. Personnel discovering a spill shall (only if safe to do so):

- Stop or contain the spill immediately (if possible) or note source. Shut off the source (e.g., pump, treatment system) if possible. If unsafe conditions exist, then leave the area, call emergency services, inform nearby personnel, notify the site supervisors, and initiate incident reporting process. The SC shall be notified immediately;
- Extinguish sources of ignition (flames, sparks, hot surfaces, cigarettes);
- Clear personnel from the spill location and barricade the area;
- Use available spill control equipment in an effort to ensure that fires, explosions, and releases do not occur, recur, or spread;
- Use sorbent materials to control the spill at the source;
- Construct a temporary containment dike of sorbent materials, cinder blocks, bricks or other suitable materials to help contain the spill;
- Attempt to identify the character, exact source, amount, and extent of the released materials. Identification of the spilled material should be made as soon as possible so that the appropriate cleanup procedure can be identified;
- Assess possible hazards to human health or the environment as a result of the release, fire or explosion; and
- Follow incident notification, reporting, and investigation section of this plan.

21.0 Inspections

21.1 Project Activity Self-Assessment Checklists

In addition to the hazard controls specified in this document, Project Activity Self-Assessment Checklists are contained as an attachment to this HSP. The Project-Activity Self–Assessment Checklists are based upon minimum regulatory compliance and some site-specific requirements may be more stringent. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. The self-assessment checklists, including documented corrective actions, shall be made part of the permanent project records and maintained by the SC.

The self-assessment checklists will also be used by the SC in evaluating the subcontractors and any client contractors' compliance on site.

The self-assessment checklists for the following tasks and exposures are required when the task or exposure is initiated and weekly thereafter while the task or exposure is taking place. The checklists shall be completed by the SC or other CH2M HILL representative and maintained in project files.

- Hand and Power Tools

21.2 Safe Behavior Observations

Safe Behavior Observations (SBOs) are a tool to be used by supervisors to provide positive reinforcement for work practices performed correctly, while also identifying and eliminating deviations from safe work procedures that could result in a loss.

The SC or designee shall perform at least one SBO each week for any field work performed by subcontractors or when there are at least two CH2M HILL personnel performing field work.

The SC or designee shall complete the SBO form (attached to this HSP) for the task/operation being observed and submit them weekly.

For commercial projects, SBOs may be submitted electronically by e-mailing them to the address, "CH2MHILL ES COM Safe Behavior Observations" when connected to the network or at SafeBehaviorObservations@ch2m.com. For Federal projects, SBOs may be submitted electronically by e-mailing them to the address, "CH2M HILL ES FED Safe Behavior Observations" " when connected to the network or at CH2MHILLESFEDSafeBehaviorObservation@ch2m.com.

22.0 Incident Notification, Reporting, and Investigation

(Reference CH2M HILL SOP HSE-111, *Incident Notification, Reporting and Investigation*)

22.1 General Information

This section applies to the following:

- All injuries involving employees, third parties, or members of the public;
- Damage to property or equipment;
- Interruptions to work or public service (hitting a utility);
- Incidents which attract negative media coverage;
- Near misses;
- Spills, leaks, or regulatory violations; and
- Motor vehicle accidents.

Documentation, including incident reports, investigation, analysis and corrective measure taken, shall be kept by the SC and maintained onsite for the duration of the project.

22.2 Section Definitions

Incident: An incident is an event that causes or could have caused undesired consequences. An incident may be caused by natural forces, employees, subcontractors, or third parties in any location associated with CH2M HILL operations, including offices, warehouses, project sites, private property, or public spaces. Incidents include:

- Injury or illness to a CH2M HILL employee or subcontractor employee, or member of the public;
- Property damage;
- Spill or release;
- Environmental requirement or permit violation;
- A "near-miss"; or
- Other (e.g., fire, explosion, bomb threat, workplace violence, threats)**Accident**: an incident involving actual loss through injury, damage to assets, or environmental harm.

Near Miss: A near-miss occurs when an intervening factor prevented an injury or illness, property damage, spill or release, permit violation or other event from occurring. Examples of near-miss situations include: a hard hat or other personal protective equipment (PPE) prevented an injury; secondary containment or emergency shutoff prevented a spill; or an alert co-worker prevented an incident.

Serious Incident:

A Serious Incident must be immediately reported to senior management includes:

- Work related death, or life threatening injury or illness of a CH2M HILL employee;
- subcontractor, or member of the public;
- Kidnap/missing person;
- Acts or threats of terrorism;
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage; or

- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

22.3 Reporting Requirements

All employees and subcontractors' employees shall immediately report any incident (including "near misses," as defined in the section above) in which they are involved or witness to their supervisor.

The CH2M HILL or Subcontractor supervisor, upon receiving an incident report, shall inform his immediate superior and the CH2M HILL SC.

The SC shall immediately report the following information to the RHSM and PM by phone and e-mail:

- Project Name and Site Manager;
- Date and time of incident;
- Description of incident;
- Extent of known injuries or damage;
- Level of medical attention; and
- Preliminary root cause/corrective actions

The RHSM shall immediately inform the EM (or available alternate) of spills, potential environmental permit compliance, or any environmental situation that could result in a notice of violation from an agency.

The CH2M HILL team shall comply with all applicable statutory incident reporting requirements such as those to OSHA, the police, or state or Federal environmental agency.

22.4 HITS System and Incident Report Form

CH2M HILL maintains a HITS entry and/or Incident Report Form (IRF) for all work-related injuries and illnesses sustained by its employees in accordance with recordkeeping and insurance requirements. A HITS entry and/or IRF will also be maintained for other incidents (property damage, fire or explosion, spill, release, potential violation, and near misses) as part of our loss prevention and risk reduction initiative.

The SC shall complete an entry into the Hours and Incident Tracking System (HITS) database system located on CH2M HILL's Virtual Office (or if VO not available, use the hard copy Incident Report Form and Root Cause Analysis Form and forward it to the RHSM) within 24 hours and finalize those forms within 3 calendar days.

22.5 Injury Management/Return-to-Work (for US/Puerto Rico based CH2M HILL Staff Only)

(Reference CH2M HILL, SOP HSSE-124, Injury Management/Return-to-Work)

22.5.1 Background

The Injury Management Program has been established to provide orderly, effective and timely medical treatment and return-to-work transition for an employee who sustains a work-related injury or illness. It also provides guidance and assistance with obtaining appropriate treatment to aid recovery, keep supervisors informed of employee status, and to quickly report and investigate work-related injury/illnesses to prevent recurrence.

To implement the Injury Management/Return-to-Work Program successfully, supervisors and/or SC should:

- Ensure employees are informed of the Injury Management/Return-to-Work Program;
- Become familiar with the Notification Process (detailed below); and
- Post the Injury Management/Return-to-Work Notification Poster.

22.5.2 The Injury Management/Return-to-Work Notification Process:

- Employee informs their supervisor.
- Employee calls the Injury Management Program toll free number 1-866-893-2514 immediately and speaks with the Occupational Injury Nurse. This number is operable 24 hours per day, 7 days a week.
- Supervisor ensures employee immediately calls the Injury Management Program number. Supervisor makes the call with the injured worker or for the injured worker, if needed.
- Nurse assists employee with obtaining appropriate medical treatment, as necessary schedules clinic visit for employee (calls ahead, and assists with any necessary follow up treatment). The supervisor or SC accompanies the employee if a clinic visit is necessary to ensure that employees receive appropriate and timely care.
- Supervisor or SC completes the HITS entry or Incident Report Form immediately (within 24 hours) and forwards it to the Project Manager and RHSM.
- Nurse notifies appropriate CH2M HILL staff by e-mail (supervisor, Health & Safety, Human Resources, Workers' Compensation).
- Nurse communicates and coordinates with and for employee on treatment through recovery.
- Supervisor ensures suitable duties are identified and available for injured or ill workers who are determined to be medically fit to return to work on transitional duty (temporary and progressive).
- Supervisor ensures medical limitations prescribed (if any) by physician are followed until the worker is released to full duty.

22.6 Serious Incident Reporting Requirements

(Reference CH2M HILL SOP HSE-111, *Incident Reporting, Notification and Investigation*)

The serious incident reporting requirements ensures timely notification and allows for positive control over flow of information so that the incident is handled effectively, efficiently, and in conjunction with appropriate corporate entities. This standard notification process integrates Health, Safety, Security and Environment and Firm Wide Security Operations requirements for the consistent reporting of and managing of serious events throughout our operations.

22.6.1 Serious Incident Determination

The following are general criteria for determining whether an incident on CH2M HILL owned or managed facilities or program sites is considered serious and must be immediately reported up to Group President level through the reporting/notification process:

- Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or member of the public;
- Kidnap or missing person;
- Acts or threats of terrorism;
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage; or

- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

22.6.2 Serious Incident Reporting

If an incident meets the "Serious Incident" criteria, the Project Manager is to immediately contact the Crisis Manager at 720-286-4911, then follow the standard incident reporting procedure.

For all serious incidents this standard reporting process is implemented immediately so as to ultimately achieve notification to the Business Group President within 2 hours of incident onset or discovery, and notification to appropriate corporate Crisis Management Support Team.

22.7 Incident Root Cause Analysis

The accident analysis is essential if all causes of the incident are to be identified for the correct remedial actions to be taken to prevent the same and similar type of incident from recurring. Root Cause Analysis (RCA) shall be completed for all recordable injuries, property damage incidents in excess of $5000.00 (US), environmental permit violations, spills and releases which are required to be reported to regulatory agencies, and any other incident, including near misses where they RHSM or PM determines an RCA is appropriate. The RHSM/REM is responsible for ensuring it is completed and results entered in the incident report form in HITS. RCA's must be completed using a Team that includes, at least the RHSM or designee, the involved party(ies), a responsible operations representative (e.g. PM, construction manager, crew supervisor, etc.) and an independent management representative not associated with the incident.

The Root Cause Analysis Form must be completed for all Loss Incidents and Near Loss Incidents. This form must be submitted to the investigation team for review.

For minor losses or near losses, the information may be gathered by the supervisor or other personnel immediately following the loss. Based on the complexity of the situation, this information may be all that is necessary to enable the investigation team to analyze the loss, determine the root cause, and develop recommendations. More complex situations may require the investigation team to revisit the loss site or re-interview key witnesses to obtain answers to questions that may arise during the investigation process.

Photographs or videotapes of the scene and damaged equipment should be taken from all sides and from various distances. This point is especially important when the investigation team will not be able to review the loss scene.

The investigation team must follow the Root Cause Analysis Flow Chart (see Attachment 4 of the SOP) to assist in identifying the root cause(s) of a loss. Any loss may have one or more root causes and contributing factors. The root cause is the primary or immediate cause of the incident, while a contributing factor is a condition or event that contributes to the incident happening, but is not the primary cause of the incident. Root causes and contributing factors that relate to the person involved in the loss, his or her peers, or the supervisor should be referred to as "personal factors." Causes that pertain to the system within which the loss or injury occurred should be referred to as "job factors."

Personal factors include:

- Lack of skill or knowledge;
- Correct way takes more time and/or requires more effort;
- Short-cutting standard procedures is positively reinforced or tolerated; or
- Person thinks there is no personal benefit to always doing the job according to standards.

Job Factors include:

- Lack of or inadequate operational procedures or work standards;
- Inadequate communication of expectations regarding procedures or standards; or
- Inadequate tools or equipment.

The root cause(s) could be any one or a combination of these seven possibilities or some other uncontrollable factor. In the vast majority of losses, the root cause is very much related to one or more of these seven factors. Uncontrollable factors should be used rarely and only after a thorough review eliminates all seven other factors.

22.7.1 Corrective Actions

Include all corrective actions taken or those that should be taken to prevent recurrence of the incident. Include the specific actions to be taken, the employer and personnel responsible for implementing the actions, and a timeframe for completion. Be sure the corrective actions address the causes.

Once the investigation report has been completed, the PM shall hold a review meeting to discuss the incident and provide recommendations. The responsible supervisors shall be assigned to carry out the recommendations, and shall inform the SC upon successful implementation of all recommended actions.

- Evaluation and follow-up of the IRF will be completed by the type of incident by the RHSM, EM, or FWSO.
- Incident investigations must be initiated and completed as soon as possible but no later than 72 hours after the incident.

23.0 Records and Reports

An organized project filing system is essential for good documentation and recordkeeping. There are many benefits to an organized filing system:

- Other CH2M HILL employees can easily and quickly find documents;
- Records are readily available for review;
- Records may be needed during OSHA investigations, audits, or other legal matters;
- Records may be needed on short notice in case of an accident, illness or other emergency; and
- Systematic recordkeeping aids in overall project organization.

The project filing system shall be established at the beginning of the project and maintained throughout all phases of construction and archived in accordance with CH2M HILL's Records Retention Policy. The information contained in the filing system shall be updated regularly and/or as specified in this document. The PM and SC are responsible for collecting documentation, including subcontractor documentation, and maintaining a complete and organized filing system.

Below are examples of records that must be maintained as the project progresses:

- Exposure records includes air monitoring data (including calibration records), MSDSs, exposure modeling results;
- Physical hazard exposure records include noise, ionizing radiation, non-ionizing radiation, vibration, and lasers exposure assessments and measurements;
- Respiratory fit test records;
- Training records;
- Incident reports, investigations and associated back-up information such as agency notifications, calculations, and corrective actions taken;
- Federal or state agency inspection records;
- Other Records:
  - Ergonomic evaluations;
  - HSE audits and assessments;
  - Project-specific HSE plans;
  - Equipment inspections;
  - Equipment maintenance;
  - Emergency equipment inspection records;
  - SBOs;
- The RHSM shall coordinate with the PM or designee to ensure that final project-specific HSE records described in this section, including negative exposure determinations, are maintained with the project files in accordance with the CH2M HILL records retention schedule, or forwarded to the Medical Surveillance Program Administrator, as appropriate. Records retention requirements are detailed in the Recordkeeping and Access to Records SOP, HSE-119.

CH2M HILL Health and Safety Plan

Attachment 1

Health and Safety Plan Employee Sign-off Form

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: **Project Number:**

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

CH2M HILL Health and Safety Plan

Attachment 2

Chemical Inventory/Register Form

CH2MHILL

CHEMICAL INVENTORY/REGISTER FORM

Refer to SOP HSE-107, Attachment 1, for instructions on completing this form.

Location:

HCC:

☐ Office ☐ Warehouse ☐ Laboratory ☐ Project:

Project No.:

Regulated Product	Location	Container labeled (✓if yes)	MSDS available (✓if yes)

MSDS for the listed products will be maintained at:

CH2M HILL Health and Safety Plan

Attachment 3

Chemical-Specific Training Form

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Refer to SOP HSE-107 Attachment 1 for instructions on completing this form.

Location:	Project # :
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

CH2M HILL Health and Safety Plan

Attachment 4

Project Activity Self-Assessment Checklists/Permits/Forms

Hand and Power Tools

CH2M HILL Health and Safety Plan

Attachment 5

Key Target Zero Program Elements

Activity Hazard Analysis

Pre-Task Safety Plans

Safe Behavior Observation

ACTIVITY HAZARD ANALYSIS

Activity:	**Date**:
	Project Name:
Description of the work:	**Site Supervisor**:
	Site Safety Officer:
	Review for latest use: Before the job is performed

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls (Develop specific controls for each potential hazard)

ACTIVITY HAZARD ANALYSIS

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls (Develop specific controls for each potential hazard)

Equipment to be used (List equipment to be used in the work activity)	**Inspection Requirements** (List inspection requirements for the work activity)	**Training Requirements** (List training requirements including hazard communication)

ACTIVITY HAZARD ANALYSIS

	PRINT NAME	SIGNATURE	
Supervisor Name:	_____	_____	**Date/Time:** _____
Safety Officer Name:	_____	_____	**Date/Time:** _____
Employee Name(s):	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____
	_____	_____	**Date/Time:** _____

CH2MHILL

Pre-Task Safety Plan (PTSP) and Safety Meeting Sign-in Sheet

Project:_____ Location: _____ Date:_____

Supervisor: _____ Job Activity:_____

_____

Attendees: Print Name Sign Name

_____

_____

_____

_____

_____

_____

_____

List Tasks and verify that applicable AHAs have been reviewed:

_____

_____

_____

Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools):

_____

_____

_____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check all that apply):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__ Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__ Heights/fall > 6 feet	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__ Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__ Welding/cutting	__ Demolition
__Underground Utilities	__ Security	__ Poor communications

Other Potential Hazards (Describe):

_____

_____

_____

Hazard Control Measures (Check All That Apply):

PPE	Protective Systems	Fire Protection	Electrical
__ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device __ Hard Hat	__ Sloping __ Shoring __ Trench box __ Barricades __ Competent person __ Locate buried utilities __ Daily inspections __ Entry Permits/notification	__ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment	__ Lockout/tagout __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected __ Overhead line clearance __ Underground utils ID'd
Fall Protection	**Air Monitoring**	**Proper Equipment**	**Welding & Cutting**
__ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	__ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ No visible dust __ Other	__ Aerial lift/ladders/scaffolds __ Forklift/heavy equipment __ Backup alarms __ Hand/power tools __ Crane with current inspection __ Proper rigging __ Operator qualified	__ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in CSE __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry	**Medical/ER**	**Heat/Cold Stress**	**Vehicle/Traffic**
__ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue	__ First-aid kit __ Eye wash __ FA-CPR trained personnel __ Route to hospital	__ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	__ Traffic control __ Barricades __ Flags __ Signs
Permits	**Demolition**	**Inspections:**	**Training:**
__ Hot work __ Confined space __ Lockout/tagout __ Excavation __ Demolition __ Energized work	__ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	__ Ladders/aerial lifts __ Lanyards/harness __ Scaffolds __ Heavy equipment __ Drill rigs/geoprobe rigs __ Cranes and rigging __ Utilities marked	__ Hazwaste (current) __ Construction __ Competent person __ Task-specific __ FA/CPR __ Confined Space __ Hazcom
Underground Utilities	**Incident Communications**	**AHA' s**	
__Dig alert called __3rd Party locater __As-builts reviewed __Interview site staff __Client review __soft locate necessary?	__Work stops until cleared by TM/CM __Immediate calls to TM/CM __Client notification __24 hour notification setup __Clear communications	__reviewed and approved by HSM __on site and current __applicable for this day's work __Communication and incident processes included?	

Field Notes (including observations from prior day, etc.):

_____

_____

_____

Name (Print): _____

Signature:_____ Date:_____

CH2MHILL

Safe Behavior Observation Form		
☐Federal or ☐Commercial Sector (check one)	☐Construction or ☐Consulting (check one)	
Project Number:	Client/Program:	
Project Name:	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- ❖ Identify and reinforce safe work practices/behaviors
- ❖ Identify and improve on at-risk practices/acts
- ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- ❖ Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

For ES Federal Sector projects please email completed forms to: CH2M HILL ES FED Safe Behavior Observation
For ES Commercial Sector projects please email completed forms to: CH2M HILL ES COM Safe Behavior Observation
For CNR ES staff please email completed forms to: cnressafe@ch2m.com

Agency Inspection Target Zero Bulletin

Environmental Services Business Group

TARGET ZERO Bulletin

Subject: HSSE Agency Inspections (OSHA, EPA, DOT, State Health Department)

Do you know what YOU would do if an agency inspector arrived at your site unannounced?

Recently, a State Occupational Safety and Health Administration (OSHA) inspector made an unannounced visit to one of our Federal project sites. OSHA, U.S. Environmental Protection Agency (EPA), and authorized state or local agencies have authority to inspect any facility that is subject to health, safety, and environmental legislation. Inspections may be announced or unannounced. This particular inspector indicated that the project was targeted for an inspection because the work was funded by the American Recovery and Reinvestment Act (ARRA).

Enterprise Standard Operating Procedure (SOP) HSE-201, *Agency Inspections and Communications,* describes the responsibilities, procedures, and requirements associated with inspections conducted by external regulatory agencies, as well as the methods for communicating information to key individuals. This Target Zero Bulletin is a brief summary of what to do in the event of an agency inspection at your site. Refer to the SOP for more specific guidance.

Notification of Inspections

- If the inspection is an announced regulatory agency inspection, the Project Manager (PM) should notify the Responsible Health and Safety Manager (RHSM) and Responsible Environmental Manager (REM) well in advance of the inspection.
- If an unannounced agency inspector visits one of our projects, Field personnel must immediately notify the project Emergency Response Coordinator (ERC). Typically the ERC is the Safety Coordinator (SC).
- The ERC must immediately notify the RHSM/REM, as appropriate, of unannounced inspections, or designate someone to call the RHSM/REM. The RHSM/REMs can provide guidance to the field staff and PM.

Inspector Credential Verification

- Upon arrival, the ERC must request the inspector to provide official credentials. Record the inspector's name and office phone number or obtain the inspector's business card.
- The inspector shall sign the visitors log and be given a site-specific health, safety, and environmental protection briefing.
- The inspector shall meet any site access requirements associated with security clearances, specialized training, and medical monitoring. The CH2M HILL representative shall verify that the inspector possesses these requirements; access will only be granted to those areas where appropriate access requirements are met. Some inspectors have the authority to gain access to any work area at any time, such as an inspector with a search warrant. In these cases, we can stop work operations as necessary to protect the safety of the inspector(s).

Opening Conference

- The CH2M HILL Project Manager, ERC, RHSM, or REM, and the inspector shall determine attendees for the opening conference. The RHSM (for OSHA and other worker health and safety inspections) or REM (for environmental inspections) shall join the opening conference via conference call.
- The inspector shall inform CH2M HILL of the purpose of the inspection and provide a copy of the complaint, if applicable.
- The inspector shall outline the scope of the inspection, including employee interviews conducted in private, physical inspection of the workplace and records, possible referrals, discrimination complaints, and the closing conference(s).

Requests for OSHA Logs

- An OSHA inspector may request to review the project OSHA Injury/Illness log, better known as the OSHA 300 Log. Contact your RHSM for assistance in obtaining the OSHA 300 Log.
- Field projects with a continuous duration of one year or longer are considered to be separate establishments and are required to maintain an OSHA 300 log specific to the project. The project OSHA 300 log should be maintained onsite and kept current.
- Recordable injuries and illnesses sustained on field projects less than one year in duration are maintained on the CH2M HILL office log where the injured employee is based.

The Inspection

- The scope of the inspection shall be limited to that indicated by the inspector in the opening conference. The inspector shall be escorted to relevant areas only. The ERC or other designated by the RHSM or REM must accompany the inspector during the inspection.
- Ensure that the inspection is limited to the scope that the inspector disclosed during the opening conference. The ERC should always take notes which identify: areas inspected, machinery or equipment and materials examined, employees or other persons interviewed, and photographs taken by the inspector.
- The inspector will observe safety, health, and environmental conditions and practices and document the inspection process. The inspector may also take photos and instrument readings, examine records, collect air samples, measure noise levels, survey existing engineering controls, and monitor employee exposure to toxic vapors, gases, and dusts.
- CH2M HILL should gather duplicate information (photographs, readings, samples) in the same manner and condition as the inspector. If the equipment needed to take duplicate samples is not onsite, ask the inspector if the sampling can wait until the equipment is available. If samples are taken, request a description of the tests that the agency intends to perform on the samples and request results as soon as they are available.
- Employees may be questioned during the inspection tour. The employee can refuse to speak to an inspector, can speak to the inspector with a company representative (including management) present, or can speak to the inspector privately. It is CH2M HILL policy that employees who wish to speak to the inspector are not discriminated against, intimidated, or otherwise mistreated for exercising their rights during compliance inspections.
- Copies of documents should not be provided to the inspector without the approval of the RHSM or REM or Legal Insurance Department (LID). **DO NOT** voluntarily release documents. Respond only to inspection team requests.
- During the course of the inspection, the inspector may point out violations. For each violation, the CH2M HILL representative should ask the inspector to discuss possible corrective action. Where possible, violations detected by the inspector should be corrected immediately and noted by the inspector as corrected.
- For those items which cannot be corrected immediately, an action plan shall be formulated for timely correction. In any instance, employees exposed to hazards shall be removed from the area.

Closing Conference

After the inspection, a closing conference is normally held as follows:

- The CH2M HILL PM, ERC, RHSM or REM shall be involved via conference call in the closing conference, at a minimum;
- The inspector shall describe the apparent violations found during the inspection and other pertinent issues as deemed necessary by the inspector. CH2M HILL shall be advised of their rights to participate in any subsequent conferences, meetings or discussions. Any unusual circumstances noted during the closing conference shall be documented by the ERC;
- The inspector shall discuss violations observed during the inspection and indicate for which violations a citation and a proposed penalty may be issued or recommended;
- The ERC shall request receipts for all samples and approved documents photocopied by the inspector, request a photocopy of the inspector's photograph log, and request a copy of the final inspection report; and
- Any documentation from an agency inspection must be transmitted immediately to the RHSM or REM, and LID.

Unannounced regulatory agency inspections may happen at any time on our projects -

Get your RHSM/REM and PM involved immediately if an Inspector arrives.

Appendix D
Analytical Specs

APPENDIX D

Analytical Specifications

TABLE D-1
Summary of Test Conditions for Sediment Testing with *Eohaustorius estuarius*
Salt Chuck Mine Preremedial Intertidal Investigation

1. Test type:	Static nonrenewal
2. Test duration:	10 days
3. Temperature:	15 ± 1˚C
4. Dissolved oxygen:	> 5 mg/L
5. Salinity:	Selected test salinity, frequently 28‰ (± 1‰)
6. Light quality & intensity:	Ambient laboratory light of at least 100 lux (9.3 ft-candles) at the test sediment surface (ASTM E1367)
7. Photoperiod:	Continuous illumination
8. Test chambers:	1 L glass beakers covered with watch glasses
9. Test solution volume:	175 mL (~2 cm deep layer) test sediment/replicate; fill to 950 mL mark with overlying water
10. Renewal of test solutions:	None
11. Age of test organisms:	Adult, 3-5 mm length; no females with embryos
12. No. of amphipods/container:	20
13. Test Concentrations:	100%, 50%, 25%, 12.5%, 6.25%, & 0% (control)
14. No. of replicates/concentration:	5
15. No. of amphipods/concentration:	100
16. Feeding regime:	No feeding during test
17. Aeration:	Provided through 1-mL glass pipet placed not closer than 2 cm from sediment & bubbled at a rate not to disturb sediment surface (~100 bubbles/min)
18. Overlying (test) water:	Filtered (≤0.45µm) seawater at 28‰ or other selected salinity. Use oceanic or MilliQ deionized water to salinity-adjust.
19. Endpoints:	Mortality, sediment emergence & failure to rebury
20. Test acceptability criteria:	≤10% mean mortality & ≤20% individual replicate mortality in negative control
21. Performance criteria:	Reference sediment mean mortality ≤20% higher than that in negative control (PSDDA)
22. Sample volume required:	Approx. 2.5L/sediment
23. Negative control:	Amphipod collection site sediment
24. Positive control:	96-hour reference toxicant water only NH_3 test; endpoint LC50

Note:

Adult amphipods are exposed in a static system for ten days to five replicates of test sediment. Endpoints are mortality, emergence and failure to rebury.

TABLE D-2
Summary of Test Conditions for Testing with Polychaete, *Neanthes arenaceodentata*
Salt Chuck Mine Preremedial Intertidal Investigation

1. Test type:	Static renewal
2. Test Duration:	20 days
3. Temperature:	20 ± 1˚C
4. Dissolved oxygen:	>4 mg/L
5. Salinity:	28 □ 2 ‰
6. Light quality & intensity:	Ambient laboratory light.
7. Photoperiod:	Continuous illumination
8. Test chambers:	1 L glass beakers covered with watch glasses
9. Test solution volume:	175 mL (~2 cm deep layer) test sediment/ replicate; fill to 950 mL mark with overlying water
10. Renewal of test solutions:	1/3 of overlying replaced every 3rd day
11. Age of test organisms:	2 3 weeks post emergence (corresponds to 0.5 1.0 mg dry wt.)
12. Number of worms/container:	5
13. Test Concentrations	100%, 50%, 25%, 12.5%, 6.25%, & 0% (control)
14. Number of replicates/conc:	5
15. Number of worms/conc:	25
16. Feeding regime:	40 mg ground TetraMarine®/beaker every other day
17. Aeration:	Provided through 1 mL glass pipet placed not closer than 2 cm from sediment & bubbled at a rate not to disturb sediment surface (~100 bubbles/min)
18. Overlying (test) water:	Filtered (≤0.45 µm) seawater at 28‰. Use oceanic or MilliQ deionized water to salinity-adjust.
19. Endpoints:	Survival, total biomass, individual biomass, and growth rate
20. Test acceptability criteria:	Control: ≤10% mean mortality (PSEP); target growth rate, >0.72 mg/worm/day (failure if <0.38 mg/worm/day). Initial worm weight: 0.5-1.0 mg dry wt. (failure if <0.25 mg)(PSDDA)
21. Performance criteria:	Reference sediment should have ≤20% mortality & growth rate of ≥80% that of control.
22. Sample volume required:	Approx. 2.5L/sediment
23. Negative control:	amphipod (Eohaustorius) Yaquina Bay collection site sediment
24. Positive control:	Reference toxicant 96 hour water only NH3 test, endpoint LC50

Note: Juvenile worms are exposed in a static renewal system for 20 days to five replicates of test sediment. Endpoints are survival, total biomass, average individual biomass, and average individual growth rate.

TABLE D-3
Summary of Test Conditions for Sediment Testing with *Menidia beryllina*
Salt Chuck Mine Preremedial Intertidal Investigation

1. Test type:	Static non-renewal
2. Test duration:	Bivalve species - 48 hours, or until complete development up to 54 hours. Echinoderms - 48-96 hours to achieve normal pluteus larvae in controls.
3. Temperature:	20 ± 1°C oysters 16 ± 1°C mussels (ASTM), 15 or 18 ± 1°C (EPA 1995) 15 ± 1°C echinoderms
4. Dissolved oxygen:	≥ 60% saturation
5. Salinity:	30 ± 2‰
6. Light quality & intensity:	Ambient laboratory light (50-100 ft-c)
7. Photoperiod:	16:8 hr L/D
8. Test chambers:	30 ml glass vials
9. Test solution volume:	10 ml per replicate
10. Renewal of test solutions:	None
11. Age of test organisms:	<4 hr old embryos
12. No. of larvae/container:	150-300
13. Test Concentrations	100%, 50%, 25%, 12.5%, 6.25%, & 0% (control)
14. No. of replicates/treatment:	5
15. No. of zero time replicates:	6
16. Feeding regime:	Organisms are not fed during the test.
17. Aeration:	None. Initially aerated if necessary to achieve >60% saturation.
18. Dilution water:	Filtered Yaquina Bay seawater, salinity adjusted to 30 ± 2‰ and filtered to ≤0.45 μm.
19. Effects measured:	Bivalve mollusks - Mortality and abnormal shell development. Echinoderms – Mortality and abnormal pluteus development.
20. Test acceptability:	≥70% of embryos introduced into a required control treatment resulted in live normal larvae.
21. Sample volume required:	2 L normally requested, but depends on sediment type. Sandy sediments must contain at least 150 mL of eluitriate.