



SFPP, L.P.

Operating Partnership

March 16, 2018

Ching Yin To
Industrial Permitting Unit
California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, California 90013

Subject: Monitoring Plan and Quality Assurance Project Plan (QAPP) to Address Harbor Toxics Total Maximum Daily Load Monitoring Requirements. SFPP Norwalk Pump Station, National Pollutant Discharge Elimination System Permit Number CA0063509 (Order No. R4-2016- 0309)

Dear Ms. To,

SFPP, L.P. (SFPP), an operating partner of Kinder Morgan Energy Partners, L.P., is pleased to submit the enclosed Monitoring Plan and Quality Assurance Project Plan (QAPP) for Harbor Toxics Total Maximum Daily Load (TMDL) monitoring to the California Regional Water Quality Control Board, Los Angeles Region (Water Board) for review. This document addresses surface water and sediment sampling and reporting requirements established in Order R4-2016-0309 (Provision VII.C.2.b) for a site- specific study by the SFPP Norwalk Pump Station.

We look forward to receiving any comments on this Work Plan and QAPP. Please do not hesitate to contact me at 714.560.4802 or Eric Davis of CH2M at 213.228.8262 should you have any questions or desire additional information.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on the 16th day of March 2018, at 11:42 a.m.

Sincerely,

SFP, L.P.

A handwritten signature in blue ink, appearing to read 'Stephen Defibaugh', is written over a horizontal line.

Stephen Defibaugh, RG, CHG
Remediation Project Manager

cc: Cassandra D. Owens, Water Board
Samuel Unger, Water Board
Paul Cho, Water Board
Eric Davis, CH2M
Jeffrey Johnson, CH2M
Norwalk Tank Farm Restoration Advisory Board



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Mr. Samuel Unger, P.E.
California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, California 90013

March 19, 2018

Subject: **Response to the Los Angeles Regional Water Quality Control Board
Comments on the: *Draft Monitoring Plan and Quality Assurance – SFPP, L.P.,
SFPP Norwalk Pump Station, Norwalk, California (NPDES No. CA0063509), Dated
October 30, 2017***

Dear Mr. Unger,

On behalf of Santa Fe Pacific Pipeline, L.P. (SFPP), an operating partner of Kinder Morgan Energy Partners, L.P. (KMEP), CH2M HILL Engineers, Inc. (CH2M) has prepared this response to comments provided by the Los Angeles Regional Water Quality Control Board (Water Board) on the *Draft Monitoring Plan and Quality Assurance Project Plan – SFPP, L.P., SFPP Norwalk Pump Station, Norwalk California*, dated October 30, 2017. The Water Board's comments were received by SFPP and KMEP on February 26, 2018.

Background

Kinder Morgan Energy Partners, L.P. owns and operates a groundwater treatment system (GWTS) at the former SFPP Norwalk Pump Station (Norwalk Station) located within the Defense Fuel Support Point (DFSP) Norwalk site, at 15306 Norwalk Boulevard, Norwalk, California. Treated groundwater is discharged from Norwalk Station to Coyote Creek, located within the San Gabriel River Watershed, under a National Pollutant Discharge Elimination System (NPDES) Permit (Order Number [No.] R4-2016-0309), as adopted by the Water Board. Section VII.C.2.b of the Norwalk Station NPDES Permit states that dischargers into the San Gabriel River Watershed shall conduct ambient surface water and sediment monitoring at the mouth of the San Gabriel River to comply with the Toxic Pollutants in the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters total maximum daily load (TMDL) [herein referred to as the Harbor Toxics TMDL] requirement (Water Board, 2011). CH2M prepared the Monitoring Plan and Quality Assurance Project Plan (QAPP) on behalf of Kinder Morgan to present the approach for performing Harbor Toxics TMDL monitoring for this site.

Response to Comments

Responses to Water Board comments are presented below, and are organized by section and by each Water Board comment (italicized) followed by the SFPP response.

1. *Section 2.2. Sample Media and Frequency. Since the Facility discharges to Coyote Creek, the dry and wet weather conditions used in the Compliance Monitoring Program shall be consistent with the dry and wet weather conditions for Coyote Creek as defined in the San Gabriel River Metals TMDL.*

The dry and wet weather conditions for Coyote Creek included in the San Gabriel River Metals TMDL are as follows:

- Dry weather condition applies to any day when the maximum daily flowing Coyote Creek is less than 156 cubic feet per second (cfs) as measured at the Los Angeles County Department of Public Works' (LACDPW) flow gauge station F354-R, located at the bottom of the creek just above the Long Beach Water Reclamation Plant.*
- Wet weather condition applies to any day when the maximum daily flow in Coyote Creek is equal to or greater than 156 cubic feet per second (cfs) as measured at the LACDPW's flow station F354-R, located at the bottom of the creek just above the Long Beach Water Reclamation Plant.*

As such, references to the USGS gauging station 11085000 that were included in the Draft Plans to define dry and wet weather conditions for the Compliance Monitoring Program shall be replaced in the references to LACDPW's flow gauge station F354-R and the definition of dry and wet weather conditions for Coyote Creek as indicated above.

Since the Discharger is developing a site-specific Compliance Monitoring Program, and if discharges from the Facility will be intermittent and may not occur for the duration of a calendar year, the Discharger may stipulate in the document that the Discharger will conduct sampling required by Harbor Toxics TMDL Compliance Monitoring Program only during a calendar year when a discharge occurs from the Facility.

Response:

SFPP appreciates the clarification on the proper gauging station to use; the document has been revised accordingly.

2. Section 3.5. Flow Measurement: *If possible, flow measurements shall be conducted during each sampling event at the sampling location at the mouth of the San Gabriel River. However, if it is not possible to measure flow at that location due to safety reasons, a flow measurement shall be taken at the nearest safe location, and the new location shall be documented in the annual report. If no safe sampling location can be identified during a sampling event, the unsafe conditions shall be documented and included in the corresponding annual report, and the Discharger may report the combined flow at the two LACDPW flow gauge stations at San Gabriel River Reach 1 and Coyote Creek as an estimation of flow at the mouth of the river for that sampling event.*

Use of this estimation shall be the least preferable method. The estimation of flow suggested in the Draft Plans based on the sum of the two LACDPW flow gauge stations at San Gabriel River Reach 1 and Coyote Creek may not be representative of the flow at the mouth of the River, as these locations do not account for the inflow to the River downstream of the flow gauge stations and prior to reaching the mouth of the River (approximately 6 miles), the span of which includes inflows from several major dischargers.

Response:

SFPP agrees that direct field measurements are preferred over an estimate based on gauging station data. The document has been revised to highlight this point.

3. Section 4.1.3 Equipment Blank Samples: *If an equipment blank is not analyzed every sampling event and only annually as suggested, the Plans should include procedures to ensure the proper cleaning of the tubing to avoid cross contamination between sample events and biological growth due to long periods of inactivity.*

Response:

An equipment blank will be collected during each sampling event. The second paragraph of this section has been deleted.

4. Table A-2. Field Data Reporting Requirements: *Please report the actual salinity results above 1.0 ppt.*

Response:

The document has been revised accordingly.

5. Attachment 1. Note to Standardize SWAMP Field Data Sheets. *The sample time for each sample (Item 1 listed on the “Key Reminders to Identify Samples” section) shall be its actual collection time, instead of the time of the first sample collected during the same sampling event as indicated in this section).*

Response:

Attachment 1 (“Notes to Standardize SWAMP Field Data Sheets”) indicates that sample time shall be the same for all samples, regardless of the order in which they are collected during a given sampling event. The SWAMP Field Data Sheet has been modified accordingly.

6. Appendix B.1.1 Analytical Methods and Monitoring Procedures: *Please include the laboratory certification in the Draft Plans.*

Response:

A reference to the laboratory certification has been added to Section B.1.1 and a copy has been provided at the end of Appendix B.

7. Tables B.1. and B.2. Analytical Methods: *Replace the column heading “Benchmark” with “Target”, so the language is consistent with Attachment A to Resolution No. R11-008. Also, the targets included for all the listed parameters shall be consistent with the corresponding saltwater water column targets (or the human health criteria, whichever is more stringent) listed on Pg. 3 of Attachment A, and the marine sediment targets listed on Pg. 4 of Attachment A. Freshwater targets are not appropriate, as the mouth of the San Gabriel River is estuarine / saltwater.*

Response:

The document has been revised accordingly.

8. Table B.4. Sample Container, Volume, Preservation, and Holding Times: *List the appropriate preservatives to be used for each analysis if the samples are not analyzed immediately.*

Response:

A Sample Preservative column has been added to Table B.4.

Please contact the undersigned if you have any questions or comments.

Sincerely,
CH2M HILL Engineers, Inc.



Jeffrey Johnson
Senior Technical Coordinator



Eric Davis, P.G.
Project Manager

FINAL

Monitoring Plan and Quality Assurance Project Plan for Harbor Toxics Total Maximum Daily Load Sampling – SFPP Norwalk Pump Station

Prepared for

Los Angeles Regional Water Quality Control Board

Prepared on behalf of

Kinder Morgan Energy Partners, L.P.

March 19, 2018



6 Hutton Centre Drive, Suite 700
Santa Ana, California 92707

Title and Approval Sheets (QAPP Element A1)

MONITORING PLAN AND QUALITY ASSURANCE PROJECT PLAN FOR HARBOR TOXICS TOTAL MAXIMUM DAILY LOAD SAMPLING - SFPP NORWALK PUMP STATION

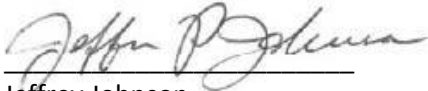
The material presented in this Monitoring Plan and Quality Assurance Project Plan was prepared consistent with current and generally accepted consulting principles and practices. This document was developed and supervised by the following environmental professionals:



Eric Davis, M.S., P.G.
CH2M Project Manager
California Professional Geologist No. 9443

March 19, 2018

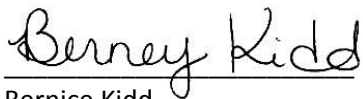
Date



Jeffrey Johnson
CH2M Senior Technical Coordinator

March 19, 2018

Date



Bernice Kidd
CH2M Quality Assurance Officer

March 19, 2018

Date

Water Board Quality Assurance Officer

Date

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- 1 Harbor Toxics TMDL Sampling Schedule
- 2 SFPP Norwalk Analyses in Harbor Toxics TMDL Monitoring Plan Samples

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- 1 San Gabriel River Watershed
- 2 San Gabriel River Sampling Location

Distribution List (QAPP Element A3)

Individuals listed below will receive a copy of this document.

- Ching-Yin To, Regional Water Quality Control Board, Los Angeles Region (electronic copy and hard copy)
- Samuel Unger, Regional Water Quality Control Board, Los Angeles Region (electronic copy)
- Paul Cho, Regional Water Quality Control Board, Los Angeles Region (electronic copy)
- Steve Defibaugh, Kinder Morgan Energy Partners, L.P. (electronic copy and hard copy)
- Minxia Dong, Norwalk Public Library (electronic copy and hard copy)
- Cassandra Owens, Regional Water Quality Control Board, Los Angeles Region (electronic copy)
- Adam Ly, Liberty Utilities (electronic copy)
- Adriana Figueroa, City of Norwalk (electronic copy)
- Brian Partington, Water Replenishment District of Southern California (electronic copy)
- Carol Devier-Heeney, Defense Logistics Agency Energy (electronic copy)
- Charles Emig, City of Cerritos (electronic copy)
- Daniel Swensson, The Source Group, Inc. (electronic copy)
- Everett Ferguson, Water Replenishment District of Southern California (electronic copy)
- Jon Wrescinsky, March ARB (electronic copy)
- Justin Settles, Defense Logistics Agency Energy (electronic copy)
- Lisa Moreno, The Source Group, Inc. (electronic copy)
- Lorena Sierra, John Dolland Elementary School (electronic copy)
- Mary Jane McIntosh, Restoration Advisory Board (RAB) Co-Chair (electronic copy)
- Michael T. Wilson, Air Force Real Property Agency (electronic copy)
- Neil F. Irish, P.G., The Source Group, Inc. (electronic copy)
- Norman Dupont, Esq., Ring Bender Law (electronic copy)
- Paul Parmentier, The Source Group, Inc. (electronic copy)
- Perla Hernandez, Office of Grace F. Napolitano (electronic copy)
- Shyamolika Dube, Office of Assembly member Christina Garcia (electronic copy)
- Tracy Winkler, RAB (electronic copy)
- Yahaira Ortiz, Office of State Senator Tony Mendoza (electronic copy)
- Yvette Shahinian, Office of Congresswoman Linda Sanchez (electronic copy)

Acronyms and Abbreviations

Cd	cadmium
cfs	cubic feet per second
CH2M	CH2M HILL Engineers, Inc.
COC	chain-of-custody
Cu	copper
DDT	dichlorodiphenyltrichloroethane
DFSP	defense fuel support point
DO	dissolved oxygen
DQO	data quality objective
EDD	electronic data deliverables
EPA	United States Environmental Protection Agency
FTL	field team leader
GWTS	groundwater treatment system
Hg	mercury
HSP	health and safety plan
IDW	investigation-derived waste
JP	jet propellant (e.g., JP-4 and JP-8)
Kinder Morgan	Kinder Morgan Energy Partners, L.P.
LACDPW	Los Angeles County Department of Public Works
LGAC	liquid-phase granular activated carbon
mg/L	milligram(s) per liter
MQO	measurement quality objectives
MS/MSD	matrix spike/matrix spike duplicate
MTBE	methyl tertiary butyl ether
NPDES	National Pollutant Discharge Elimination System
No.	number
Norwalk Station	Santa Fe Pacific Pipeline Norwalk Pump Station
OWS	oil-water separator
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCB	polychlorinated biphenyl
PM	project manager
PPE	personal protective equipment

ACRONYMS AND ABBREVIATIONS

QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RL	reporting limit
SFPP	Santa Fe Pacific Pipeline
SOP	standard operating procedure
STC	senior technical coordinator
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	California State Water Resources Control Board
TBA	tertiary butyl alcohol
TMDL	total maximum daily load
TOC	total organic carbon
TSS	total suspended solids
USGS	United States Geological Survey
Water Board	California Regional Water Quality Control Board, Los Angeles Region
Zn	zinc

Problem Definition and Background (QAPP Element A5)

Kinder Morgan Energy Partners, L.P. (Kinder Morgan) owns and operates a groundwater treatment system (GWTS) at the former Santa Fe Pacific Pipeline (SFPP) Norwalk Pump Station (Norwalk Station) located within the Defense Fuel Support Point (DFSP) Norwalk site, at 15306 Norwalk Boulevard, Norwalk, California. Treated groundwater is discharged from Norwalk Station to Coyote Creek, located within the San Gabriel River Watershed, under a National Pollutant Discharge Elimination System (NPDES) Permit (Order Number [No.] R4-2016-0309), as adopted by the California Regional Water Quality Control Board, Los Angeles Region (Water Board). Section VII.C.2.b of the Norwalk Station NPDES Permit states that dischargers into the San Gabriel River Watershed shall conduct ambient surface water and sediment monitoring at the mouth of the San Gabriel River to comply with the Toxic Pollutants in the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters total maximum daily load (TMDL) [Harbor Toxics TMDL] requirement (Water Board, 2011).

CH2M HILL Engineers, Inc. (CH2M) prepared this Monitoring Plan and Quality Assurance Project Plan (QAPP) on behalf of Kinder Morgan to present the approach for performing Harbor Toxics TMDL monitoring for this site. This document provides background information about the Norwalk Station site, presents required Harbor Toxics TMDL monitoring requirements in the San Gabriel River, and contains the sampling and analytical procedures and a health and safety plan (HSP) to support data collection and reporting of the ambient monitoring data to the Water Board. QAPP elements required by the California State Water Resources Control Board (SWRCB) Surface Water Ambient Monitoring Program (SWAMP) (2017) and United States Environmental Protection Agency (EPA) (2002) are identified in the section headings or applicable text. These elements are not necessarily presented in order because of the nature of this document performing the role of both Workplan and QAPP, which have similar but not identical sequences.

1.1 Objectives /Task Description (QAPP Element A6)

This Monitoring Plan and QAPP provides the approach for data collection to achieve the following objectives in support of the Harbor Toxics TMDL:

1. Characterize concentrations and loads of Harbor Toxics TMDL constituents in surface waters at the mouth of the San Gabriel River
2. Characterize concentrations of Harbor Toxics TMDL constituents in sediment at the mouth of the San Gabriel River

Monitoring will be performed in the San Gabriel River to assess if sediment and water quality benchmarks (e.g., sediment quality objectives and water quality objectives) are being met in the San Gabriel River, which discharges into the Greater Los Angeles Harbor. Harbor Toxics TMDL constituents include metals, organochlorine pesticides (chlordanes, dichlorodiphenyltrichloroethane [DDT], dieldrin), polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs).

1.2 Monitoring Requirements

NPDES dischargers are responsible parties that are required to collect data informing the Water Board of status and trends for Harbor Toxics TMDL constituents (i.e., metals, pesticides, PCBs, and PAHs) in surface water and sediment. The Norwalk Station NPDES Permit, Section VII.C.2.b, requires ambient surface water and sediment monitoring as part of the Harbor Toxics TMDL:

“The Compliance Monitoring Program shall include:

i. Water Column Monitoring. *Water samples and total suspended solids samples shall be collected at no less than one site, and preferably more than one site, during two wet weather events and one dry weather event each year. The first large storm event of the season shall be included as one of the wet weather monitoring events. Water samples and total suspended solid samples shall be analyzed for metals, DDT, PCBs, and PAHs. Sampling shall be designed to collect sufficient volumes of suspended solids to allow for analysis of the listed pollutants in the bulk sediment. General water chemistry (temperature, dissolved oxygen, pH, and electrical conductivity) and a flow measurement shall be required at each sampling event. General chemistry measurements may be taken in the laboratory immediately following sample collection if auto samplers are used for sample collection or if weather conditions are unsuitable for field measurements.*

ii. Sediment Monitoring. *For sediment chemistry, sediment samples shall be collected at, at least one site every two years for analysis of general sediment quality constituents and the full chemical suite as specified in the State Water Quality Control Plan for Enclosed Bays and Estuaries-Part 1 Sediment Quality (SQO Part 1). All samples shall be collected in accordance with Surface Water Ambient Monitoring Program (SWAMP) protocols.”*

Each discharger is required to contribute to the regional effort in gathering data on the watersheds to satisfy the TMDL monitoring requirements, and all data collected will be used by the Water Board to assess pollutant loadings/ future allocations for the watersheds through possible TMDL revisions in the future, if necessary.

The Harbor Toxics TMDL requires monitoring in three water body areas, subject to applicability:

1. Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary
2. Greater Los Angeles and Long Beach Harbor Waters (including Consolidated Slip)
3. Los Angeles and San Gabriel Rivers

Kinder Morgan, as operator of the Norwalk Station, is a responsible party discharging to Coyote Creek, a tributary of the San Gabriel River (Figure 1), and the location that will be sampled to comply with the Harbor Toxics TMDL monitoring is located at the mouth of the San Gabriel River (Figure 2).

1.3 San Gabriel River Watershed Description

The San Gabriel River is a major watershed found mostly within southeastern Los Angeles County (Figure 1). Headwaters of this 689-square-mile drainage are located in the San Gabriel mountains. This includes the 150-square-mile watershed of Coyote Creek, originating in western Orange County. The watershed contains diverse land uses from the wilderness area of undisturbed riparian and woodland habitats in the upper reaches of the San Gabriel River to concrete-lined channels through urban centers (Water Board, 2000).

The Whittier Narrows Reservoir (shown on Figure 1) connects the San Gabriel River with the Los Angeles River. However, the lower portion of the San Gabriel River is hydrologically separated from the upper

portion of the San Gabriel River at the Whittier Narrows dam when flows are low (i.e., less than 260 cubic feet per second [cfs]) at United States Geological Survey (USGS) gauging station 11085000 (shown on Figure 1; figures are located at the end of this document). This gauging station is located above the Whittier Narrows Dam and is an appropriate indicator of wet weather conditions because flows there exceeding the 90th percentile will likely exceed the dam's capacity runoff and signal when the upper and lower portions of the watershed are connected (EPA, 2007).

1.4 Norwalk Station Description

Norwalk Station is part of the former DFSP, located at 15306 Norwalk Boulevard, Norwalk, California (Figure 1). The DFSP is owned by DLA Energy (formerly Defense Energy Support Center) and was formerly occupied by 12 aboveground fuel storage tanks and associated piping and facilities. The tanks had a maximum capacity of 35 million gallons and were used to store and distribute refined petroleum products including jet propellant grades 5 and 8 (JP-5 and JP-8), and reportedly also stored aviation gasoline and JP-4. DLA Energy also previously operated truck fill stands and various fuel transfer systems. The facility was decommissioned in 2001 and is no longer used to handle fuel. The aboveground tanks and the main infrastructure were demolished in 2011; demolition of the subsurface piping was completed in 2012.

SFPP has equipment at the DFSP facility and easements for its pipelines along the southern and eastern boundaries of the facility. Previously, SFPP operated a pump station near the south-central area of the site. The pump station was used to transfer fuel to and from the DFSP facility, and as an in-line pumping station for portions of the SFPP pipeline network. The pump station was decommissioned in 2001, but three pipelines heading eastward along the southern boundary of the DFSP facility (one of which bends at the southeastern corner of the facility and continues northward within the eastern easement) remain in service and continue to convey refined petroleum fuels including gasoline, diesel, and jet fuel.

Because of historical releases of fuel-related petroleum hydrocarbons at this site, subsurface assessments have been performed at the DFSP facility since 1986 to evaluate the extent of impacts to soil and groundwater. The primary impacts are to groundwater associated with fuel product that historically leaked from block valves and migrated vertically downward to the water table. Separate-phase floating product, or light-non-aqueous phase liquid, as well as sorbed-phase and dissolved-phase fuel hydrocarbons have been delineated in areas beneath the DFSP facility and at offsite properties to the south, west, and east. Site assessments indicated that the contaminants of potential concern are total petroleum hydrocarbons, including those quantified as gasoline, diesel fuel, JP-4, JP-5, and JP-8; benzene, toluene, ethylbenzene, and total xylenes; 1,2-dichloroethane; methyl tertiary butyl ether (MTBE); and tertiary butyl alcohol (TBA). A groundwater Monitoring and Reporting Program has been in effect at the site since 1995.

Kinder Morgan operates a GWTS that processes free product and groundwater that has been impacted by historical releases of gasoline, diesel, and jet fuel from pipeline operations that have been recovered from extraction wells. Free product and groundwater recovered by pneumatically operated top-loading total fluid pumps and bottom-loading groundwater pumps are conveyed to an oil-water separator (OWS). Free product, if any, from the OWS is collected in a storage tank and recycled at an offsite location. Water from the OWS is treated using liquid-phase granular activated carbon (LGAC). Treated water is routed through an onsite 3,000-gallon equalization tank. Two fluidized bed bioreactors installed downstream of the equalization tank treat MTBE, a fuel oxygenate, and TBA, a fuel oxygenate and breakdown product of MTBE. The treated groundwater then passes through polishing LGAC units before discharging to a storm drain that leads to Coyote Creek. Monthly effluent monitoring is reported quarterly to the Water Board in accordance with NPDES Order No. R4-2016-0309.

1.5 Project Organization (QAPP Element A4)

The organizational structure for activities associated with the study is described below (see Attachment 2 in Appendix A for contact information).

Kinder Morgan Project Manager (PM) — will have primary oversight responsibility for project activities.

CH2M PM — is responsible for coordinating the tasks of all team members to enable the completion of all required activities in sequence and on time. The PM will work closely with the project team to meet all requirements and study objectives, including approving responses to any comments on planning documents and reports, approving sampling activities and quality assurance (QA) reports, and authorizing necessary actions and adjustments needed to accomplish program QA objectives.

QA Manager — is responsible for reviewing and approving this Monitoring Plan and QAPP, contract laboratory oversight, and data validation.

Senior Technical Coordinator (STC) — is responsible for providing technical oversight in the design and implementation of a Monitoring Plan and QAPP that meets the Norwalk Station NPDES permit and Harbor Toxics TMDL requirements and is consistent with all applicable guidance (e.g., the SWRCB's SWAMP). The STC will coordinate responses to any comments on planning documents and reports by the Water Board, oversee sampling activities, review QA reports, and coordinate with the PM to authorize necessary actions and adjustments needed to accomplish program QA objectives.

Field Team Leader (FTL) / Site Safety Coordinator (SSC) — is responsible for implementing and conducting the sampling in a manner consistent with the objectives of the study. The FTL is responsible for overseeing the planning, coordination, and implementation of sample collection and processing activities according to the Workplan and QAPP. They will work closely with the STC, QA Manager, and PM if problems occur, and they will communicate and document any corrective actions taken.

Analytical Chemistry Laboratory Coordinator — is responsible for coordinating laboratory activities, tracking the laboratories' progress, verifying that the laboratories have implemented requirements of this plan, addressing QA issues related to the laboratory analyses, conducting the required analyses in a timely manner, and addressing scheduling issues related to laboratory analyses. The Laboratory Coordinator works closely with the laboratory PM, STC, QA Manager, and the PM.

Laboratory PM — Asset Laboratories will perform the sample processing and analyses. The laboratory PM is responsible for the successful and timely completion of sample analyses, as well as the following:

- Receiving and logging samples correctly, that the correct methods and modifications are used, and that data are reported within specified turnaround times
- Reviewing analytical data to confirm that procedures were followed as required, as well as reviewing the cited methods, and laboratory standard operating procedures (SOPs)
- Apprising the laboratory coordinator of the schedule and status of sample analyses and data package preparation
- Notifying the analytical chemistry laboratory coordinator if problems occur in sample receiving, analysis, or scheduling, or if control limits cannot be met
- Taking appropriate corrective action as necessary
- Reporting data and supporting QA information as specified
- Providing electronic data deliverables (EDDs) in a format consistent and compatible with the project electronic database.

Data Manager — is responsible for receiving validated data, storing it in a secure database, and accessing these data for reporting.

Surface Water and Sediment Monitoring

This section describes the location where Harbor Toxics TMDL required sampling will occur, media that will be sampled, timing and the conditions under which sampling will occur, and the contaminant classes that will be analyzed in each medium.

2.1 Sampling Location

Sampling will be conducted at one location at mid-channel of the San Gabriel River near its outlet to the Pacific Ocean (Figure 2). This is immediately upstream of the bridge where Marina Drive crosses the San Gabriel River.

2.2 Sample Media and Frequency

The Harbor Toxics TMDL requires surface water and sediment monitoring at the mouth of the San Gabriel River during both wet and dry weather conditions. Surface water will be collected during two wet weather and one dry weather events, annually. Sediment samples will be collocated and collected concurrently with surface water samples once every 2 years.

The criterion defining dry weather conditions is *any day when the maximum daily flowing Coyote Creek is less than 156 cfs as measured at the Los Angeles County Department of Public Works (LACDPW) flow gauge station F354-R, located at the bottom of the creek just above the Long Beach Water Reclamation Plant, as described in the San Gabriel River Metals TMDL (EPA, 2007).*

The criterion defining wet weather conditions *applies to any day when the maximum daily flow in Coyote Creek is equal to or greater than 156 cfs, as measured at the LACDPW's flow gauge station F354-R, as described in the San Gabriel River Metals TMDL (EPA, 2007).*

The first large storm event of the season will be targeted, and locations where storm events in southern California meet the following criteria:

- Storm events occurring during the wet season, from October 1 to April 15
- Storm events preceded by less than 0.1 inch of rainfall within the watershed over a 3-day period
- Storm events consisting of rainfall of at least 0.25 inch (within 24 hours) with at least 70 percent probability of sufficient rainfall at least 24 hours before the event

The second wet weather event targeted would depend on forecasts (drought year versus wet year) predicting at least 0.1 inch of precipitation preceded by a 72-hour dry period. Consideration will be given to monitoring "larger storm events" (greater than 0.5 inch) and meeting the criteria above, if forecasted.

Sampling will begin within 6 months of the final Monitoring Plan and QAPP approval from the Water Board, but specific sampling dates are yet to be determined. When planned, the sampling events over the term of the current SFPP Norwalk Station Permit will follow the schedule outlined in Table 1.

Table 1. Harbor Toxics TMDL Sampling Schedule

Event	Target Samples/TMDLs Addressed	
	Water	Sediment
<i>First and Third Annual Event</i>		
Wet-1	Water Quality ¹ and Flow Aqueous Concentrations of Metals, DDT, PAHs, and PCBs Suspended Sediment Concentrations of Metals, DDT, PAHs, and PCBs	-
Wet-2	Water Quality ¹ and Flow Aqueous Concentrations of Metals, DDT, PAHs, and PCBs Suspended Sediment Concentrations of Metals, DDT, PAHs, and PCBs	-
Dry-1	Water Quality ¹ and Flow Aqueous Concentrations of Metals, DDT, PAHs, and PCBs Suspended Sediment Concentrations of Metals, DDT, PAHs, and PCBs	-
<i>Second and Fourth Annual Event</i>		
Wet-1	Water Quality ¹ and Flow Aqueous Concentrations of Metals, DDT, PAHs, and PCBs Suspended Sediment Concentrations of Metals, DDT, PAHs, and PCBs	-
Wet-2	Water Quality ¹ and Flow Aqueous Concentrations of Metals, DDT, PAHs, and PCBs Suspended Sediment Concentrations of Metals, DDT, PAHs, and PCBs	-
Dry-1	Water Quality ¹ and Flow Aqueous Concentrations of Metals, DDT, PAHs, and PCBs Suspended Sediment Concentrations of Metals, DDT, PAHs, and PCBs	TOC, percent fines, Metals (Cd, Cu, Pb, Hg, Zn), PAHs, PCBs, Pesticides

Notes:

¹ Water Quality Measurements: temperature, DO, pH, specific conductivity

Cd = cadmium

Cu = copper

DO = dissolved oxygen

Hg = mercury

Pb = lead

TOC = total organic carbon

Zn = zinc

Field and Laboratory Procedures (QAPP Element B1)

This section describes the general procedures for water and sediment sample collection (including health and safety guidelines), specific contaminants in each medium, flow documentation procedures, and investigation-derived waste (IDW) management. Field procedures are based on guidance from SWAMP (SWRCB, 2014). Detailed SOPs for sampling are described in detail in Appendix A, and laboratory analytical methods and data quality are described in Appendix B.

3.1 Collection Procedures (QAPP Element B2)

Laboratories will provide clean sample containers with labels identifying the preservative. Pre-printed, waterproof labels and waterproof ink pens will be used whenever possible to complete sample labels. Immediately before sample collection, the sample ID, date, time of sampling, and sampler's initials will be recorded onto the label. Sample containers will be placed into resealable plastic zipper bags and packed on ice in coolers provided by the laboratory. Ice used in shipping containers must be double bagged. Vital information regarding the collection of each sample will be recorded into a field logbook and/or field sampling forms and chain-of-custody (COC) forms.

Detailed field sampling SOPs are provided in Appendix A and summarized below.

- Surface water quality measurement procedures are described in Appendix A, SOP-1.
- Surface water sample collection procedures are provided in Appendix A, SOP-2.
- Sediment sample collection procedures are provided in Appendix A, SOP-3.
- Sample storage, packing, and shipping procedures are provided in Appendix A, SOP-4.
- Sample container, volumes, and preservation requirements are provided in Appendix B, Table B-4.

Table 2 summarizes the specific Harbor Toxics TMDL contaminants that will be analyzed in each medium.

Table 2. SFPP Norwalk Analyses in Harbor Toxics TMDL Monitoring Plan Samples

Media	Analyses
Surface Water and Suspended Solids	<p><u>Water Quality</u>: temperature, DO, pH, and specific conductivity</p> <p><u>General</u>: TSS</p> <p><u>Metals</u>: Cu, Pb, Zn</p> <p><u>Pesticides</u>: 2,4-DDT, 4,4-DDT, reported as total DDT</p> <p><u>PAHs</u>: 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene</p> <p><u>PCBs</u>: Total PCBs</p>
Sediment	<p><u>General</u>: TOC, % fines</p> <p><u>Metals</u>: Cd, Cu, Pb, Ni, Hg, Zn</p> <p><u>Pesticides</u>: alpha chlordane, gamma chlordane, trans nonachlor, dieldrin, DDT derivatives</p> <p><u>PAHs</u>: 1-methylnaphthalene, 1-methylphenanthrene, 2-methylnaphthalene, 2,6-dimethylnaphthalene, acenaphthene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(e)pyrene, biphenyl, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, perylene, pyrene</p> <p><u>PCB congeners</u>: 2,4'-dichlorobiphenyl (PCB-8), 2,2',5'-trichlorobiphenyl (PCB-18), 2,4,4'-trichlorobiphenyl (PCB-28), 2,2',3,5'-tetrachlorobiphenyl (PCB-44), 2,2',5,5'-tetrachlorobiphenyl (PCB-52), 2,3',4,4'-tetrachlorobiphenyl (PCB-66), 2,2',4,5,5'-pentachlorobiphenyl (PCB-101), 2,3,3',4,4'-pentachlorobiphenyl (PCB-105), 2,3',4,4',5-pentachlorobiphenyl (PCB-118), 2,2',3,3',4,4'-</p>

Table 2. SFPP Norwalk Analyses in Harbor Toxics TMDL Monitoring Plan Samples

Media	Analyses
	hexachlorobiphenyl (PCB-128), 2,2',3,4,4',5'-hexachlorobiphenyl (PCB-138), 2,2',4,4',5,5'-hexachlorobiphenyl (PCB-153), 2,2',3,3',4,4',5-heptachlorobiphenyl (PCB-170), 2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB-180), 2,2',3,4',5,5',6-heptachlorobiphenyl (PCB-187), 2,2',3,3',4,4',5,6-octachlorobiphenyl (PCB-195), 2,2',3,3',4,4',5,5',6-nonachlorobiphenyl (PCB-206), decachlorobiphenyl

Note:

Required sediment parameters are described in Attachment A of SWRCB (2009).

TSS = total suspended solids

3.1.1 Water Sampling

Field measurements of surface water quality will be collected at the water sampling location before potential site disturbance by any sampling equipment. These measurements will include temperature, DO, pH, and specific conductivity. Measurements will be collected with a hand-held water quality meter that has been calibrated and determined to be in good working order. Detailed procedures for these activities are described in Appendix A, SOP-1.

Water grab samples will be collected from immediately below the water surface (approximately 0.1-meter depth) at mid-channel of the San Gabriel River. Pre-cleaned and double-bagged Teflon tubing will be required for water sampling and will be provided by the contracted laboratory if a peristaltic pump is used for sample collection. Water samples may also be collected as subsurface grabs by hand (e.g., from a boat positioned mid-channel) or by using a sampling device (e.g., van Dorn or Kemmerer bottle). Detailed procedures for these activities are described in Appendix A, SOP-2.

Aqueous concentrations of target parameters and concentrations in TSS are required. Direct measurement of contaminant concentrations in suspended solids is challenging. TSS varies with flow, but has been reported to range from less than 1.9 to 281 milligrams per liter (mg/L) in samples reported from Los Angeles County and with an average concentration of 16 mg/L.¹ The expected volume of surface water needed to produce sufficient TSS for conventional chemical analysis is very large (e.g., ranging from approximately 500 liters to over 1,000 liters when TSS is 50 to 200 mg/L). Filtering or centrifuging these large volumes to isolate suspended solids is logistically difficult, and these procedures can cause artifacts of the treatment. TSS is very likely to be less than 50 mg/L during dry weather flows; therefore, insufficient mass would be available for conventional chemical analysis of the TSS. Mass transport of contaminants would also be negligible in the suspended solids during low flows, and therefore, load estimates could be reasonably assumed to occur wholly in the aqueous phase. Conversely, the majority of contaminant loads will likely be associated with solids during high flows when TSS is elevated.

The contaminant loads in suspended solids will therefore be determined by analyzing contaminants in the total (i.e., unfiltered) sample and then again in samples filtered through 0.45 micrometer to characterize the dissolved fraction. The difference between total and dissolved fractions will be attributed to contamination associated with the suspended solids. This approach is consistent with best practices, is in use by other NPDES permittees in the region for reporting contaminant concentrations in suspended solids, and will achieve the desired data with reasonable effort.

3.1.2 Sediment Sampling

A surficial sediment grab sample will be collected from mid-channel of the San Gabriel River once every 2 years to support long-term sediment quality monitoring. The sediment will be sampled from the bottom of the San Gabriel River using an Ekman dredge or a similar device. The field crew will then

¹ <http://www.ceden.org>, accessed 09/29/2017; n=58

scoop the top 2 centimeters of sediment from the sampler and place it in a glass bowl for compositing. This procedure will be repeated as needed to meet the sediment sample mass requirements. Additional grab samples, if needed, will be carefully collected so that the exact same location is not sampled repeatedly. The final composited sample will be mixed and placed into the appropriate sample jars. Detailed procedures for these activities are described in Appendix A, SOP-3.

3.2 Sample Handling and Custody (QAPP Element B3)

Principal documents used to identify samples and to document possession will be field logbooks and COC records. COC forms will be used to document sample custody from the time of collection through processing and analysis until final disposition. Detailed procedures for sample handling and custody are described in Appendix A, SOP-5. It will not be acceptable for samples to be outside of project personnel custody unless the samples have been transferred to a secure area (i.e., locked up and custody sealed) or transferred to a courier. If the samples cannot be placed in a secure area, then a field team member must physically remain with the samples.

Upon receipt of samples, the laboratory will check the physical integrity of the containers and custody seals, and samples will be inventoried by comparing sample labels to those on the COC forms. The laboratory will sign COCs and will include completed COCs and shipping container receipt forms in the data package. The laboratory PM will maintain a sample-tracking record that follows each sample through all stages of sample processing at the laboratory.

3.3 Analytical Methods (QAPP Element B4)

Detailed analytical methods and data quality control (QC) information for laboratory-analyzed parameters in surface water and sediment are presented in Appendix B, Tables B-1 and B-2, respectively. Reporting limits (RLs) will meet available water and sediment quality objectives unless matrix interference is encountered that cause an increase in RLs that cannot be eliminated by additional chemical clean-up procedures by the laboratory. Data quality objectives (DQOs) for chemical analyses are provided in Appendix B, Table B-3 (QAPP Element A7).

3.4 Investigation-derived Waste

Only a small amount of IDW is expected to be generated as part of Harbor Toxics TMDL sampling activities. Solid materials will consist of disposable personal protective equipment (PPE) (e.g., used nitrile gloves) and general refuse (e.g., paper towels). A small volume of liquid waste will be generated from decontamination of sampling devices. The following potentially contaminated IDW might be generated during field activities:

- **Used PPE and disposable equipment.** Used PPE will be double-bagged and placed in a municipal refuse dumpster at the Norwalk Station. PPE and disposable equipment that is still serviceable will be rendered unusable before disposal into the dumpster.
- **Decontamination fluids.** Decontamination fluids include a non-phosphate detergent, deionized water, residual contaminants, and site water. These fluids will be collected in a 5-gallon bucket for transfer to the Norwalk Station site. Samples of the decontamination fluids will be collected for waste profiling. The waste will then be transported offsite with proper labels and a manifest in accordance with EPA and California regulations, if required. The waste will be transported to a permitted facility.

3.5 Flow Measurements

Harbor Toxics TMDL monitoring requirements include a flow measurement during each sampling event. Flow, meaning discharge, can be determined by collecting several water velocity measurements that are multiplied by the cross-sectional area. These measurements may not be feasible at the mouth of the San Gabriel River during high flows because of potential safety concerns for personnel and the loss or damage of equipment under storm conditions. If no safe sampling location can be identified during a sampling event, the unsafe conditions shall be documented and included in the corresponding annual report. The combined flow at the two LACDPW flow gauge stations (the Los Angeles County Department of Public Works gauging station F42B-R, located just above Spring Street on the San Gabriel River, and station F354-R in Coyote Creek [Figure 1]) will be reported as an estimate for that event. These data will be requested² and reported for the days when sampling occurs.

3.6 Health and Safety

Team member and public safety is of paramount importance, therefore guidance provided in the Project HSP will be strictly adhered. Field team members will be current in all required training, will review the HSP, and will sign the Employee Signoff Form before participating in any field activities. The HSP is provided in Appendix C.

3.7 Training and Certifications (QAPP Element A8)

Training and certifications are required to demonstrate competence in generating data of high quality that can inform management decisions. Laboratory certifications will be documented in Appendix B (e.g., State of California's Department of Health Services Environmental Laboratory Accreditation Program and National Environmental Laboratory Accreditation Program).

Field sampling crews will be trained in standardized sample collection and will be experienced in sampling the target media with the specified sampling equipment. Field staff will participate in safety training to mitigate potential injury to people, property, or equipment, and will be documented in the HSP (Appendix C).

3.8 Field Documentation (QAPP Element A9)

A designated logbook and/or field sampling forms will be used for each event. The logbook will be bound with consecutively numbered pages. All entries will be written in legible black ink and signed and dated by the FTL. Factual and objective language will be used to document sampling condition and details. All entries will be complete and accurate to allow reconstruction of each field activity. A line will be placed through any portion of a field notebook that is unused. Detailed documentation requirements are described in Appendix A, SOP-6. Electronic copies of all field documents will be maintained in the project folder on a secure network and original hard copies will be maintained by the PM.

3.8.1 Field Forms

Field data forms and a COC form are provided in Appendix A.

² Los Angeles County flow data are currently available from Arthur Gotingco (AGOTING@dpw.lacounty.gov)

3.8.2 Sample Labeling

Samples will be labeled with a unique identifier to coordinate correct reporting of results. These labels will include the sampling location, date, and sample type (i.e., sediment, water, or QC sample).

For Example: SG1 – 092918 – WD

Where:

- Location – SG1
- Date – six digits identifying the month, day, and year (i.e., MMDDYY)
- Sample type
 - Dry weather water sample – DW
 - Wet weather water sample – WW
 - Dry weather duplicate water – DD
 - Wet weather duplicate water – WD
 - Dry weather suspended sediment – DS
 - Wet weather suspended sediment – WS
 - Wet weather suspended sediment duplicate – WSD
 - Equipment Blank – EB
 - Surficial Sediment – SS
 - Surficial Sediment duplicate – SD
 - Matrix spike/matrix spike duplicate – MS/MSD

3.8.3 Corrections to Documentation

All original data in field sampling forms and COC records will be recorded using waterproof ink. If an error is made on a document assigned to one individual, the individual will make corrections with a single line through the error and entering the correct information. The strike-through will be initialed and dated. No correction fluid will be used. The erroneous information is *not* to be obliterated. Any subsequent error discovered on an accountable document will be corrected by the person who made the entry, if possible. All subsequent corrections will be initialed and dated.

Quality Assurance/Quality Control

This section describes the QA/QC procedures for the SWAMP. The QA program will consist of QC samples, field documentation, and data quality assessment to describe data quality (SWRCB, 2017).

4.1 QC Samples (QAPP Element B5)

A field QC program will be implemented to help maintain the required level of confidence in the field data and to provide cross-checks on the laboratory performing the analyses. QC samples, such as blanks, duplicates, and surrogate spikes will be routinely collected. QC samples will be collected for each analyte or each analytical method. Because the number of QC samples typically depends on how the fieldwork is organized and implemented, the frequency of QC sample collection will be continually monitored to avoid unnecessary sampling.

The following types of field QC samples will be collected:

- Duplicate samples
- MS/MSD
- Equipment rinsate samples

QC samples are described in detail in the following sections.

4.1.1 Duplicate Samples

A field duplicate sample is a second sample collected at the same location as the original sample and for the same analyses. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis.

Field duplicate samples will be collected to assess the reproducibility of field sampling methods. One duplicate sample would typically be collected for every 10 samples collected during each monitoring event or a minimum of 1 duplicate per monitoring event when less than 10 samples are collected. The duplicates will be analyzed for the same parameters as the primary samples.

4.1.2 Matrix Spike/Matrix Spike Duplicate

An MS/MSD sample is a replicate site sample that is spiked with known amounts of standard compounds identical to the compounds being measured and are added to the sample to evaluate interferences or other sample-specific characteristics that can affect chemical analysis to indicate the closeness of measured values to the true values. These QC samples will be collected at a frequency of once per sampling event (once per analytical batch) for each sample medium.

4.1.3 Equipment Blank Samples

Equipment rinsate blanks will be collected on the sampling equipment to assess the effectiveness of equipment decontamination procedures and to evaluate the potential for cross-contamination between sample locations. One equipment rinsate blank sample will be collected per sampling event for sediment and water sampling equipment. These blanks will be analyzed for all analytes relevant to the media and will be collected by pouring certified clean water over cleaned sampling equipment and collecting the water that has contacted the equipment (see the decontamination SOP in Appendix A). Laboratory-grade deionized water provided by the analytical laboratory will be used for sample blanks.

4.2 Instrument/Equipment Testing, Inspection, and Maintenance (QAPP Element B6)

Analytical instrument testing, inspection, maintenance, setup, and calibration will be conducted by the laboratory in accordance with requirements identified in laboratory SOPs and manufacturer instructions. In addition, each of the specified analytical methods provides protocols for proper instrument setup and tuning and critical operating parameters. Instrument maintenance and repair will be documented in the laboratory's maintenance logs or record books.

4.3 Instrument/Equipment Calibration and Frequency (QAPP Element B7)

Before beginning each analysis, laboratory instruments will be properly calibrated, and the calibration will be verified with appropriate check standards and calibration blanks for each parameter. Instrument calibration procedures and schedules will conform to analytical protocol requirements and descriptions provided in the laboratory QA plan.

Calibration standards will be obtained from either the EPA repository or a commercial vendor, and the laboratories will maintain traceability back to the National Institute of Standards and Technology. Stock standards will be used to establish intermediate standards and calibration standards. Special attention will be given to expiration dating, proper labeling, proper refrigeration, and prevention of contamination. Documentation relating to the receipt, mixing, and use of standards will be recorded in a laboratory logbook. All calibration and spiking standards will be checked against standards from another source, as specified in the methods and the laboratory QA manual.

4.4 Inspection/Acceptance of Supplies and Consumables (QAPP Element B8)

The quality of supplies and consumables used during sample collection and laboratory analysis can affect the quality of the data. Any equipment that contacts samples and extracts must be sufficiently clean to prevent detectable contamination, and the analyte concentrations must be accurate in all standards used for calibration and QC purposes.

The quality of laboratory water used will be documented at the laboratory. All containers will be visually inspected before use, and any suspect containers will be discarded.

Reagents of appropriate purity and suitably cleaned laboratory equipment will also be used for all stages of laboratory analyses. Details for acceptance requirements for supplies and consumables at the laboratories are provided in laboratory SOPs and QA plans. All supplies will be obtained from reputable suppliers with appropriate documentation or certification. Supplies will be inspected to confirm that they meet use requirements, and certification records will be retained by the field supervisor (i.e., for supplies used in the field) or the laboratory QA manager (i.e., for supplies used in the laboratory).

4.5 Non-direct Measurements (QAPP Element B9)

Flow and precipitation measurements are being provided by Los Angeles County and USGS to determine the timing and status of dry weather and wet weather conditions based on the magnitude of flows in the San Gabriel River. These data will be assumed to be accurate.

4.6 Data Quality

Measurement quality objectives (MQO) for data quality will be assessed by measures of representativeness, comparability, accuracy, precision, and completeness. Definitions of these terms, the applicable procedures, and level of effort are described below. The applicable QC procedure, quantitative target limits, and level of effort for assessing data quality are dictated by the intended use of the data and the nature of the analytical methods. The following is a description of the data quality assessment criteria.

Representativeness is a measure of how closely the results reflect the actual concentration or distribution of the analytes in the matrix samples. Equipment rinsate blanks and field duplicate samples will be used to assess field and transport contamination and method variation. To assess laboratory contamination, laboratory method blanks will be run at a minimum frequency of one per analytical batch.

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using standard procedures, where available, and by 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 analytical test results is assessed by spiking samples with known standards and establishing the average recovery. Target accuracy goals for the analytical methods proposed, expressed as percent recovery of spiked sample and are presented in Appendix B, Table B-3. Percent recoveries outside these goals will be qualified appropriately.

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. The target precision goal for the analytical methods proposed, expressed as relative percent difference between duplicate samples. Precision targets are presented in Appendix B, Table B-3. A relative percent difference outside this goal will be qualified appropriately.

Completeness is a measure of the amount of valid data obtained from the analytical measurement system and the complete implementation of defined field procedures. The target completeness objective will be 90 percent; the actual completeness may vary depending on the intrinsic nature of the samples. Completeness of the data will be assessed during QC reviews.

4.7 Data Management (QAPP Element B10)

Harbor Toxics TMDL data will be generated both in the field and at an analytical laboratory. The contract laboratory will submit data in electronic format. The laboratory PM will contact the laboratory QA manager and data manager before data delivery to discuss specific format requirements. Written documentation will also be used to clarify how field duplicate and split samples, and laboratory duplicates and QA/QC samples were recorded in the data tables, and to provide explanations of other issues that may arise. The data management task will include keeping accurate records of field and laboratory QA/QC samples so that technical team personnel who use the data will have appropriate documentation. Data management files will be stored on a secure computer.

In addition to placing all data and identifiers in an electronic database (i.e., labspec 7), electronic files of printable reports (i.e., pdf files) for all original analytical data or study records will be filed by the PM. Each analytical data set (or supporting laboratory document) will be given a unique documentation code based on the original source of the data or information, and filed based on that code. A master list of all filed documents, sorted in order by filing code, will be maintained for easy retrieval from the document library. Sample results will be reported in tabular format in the field sampling report.

4.8 Data Review, Verification, and Validation (QAPP Element D1)

Laboratory and field data will be subject to verification and validation before submittal. Data qualifiers may be added or clarified because of data validation. For example, if results for surrogates, laboratory control standards, MS/MSD samples, or laboratory duplicates do not meet method-specified control limits, including performance-based control limits.

Equipment rinse blanks will be evaluated and data qualifiers applied in the same manner as method blanks, described in the functional guidelines for data review (EPA 2017a; 2017b). Data will be rejected if control limits for acceptance of data are not met, as described in the EPA's national functional guidelines (2017a; 2017b).

Validated data will be provided electronically within 90 days of receipt of the final samples at the lab.

4.9 Verification and Validation Methods (QAPP Element D2)

Field data will be verified during preparation of samples and COC forms. Field data and COC forms will be reviewed daily by the FTL. After field data are entered into the project database, 10 percent verification of the entries will be completed to assess the accuracy and completeness of the database. Any discrepancies will be resolved before the final database is released for use. Accuracy and completeness of each data set will be verified at the laboratory when EDDs are prepared and again as part of data validation.

Harbor Toxics TMDL sampling results will be validated to Level II. This may be performed by the project chemist or other program team members.

- Level I – Verification that samples were analyzed for the methods requested and review of the data for outliers and anomalies.
- Level II – Includes all activities of Level I in addition to verification that samples were analyzed for the methods requested, review of the laboratory case narrative for events in the laboratory that affect the accuracy or precision of the data, review of QC indicator data, and a “reasonableness” review of the data.

4.10 Reconciliation with User Requirements (QAPP Element D3)

The goal of data validation is to determine the quality of each data result and to identify those that do not meet the task MQOs and DQOs. The QA Manager will review data to determine whether data quality has been met. Any data that do not meet these project criteria will be subject to qualification and corrective action will be taken to confirm there are no preventable problems that recur. Non-conforming data may be qualified as estimated (i.e., a “J” qualifier will be applied to the result) or rejected as unusable (i.e., an “R” qualifier will be applied to the result) during data validation if criteria for data quality are not met. Data may also be qualified as undetected during validation based on laboratory and field blank results. Rejected data will not be used for any purpose.

Data qualified as estimated will be used for all intended purposes and will be appropriately qualified in the final project database. However, these data are less precise or less accurate than unqualified data. Data users are responsible for assessing the effect of the inaccuracy or imprecision of the qualified data on statistical procedures and other data uses. The data validation discussion will include information regarding the direction or magnitude of bias or the degree of imprecision for qualified data to facilitate the assessment of data usability.

Assessment and Response Actions (QAPP Element C1)

Unexpected conditions can be encountered in the field or when processing samples. These situations will be recognizable to the properly trained and experienced personnel conducting these data collection tasks, will be documented, and will be reported to the STC and PM.

If unanticipated or changed conditions occur in the field, the FTL will institute the necessary corrective actions, document the cause and reason for correction action in the field notebook or form, communicate this to the STC and PM, and confirm that the appropriate procedures are followed. Any problems that cannot be easily resolved or that affect the final quality of the work product will be brought to the attention of the STC and PM before taking corrective action. These changes will be reported to the Water Board in the annual report if corrective actions require a departure from the Monitoring Plan and QAPP. In most circumstances where sampling conditions are unexpected, the appropriate sampling actions consistent with this task's objectives will be conducted.

Reporting (QAPP Element C2)

Results from Harbor Toxics TMDL required monitoring will be provided to the Water Board annually as part of the Norwalk Station Fourth Quarter NPDES discharge monitoring report. Each report will include Harbor Toxics TMDL monitoring data collected from January 1 through December 31 and will be reported by February 15 of the following year. Each report will provide the following information:

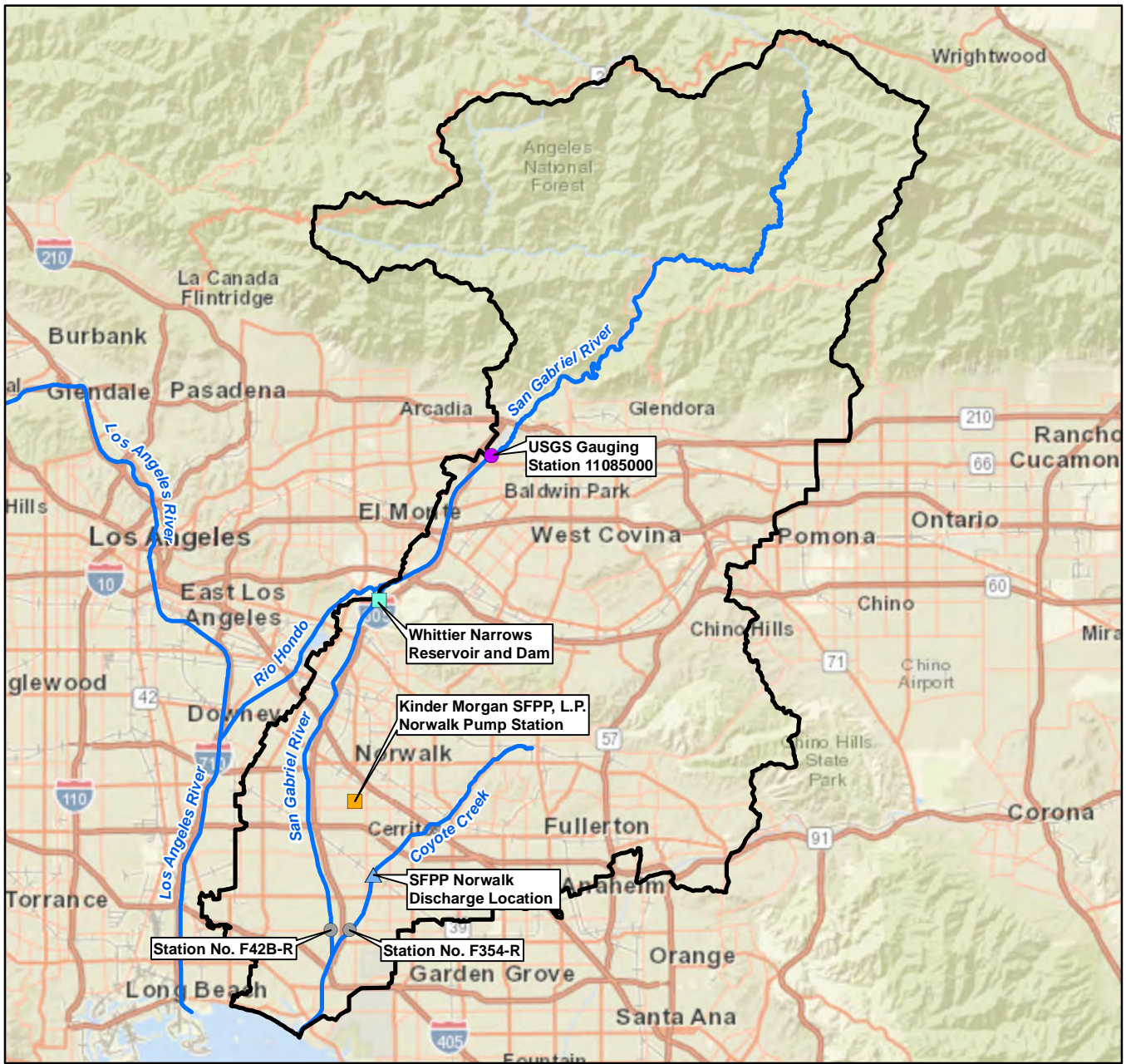
- Descriptions of field and laboratory methods
- Tables of San Gabriel River surface water and sediment analytical results
- Field sampling forms, laboratory analytical reports, and COC documentation

This report will be prepared under the supervision of a California Registered Geologist or Professional Engineer and will be submitted to the Water Board for review and approval.

References

- California Regional Water Quality Control Board, Los Angeles Region (Water Board). 2000. *State of the Watershed – Report on Surface Water Quality*. The San Gabriel River Watershed. June.
http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/regional_program/Water_Quality_and_Watersheds/san_gabriel_river_watershed/summary.shtml.
- California Regional Water Quality Control Board, Los Angeles Region (Water Board). 2011. *Amendment to the Water Quality Control Plan for the Los Angeles Region to Incorporate a Total Maximum Daily Load for Toxic Pollutants in Dominguez Channel and the Greater Los Angeles and Long Beach Harbor Waters*. Resolution No. R11-008. May 5.
- California State Water Resources Control Board (SWRCB). 2009. *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality*. August 25.
- California State Water Resources Control Board (SWRCB). 2014. *Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California*.
https://www.waterboards.ca.gov/water_issues/programs/swamp/docs/collect_bed_sediment_update.pdf
- California State Water Resources Control Board (SWRCB). 2017. *Surface Water Ambient Monitoring Program (SWAMP) Quality Assurance Program Plan*. May.
https://www.waterboards.ca.gov/water_issues/programs/swamp/qapp/swamp_QAPrP_2017_Final.pdf
- United States Environmental Protection Agency (EPA). 2002. *Guidance for Quality Assurance Project Plans (EPA QA/G-5)*. Office of Environmental Information. EPA/240/R-02/009. Washington, D.C.
- United States Environmental Protection Agency (EPA). 2007. *Total Maximum Daily Loads for Metals and Selenium, San Gabriel River and Impaired Tributaries*. Region 10. March.
- United States Environmental Protection Agency (EPA). 2017a. *USEPA National Functional Guidelines for Organic Superfund Methods Data Review*. EPA-540-R-2017-002. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, Washington, D.C.
- United States Environmental Protection Agency (EPA). 2017b. *USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review*. EPA-540-R-2017-001. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, Washington, D.C.

Figures



Basemap Source: ESRI World Streetmap

LEGEND

- Kinder Morgan SFPP, L.P. Norwalk Pump Station
- Whittier Narrows Reservoir and Dam
- ▲ SFPP Norwalk Discharge Location
- LADPW Gauging Station
- USGS Gauging Station 11085000
- ~ River/Creek
- San Gabriel River Watershed

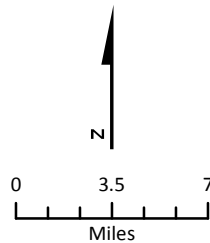
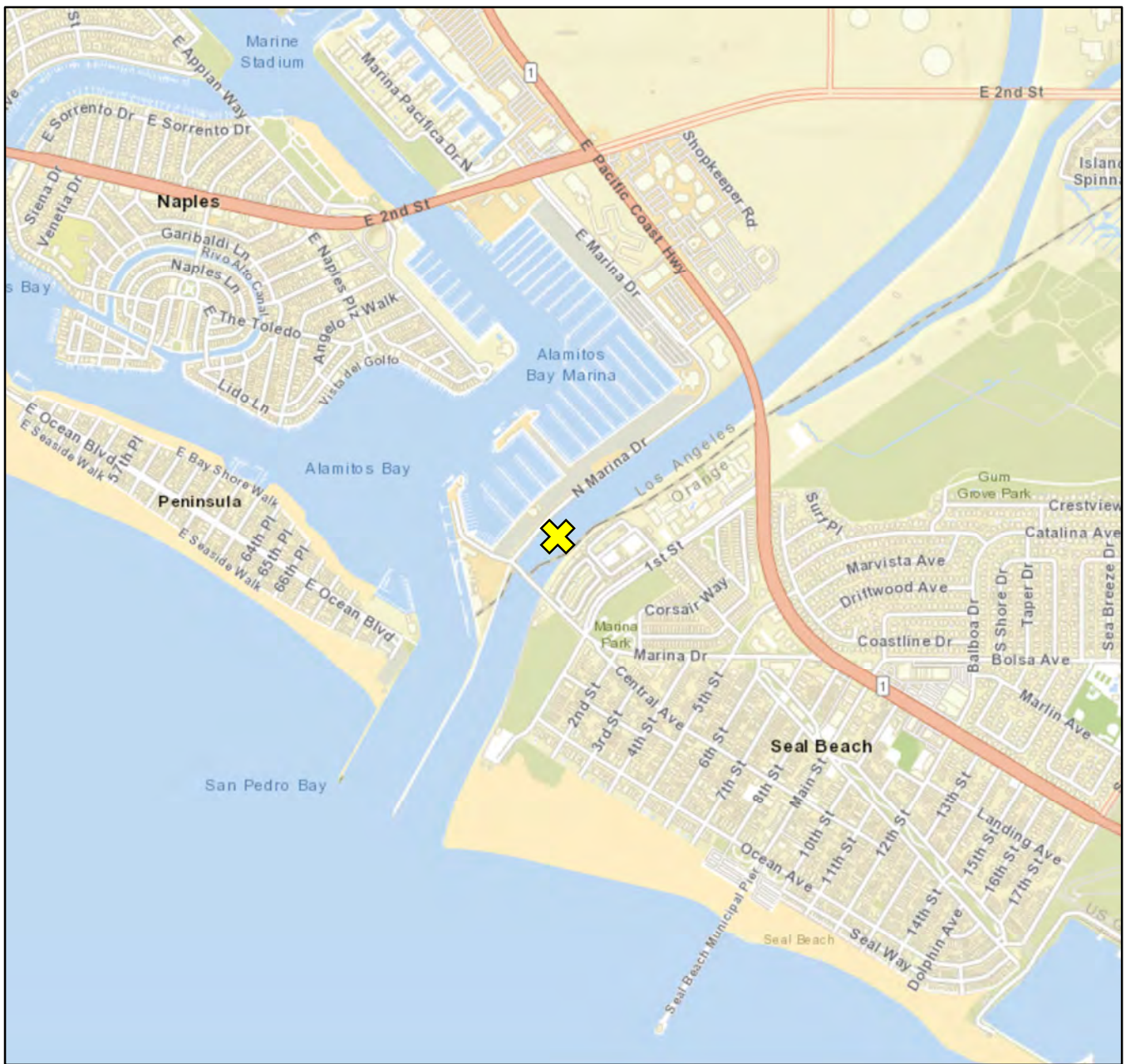


Figure 1
San Gabriel River Watershed
 Harbor Toxics TMDL Sampling for the
 SFPP Norwalk Pump Station
 Los Angeles County, California






Basemap Source: ESRI World Streetmap



LEGEND

-  Approximate Water/Sediment Sampling Location

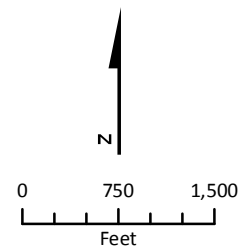


Figure 2
San Gabriel River Sampling Location
 Harbor Toxics TMDL Sampling for the
 SFPP Norwalk Pump Station
 Los Angeles County, California



Appendix A
Standard Operating Procedures

SOP-1 WATER QUALITY MEASUREMENTS

Scope and Applicability

Specific requirements and operating procedures for field measurements of surface water quality parameters (i.e., temperature, dissolved oxygen (DO), pH, and conductivity normalized to 25°C) are addressed in this Standard Operating Procedure (SOP) for SFPP Norwalk Pump Station Harbor Toxics TMDL (Total Maximum Daily Load) compliance sampling. Field personnel will have been trained in the use of specific instruments and are familiar with the theory behind their use.

Acronyms

- cm – Centimeter
- DO – Dissolved Oxygen
- Ft – feet
- Ft³/s – Cubic feet per second
- In – inches
- m – meters
- mg/L – Milligram per liter
- mV – millivolt(s)
- NIST – National Institute of Standards and Technology
- ORP – Oxidation Reduction Potential
- PPT – Parts per thousand
- QAPP – Quality Assurance Project Plan
- S/m – Siemen(s) per meter
- SOP – Standard Operating Procedure
- S.U. – Standard unit
- TMDL – Total Maximum Daily Load

Equipment and Materials

- Water quality multi-meter (e.g., Horiba U-52) with flow-through cell and Calibration Standard Solutions (4.0, 7.0, and 10 pH, 4.49 mS/cm, 0 NTU)
- Spare batteries
- Peristaltic pump or water sampling device (if needed)
- Squirt bottle containing distilled or deionized water
- Kim wipes or other non-abrasive cleaning fabric
- Disposable or cleanable sample collection containers
- Decontamination supplies
- NIST-certified thermometer
- Spare batteries

Procedures

1. Position the vessel over the sampling station and bring vessel to a complete halt prior to exposure chamber deployment. Field measurements should be made at the centroid of flow (the midpoint of the portion of the stream width which contains 50% of the total flow), if the stream visually appears to be completely mixed from shore to shore.
2. Record: GPS coordinates, equipment details, sampling personnel, weather, and time.
3. Calibrate the meter prior to each use in accordance with the manufacturer’s instructions. The calibration and maintenance log will be documented on a field form or in a field notebook and include: Instrument model and serial number, calibration solution concentrations or values, temperatures of solutions, and time of calibration.
4. Immerse the probes into the surface water at the desired depth (see Table A-1), collect a sample into a clean container for water quality measurements, or circulate surface water through a flow-through cell using a peristaltic pump. Probes should be positioned or samples collected from approximately 0.5 m below the water surface at the site or in at least 1 m of water near the site when tide is low– without disturbing the sediment. Indicate the type of sample being analyzed and the collection depth on the sample collection form.
5. Record the stable readings on a field form using Table A-2 as a guide for significant figures. DO should be recorded last. If the DO probe does not have an automatic stirrer attached, or flowing water is not being measured, then manual stirring must be provided by raising and lowering the probe at a rate of 1 ft/s without agitating the water surface. Documentation shall include: measurement location and conditions (e.g., flow-through, grab, 24-hour composite), time of sample measurement, and comments on adjustments, cleaning requirements, or other observations.
6. Rinse the probe with deionized water when done and decontaminate between sample locations.
7. The field team should have a spare unit and spare batteries readily available in case of an equipment malfunction, due to the importance of obtaining these parameters. A colorimetric kit can be maintained on-site and used as a backup.

Table A-1. Recommended Depths for Conducting Field Data Measurements

Water Depth Less than 5 ft (<1.5 m)	If the water depth is less than 5 ft (1.5 m), grab samples for water are taken at approximately 0.1 m (4 in.), and multi-probe measurements are taken at approximately 0.2 m (8 in.). This is because all sensors have to be submerged, so 0.1 m would not be deep enough. But taking a grab sample at 0.2 m is not always feasible, as it is difficult to submerge bottles to that depth, and in many cases the bottle will hit the stream bottom.
Water Depth Greater than 5 ft (>1.5 m)	If the water depth at the sampling point exceeds 5 ft (1.5 m) in depth, a vertical profile of dissolved oxygen, temperature, pH, and specific conductance are made using the multi-parameter probe equipment. The depth of the sonde at the time of measurement is most accurately determined from the depth sensor on the multi-parameter sonde rather than depth labels on the cable.
Vertical Depth Profiles and Depth-Integrated Sample Collection	If depth integration sampling is being conducted, or if vertical profile measurements are requested, multi-probe measurements are made starting at a depth of 0.2 m, and are then conducted at 1.0, 2.0, 3.0, 4.0, and 5.0 m depths after that until 5.0 m depth is reached. Beginning at 5.0 m, measurements are made every 5.0 m through depth profile.

SWAMP 2017. Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California. Version 1.1, updated March 2014.

Table A-2. Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California

Parameter	Field Data Reporting Requirements
Water Temperature (°C)	Report temperature to the nearest tenth of a degree. Round significant figures 0 through 4 down and 5 thru 9 up.
pH (s.u.)	Report pH to the nearest tenth of a pH standard unit.
D.O. mg/L D.O. (% saturation)	Report dissolved oxygen to the nearest tenth of a mg/L. Report % saturation to the nearest tenth of a percent.
Specific Conductance (micro siemens/cm)	Report specific conductance to only three significant figures if the value exceeds 100. Do not report ORP which is displayed by some multiprobes.
Salinity (ppt)	Report salinity values above 1.0 ppt to the nearest tenth of a part per thousand.
Secchi Disk (meters)	Report Secchi depth transparency in meters to two significant figures.
Flow (ft ³ /s)	Report instantaneous flow values less than 10 ft ³ /s to two significant figures. Report flow values greater than 10 ft ³ /s to the nearest whole number, but no more than three significant figures. When there is no flow (pools), report as 0.0. When there is no water, do not report a value, but report as “dry” in the observations.

Source: SWAMP 2017. Version 1.1, updated March 2014.

Parameters and Specifications

Parameter	Range of Measurement	Accuracy
pH	0 to 14 pH units	± 0.1 pH units
Specific conductance	0 to 9.99 S/m	± 3% full scale
DO	0 to 19.99 mg/L	± 0.2 mg/L
Temperature	0 to 55°C	± 0.5°C
Salinity	0 to 4 ‰	± 0.3%

Source: Horiba U-52 Manual; SWAMP (2017) Field Measurements in Fresh and Marine Water.

Notes: Readings should be recorded with significant figures supported by the measurement accuracy.

SOP-2 SURFACE WATER SAMPLING

Scope and Applicability

Specific requirements and operating procedures for surface water collection are addressed in this Standard Operating Procedure (SOP) for SFPP Norwalk Pump Station Harbor Toxics TMDL (Total Maximum Daily Load) compliance sampling.

Acronyms

- cm – Centimeter
- COC – Chain of Custody
- DO – Dissolved oxygen
- HSP – Health and Safety Plan
- mL – Milliliter
- min – Minute
- PPE – Personal Protective Equipment
- QAPP – Quality Assurance Project Plan
- SOP – Standard Operating Procedure
- TMDL – Total Maximum Daily Load
- VOC – Volatile Organic Compound

Equipment and Materials

- Field logbook
- Weighted measuring line or sounding pole
- Bottleneck, labels, and appropriate preservatives for samples
- Pens and markers
- PPE as directed in the HSP
- Sampling device: Kemmerer sampler, Van Dorn bottles, or other appropriate discrete water sampler; or, peristaltic pump (with power source), and tubing
- Ziploc bags
- Ice
- Cooler
- Decontamination solution, DI water, spray bottle(s), scrub brush, bowl
- Digital camera

Procedures

Surface water sample collection may be conducted from a bridge over the target location or from a boat. Vessel maneuvering and positioning will be performed by a qualified subcontractor in accordance with their

standard procedures and specifications noted in the HSP. The subcontractor may also support the sampling. Surface water samples should be collected before any other work is performed (e.g., sediment sampling and water quality monitoring) to avoid potential contamination or disturbing the substrate.

1. The sample site is approached from downstream in a manner that avoids disturbance of bottom sediments as much as possible.
2. Sub-surface grab samples may be collected directly into sample containers not containing preservative at 0.1 m below the water surface. Containers should be opened and re-capped under water in most cases. Surface water should be noted on the field data sheet as 0 m.
3. Sub-surface water samples to be collected in containers with preservative already added will be collected using a properly decontaminated or new pond sampler, Kemmerer or Van Dorn bottle, or a with a peristaltic pump with pre-cleaned and blanked Teflon lined tubing.
4. For discrete sampling devices:
 - a) Lower the pre-set sampling device to approximately 10 cm below the water surface. Avoid bottom disturbance. When the discrete sampler bottle is at the required depth, send down the messenger, closing the sampling device.
 - b) Retrieve the sampler and discharge the first 10 to 20 mL to clear any potential contamination on the valve. Transfer the sample to the appropriate sample container.
 - c) Use special attachments available on some discrete samplers to distribute small volumes at low flow rates (e.g., 100 to 200 mL/ min for VOCs).
 - d) For sample collection with a peristaltic pump, begin pump operation once the peristaltic pump tubing is at the desired depth. Allow several volumes to be purged from the tubing before collecting water into sample containers.
5. Collect and record in-situ water quality parameters (temperature, DO, pH, and conductivity) from the depth at which the water sample is to be collected.
6. Record the following sample collection information in the field book or sampling form: Date and time of sample collection, weather, station location/coordinates (as-sampled), depth, personnel, analytical samples collected, any problems or other observations (e.g., odor, color of water, clarity/turbidity, presence of floating debris/trash). Water depth can be determined with a weighted line or sounding pole.

Precautions

Sample preservatives may include acids or bases and require use of nitrile gloves and safety glasses. Sampling devices with “snap-top” designs can pose a pinch hazard and care should be taken when setting the devices.

SOP-3 SEDIMENT SAMPLING

Scope and Applicability

Specific requirements and operating procedures for sediment collection with an Ekman dredge, petite Ponar, or similar grab sampler from a vessel are addressed in this Standard Operating Procedure (SOP) for SFPP Norwalk Pump Station Harbor Toxics TMDL (Total Maximum Daily Load) compliance sampling.

Acronyms

- cm – Centimeter
- COC – Chain of Custody
- m – Meter
- PFD – Personal flotation device
- QAPP – Quality Assurance Project Plan
- SOP – Standard Operating Procedure
- TMDL – Total Maximum Daily Load

Equipment and Materials

- Ekman or Ponar grab sampler (or similar) and rope (and a backup sampler)
- Plastic float for Ekman grab
- Polyethylene or Teflon (polytetrafluoroethylene; PTFE) disposable scoop
- Glass mixing bowl
- Camera (plus applicable batteries, chargers, etc.)
- Measuring tape
- Forceps
- GPS
- Field notebook
- Waterproof pens /markers
- Sample containers and labels
- Personal protection equipment as required by the Health and Safety Plan (e.g., nitrile gloves, safety glasses, PFD)
- Coolers with ice (double-bagged) for sample storage
- Packing tape

Procedures

Vessels equipped with an Ekman dredge (or equivalent) may be used to collect below-water sediment samples. A backup dredge shall also be available in the event that the primary dredge is damaged,

malfunctions, or is lost. It can also be helpful to bring multiple devices suitable for different sediment densities if site conditions are not known.

The dredge will be decontaminated prior to sample collection. The dredge must be cleaned according to the decontamination SOP (Appendix A, SOP 7) prior to sampling and ensure it is in good working condition.

1. Position the vessel over the sampling station and bring vessel to a complete halt prior to deployment of the dredge. Sampling locations will be approached at slow boat speeds with minimal wake to minimize disturbance of bottom sediment prior to sampling, particularly in shallow sampling locations. Record the coordinates from a GPS. Note: to ensure that the position fix represents the actual location sampled, the antenna for the GPS unit must be as close as practical to the sampler (e.g., within 1 to 2 meters).
2. Prepare the sampler by opening the jaws and setting the trigger mechanism, if applicable.
3. Lower the sampler at a steady pace that avoids creating a bow wave that could disrupt the surface sediment. Drop the sampler onto the sediment from approximately 0.5 m above the sediment surface. Keep the rope snug so there is no slack and it is vertical in the water.
4. Note the depth marked on the sampler rope and record in field book (depth numbering should be properly marked on the rope; zero meters begins at the hinge between the jaws).
5. If necessary, trigger the jaw release mechanism by lowering a messenger down the line, or by depressing the button on the upper end of the extended handle.
6. Raise the sampler firmly and steadily - at a rate of approximately 1 meter per second – and bring on-board into a sampling table or stand (e.g., an empty cooler).
7. Slowly decant free liquid through the top of the sampler once it is on-board. Be careful to retain fine sediment. A peristaltic pump and/or tubing may be used to siphon water from sampler.
8. Check sample acceptability (e.g., closed sampler, not overfilled, adequate penetration depth achieved, minimal winnowing, approximately 10 cm sediment depth collected; Figure A-1). Accept the sample if criteria are met. If not acceptable, then the rejected sediment shall be temporarily stored until sampling at the site has been completed. Rejected sediment can be returned to the site – adjacent to the collection location – once sampling is complete.
9. Photograph acceptable sediment while in the sampler and document and document any notable observations (e.g., odors, colors, layering, consistency).
10. Open the top of the dredge and transfer the top 2 cm of the sediment into a glass bowl using a Teflon scoop. Team members conducting the sample processing will use a clean polyethylene or PTFE scoop and wear clean disposable nitrile gloves. Sediment that is in direct contact with the sides of the grab sampler should not be collected. Continue to collect additional sediment samples until sufficient material has been secured to fill all sample containers.
11. Thoroughly mix sediment to obtain a homogeneous sample with disposable hand tools.
12. Label sample containers and cover the label with packing tape.
13. Transfer the sample into the appropriate sample container(s). Sample containers shall be filled to capacity, and stored in a cooler with a maximum temperature of 4°C.
14. Double-bag the sample container within resealable bags and place an additional label marked with pencil on label or on a piece of waterproof paper between the 2 bags.
15. Return any excess sediment to the site with care not to disturb the location.

16. Once sampling is complete, thoroughly rinse the dredge using a brush and site water. Decontaminate the sampler between stations and when sampling is complete.
17. Sediment samples will be handled carefully to minimize disturbance during collection and transportation to the analytical laboratory. Additional guidance on sample shipping and handling is provided in Appendix A SOPs 4 and 5.
18. Record the following sample collection information in the field book or sampling form: Date and time of sample collection, weather, station location/coordinates (as-sampled), depth, personnel, analytical samples collected, any problems or other observations (e.g., odor, colors, presence of debris/trash).

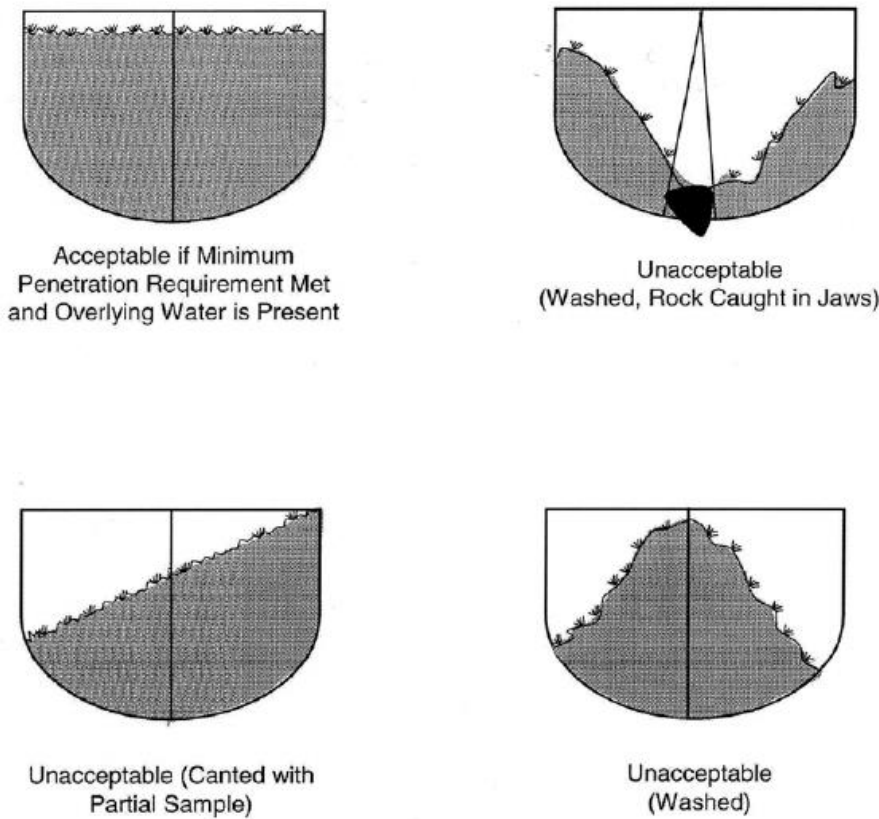


Figure A-1. Examples of Acceptable and Unacceptable Sediment Grab Samples.

SOP-4 SAMPLE STORAGE, PACKING, AND SHIPPING

Scope and Applicability

Specific requirements for sample storage on-site, packaging of sample coolers, and shipment to the off-site analytical laboratory are addressed in this Standard Operating Procedure (SOP) for SFPP Norwalk Pump Station Harbor Toxics TMDL (Total Maximum Daily Load) compliance sampling.

Acronyms

- COC – Chain of Custody
- FS – Field Supervisor
- NPDES – National Pollutant Discharge Elimination System
- QAPP – Quality Assurance Project Plan
- SPC – Sample Processing Coordinator
- SOP – Standard Operating Procedure
- TMDL – Total Maximum Daily Load

Equipment and Materials

Specific equipment or supplies necessary to properly pack and ship samples include the following:

- Quality Assurance Project Plan
- Thermometers
- Resealable plastic bags (assorted sizes)
- Wet ice in doubled, sealable bags
- Coolers
- Bubble wrap
- Fiber-reinforced packing/strapping tape and clear plastic packing tape
- Scissors
- Chain-of-custody (COC) forms
- Ziploc bags (1-gallon size recommended)
- COC seals
- Large plastic garbage bags (preferably 3-mil-thick) for cooler lining
- Paper towels
- “Fragile,” “This End Up,” or “Handle with Care” labels

Procedures

All sample shipping will utilize a commercial courier or shipping service. As a courier will be used, CH2M field personnel will need to be aware of any potentially limiting factors to timely shipping (e.g., availability of overnight service and weekend deliveries to specific areas of the country, shipping regulations “restricted articles” [e.g., dry ice]) prior to shipping the samples.

On-site Sample Storage

Samples will be placed in secure storage (i.e., locked room or vehicle) or remain in the possession of CH2M sampling personnel prior to shipment. Any sample storage areas will be locked and secured to maintain sample integrity and COC requirements.

Packing and Preparation

The following steps should be followed to ensure the proper transfer of samples from the field to the off-site analytical laboratory.

1. Confirm each sample container against the COC form to ensure all samples intended for shipment are accounted and labels match the IDs listed on the COC.
2. Choose the appropriate size cooler (or coolers) and make sure that the outside and inside of the cooler is clean of gross contamination. If the cooler has a drain on the outside at the bottom of the cooler, the drain should be capped and securely taped shut with duct tape.
3. The cooler should be lined with a large plastic bag (preferably a bag with a thickness of 3 mil) should be opened and placed inside the cooler.
4. Individual sample containers should be secured in bubble-wrap (or other available clean packing material) to reduce movement and the potential for breakage or opening inside the cooler during shipment.
5. Place the individual subsamples into the large plastic bag in the cooler, leaving space for sufficient ice that it will not be melted prior to receipt at the lab.
6. Add double-bagged wet ice to keep the samples cool during shipping (i.e., 4°C). Always over-estimate the amount of ice that you think will be required. After all samples and ice have been added to the cooler, use bubble wrap (or other available clean packing material) to fill any empty space to keep the samples from shifting during transport.
7. Sign and date the completed COC form and retain the pink (back) copy for project files. Take a photo of the COC for the project file if carbon copies are not available. Place the rest of the signed COC form in a resealable bag (e.g., 1 gallon Ziploc) and tape the bag containing the form to the inside of the cooler lid. Each cooler should contain an individual COC form for the samples contained in each respective cooler. If time constraints impact sample shipping, and it becomes necessary to combine all the samples onto a single set of COC forms, and the shipment contains multiple coolers, indicate on the outside of the respective cooler "Chain-of-Custody Inside."
8. After the cooler is sufficiently packed to prevent shifting of the containers, close the lid and seal it shut with fiber-reinforced packing tape. The cooler should be taped shut around the opening between the lid and the bottom of the cooler and around the circumference of the cooler at both hinges.
9. As security against unauthorized handling of the samples, apply two COC seals across the opening of the cooler lid. One seal should be placed on the front right portion of the cooler and one seal should be placed on the back-left portion of the cooler. Be sure the seals are properly affixed to the cooler so they are not removed during shipment. Additional clear packing tape across the seal may be necessary if the outside of the cooler is wet.

The sample processing coordinator (SPC) should notify the laboratory contact will be shipped and the estimated arrival time. This must be done for Saturday deliveries. The SPC should also send copies of all COC forms to the project manager or place electronic copies on the project folder

(\\Cheron\Proj\KinderMorgan\407609Norwalk\), as appropriate.

Shipping

1. Shipping labels will be generated using CH2M’s shipping tools (e.g., CH Express or Ship Right) (<https://www.int.ch2m.com/VO/Site?folders=RFOM&file=tools>).
2. Add appropriate labels, such as “This End Up,” “Fragile,” and “Handle with Care.” If the shipment contains multiple coolers, indicate on the mailing label the number of coolers that the testing laboratory should expect to receive (e.g., 1 of 2; 2 of 2).
3. Samples shipped for Saturday delivery, or for overnight delivery expected on Friday, shall indicate Saturday delivery on the shipping label – in case of delay by the courier.

SOP-5 SAMPLE CUSTODY

Scope and Applicability

This SOP describes CH2M procedures for custody management of environmental samples during SFPP Norwalk Pump Station Harbor Toxics TMDL (Total Maximum Daily Load) compliance sampling.

Chain-of-custody (COC) forms ensure that samples are traceable from the time of collection through processing and analysis until final disposition. A sample is in a person's custody if any of the following criteria are met:

1. The sample is in the person's possession
2. The sample is in the person's view after being in possession
3. The sample is in the person's possession and is being transferred to a designated secure area
4. The sample has been locked up to prevent tampering after it was in the person's possession.

At no time is it acceptable for samples to be outside of CH2M personnel's custody unless the samples have been transferred to a secure area (i.e., locked up and custody sealed). If the samples cannot be placed in a secure area, then a CH2M field team member must physically remain with the samples (e.g., at lunch time one team member must remain with the samples).

Acronyms

- COC – Chain of Custody
- FS – Field Supervisor
- PM – Project Manager
- QA/QC – Quality Assurance/Quality Control
- SPC – Sample Processing Coordinator
- TMDL – Total Maximum Daily Load

Chain-of-Custody Forms

The COC form is critical because it documents sample possession from the time of collection through the final disposition of the sample. The form also provides information to the laboratory regarding what analyses are to be performed on the samples that are shipped.

The COC form will be completed after each field collection activity and before the samples are shipped to the laboratory. Sampling personnel are responsible for the care and custody of the samples until they are shipped. When transferring possession of the samples, the individuals relinquishing and receiving the samples must sign the COC form(s), indicating the time and date that the transfer occurs.

COC forms typically consist of 3-part carbon-less paper with white, yellow, and pink copies. The white sheet and the yellow sheet will be placed into a plastic sealable bag and secured to the inside top of each transfer container (e.g., cooler). The pink sheet will be retained by the field staff for filing at the CH2M PM's location. Each COC form has a unique number. This number and the samples on the form shall be recorded in the field logbook. CH2M also uses computer-generated COC forms.

If computer-generated forms are used, then the forms will be printed in triplicate, sequentially numbered, and all three sheets signed so that two sheets can accompany the shipment to the laboratory and one sheet can be retained on file at the CH2M PM's location. Alternatively, if sufficient lead time is available, the computer-generated forms should be printed on 3-part carbon-less paper.

The individual sample identifiers will be recorded on the COC form. The COC form will also identify the following:

- sample collection date and time
- sample location
- sample media (e.g., effluent or surface water)
- type of sample (e.g., grab or composite)
- number of containers per sample
- each sample container volume and material
- preservatives (if any)

In addition, the COC form provides information on any other sample pretreatment applied in the field and the analyses to be conducted by referencing a list of specific analyses or the statement of work for the laboratory. The COC form will be sent to the laboratory along with the sample(s).

Procedures

The following guidelines will be followed to ensure the integrity of the samples:

1. COC forms will be completed in ink.
2. At the end of each sampling day and prior to shipping or storage, COC entries will be made for all samples and COCs will be filled out for all samples. Information on the COCs will be checked against field logbook entries.
3. At the bottom of each COC form is a space for the signatures of the persons relinquishing and receiving the samples and the time and date that the transfer occurred. Usually either the Sample Processing Coordinator (SPC) or Field Supervisor (FS) will relinquish the samples. The time that the samples were relinquished should match. Each COC form must be appropriately signed and dated by the sampling personnel. The person who relinquishes custody of the samples must also sign this form.
4. The COC form should not be signed until the information has been checked for inaccuracies by the FS. All changes should be made by drawing a single line through the incorrect entry and initialing and dating it. Revised entries should be made in the space below the entries. Any blank lines remaining on the COC form after corrections are made should be marked out with single lines that are initialed and dated. This procedure will preclude any unauthorized additions.
5. At the bottom of each COC form is a space for the signatures of the persons relinquishing and receiving the samples and the time and date that the transfer occurred. The time that the samples were relinquished should match exactly the time they were received by another party. Under no circumstances should there be any time when custody of the samples is undocumented.
6. If samples are sent by a commercial carrier not affiliated with the laboratory, such as Federal Express (FedEx) or United Parcel Service (UPS), the name of the carrier should be recorded on the COC form. Any tracking numbers supplied by the carrier should be also entered on the COC form. The time of transfer should be as close to the actual drop-off time as possible. After the COC forms are signed and the "pink" copy has been removed, they should be sealed inside the transfer container.

7. If errors are found after the shipment has left the custody of sampling personnel, a corrected version of the forms must be made and sent to all relevant parties. Minor errors can be rectified by making the change on a copy of the original with a brief explanation and signature. Errors in the signature block may require a letter of explanation.
8. Upon completion of a field sampling event, the FS will be responsible for submitting all COC forms to be scanned and posted to the project folder.

Custody Seal

As security against unauthorized handling of the samples during shipping, two custody seals will be affixed to each sample cooler. The custody seals will be placed across the opening of the cooler (front right and back left) prior to shipping. Be sure the seals are properly affixed to the cooler so they cannot be removed during shipping. Additional tape across the seal may be prudent.

Shipping Air Bills

When samples are shipped from the field to the testing laboratory via a commercial carrier (e.g., Federal Express, UPS), an air bill or receipt is provided by the shipper. The FS is responsible for posting a copy of the shipping air bills to the project LAN folder upon completion of the field sampling event. The air bill number (or tracking number) shall be noted on the applicable COC forms and the applicable COC form number should be noted on the air bill to enable sample tracking if a cooler becomes lost.

Acknowledgement of Sample Receipt Forms

In most cases, when samples are sent to a testing laboratory, an Acknowledgment of Sample Receipt form is faxed to the project QA/QC coordinator the day the samples are received by the laboratory. It is the responsibility of the person receiving this form (designated by PM) to review the form and make sure that all the samples that were sent to the laboratory were received by the laboratory and that the correct analyses were requested. If an error is found, the laboratory must be called immediately. Decisions made during the telephone conversation should be documented in writing on the Acknowledgment of Sample Receipt Form. In addition, corrections should be made to the COC form and the corrected version of the COC form should be faxed to the laboratory.

The Acknowledgment of Sample Receipt form (and any modified COC forms) will then be submitted to be scanned and copied to the project folder.

Archive Record Forms

On occasion, samples are archived at a CH2M office or a CH2M authorized laboratory. If samples are to be archived, it is the responsibility of the PM or analytical laboratory manager to complete an Archive Record form. This form is to be accompanied by a copy of the COC form for the samples, and will be placed in a locked file cabinet. The original COC form will remain with the samples in a resealable plastic bag.

SOP-6 FIELD DOCUMENTATION

Scope and Applicability

The integrity of each sample from the time of collection to the point of data reporting must be maintained throughout SFPP Norwalk Pump Station Harbor Toxics TMDL (Total Maximum Daily Load) compliance sampling. Proper record keeping will be implemented in the field to allow samples to be tracked from collection to final disposition.

All information pertaining to field operations during sample collection must be properly documented to ensure transparency (and reproducibility) of methods and procedures. Several types of field documents will be used for this purpose by field personnel.

Acronyms

- COC – Chain of Custody
- FS – Field Supervisor
- FTL – Field Team Leader
- PM – Project Manager
- QAPP – Quality Assurance Project Plan
- SOP – Standard Operating Procedure
- STC – Senior Technical Consultant
- TMDL – Total Maximum Daily Load

Field Logbooks

During field sampling events, field logbooks are used to record all daily field activities during sample collection. The purpose of the field logbook is to document events that occur during field activities and to record data measured in the field to ensure transparency and reproducibility.

The field logbook is the responsibility of, and maintained by the Field Team Leader (FTL). A site logbook may be kept by the Field Supervisor (FS) during sampling activities and will be placed in the project files when filled or at the conclusion of field activities.

The field logbook will be bound and waterproof with consecutively numbered pages. All entries will be made using waterproof ink and no erasures will be made. Any necessary corrections in the logbook should consist of a single line-out deletion, followed by the author's initials and the date. The author will initial and date each page of the field logbook, sign and date the last page at the end of each day, and draw a line through the remainder (unused portion) of that page.

The project name, dates of the field work, site name, and location (city and state) should be written on the cover of the field logbook. If more than one logbook is used during a single sampling event, then the upper right-hand corner of the logbook will be annotated (e.g., Volume 1 of 2, 2 of 2) to indicate the number of logbooks used during the field event. Field logbooks will be stored in a secure manner when not in use in the field.

At a minimum, the following information will be recorded in the field logbook:

- Project name and location.

- Purpose and description of the field task.
- Date(s) and times of activities (24-hour clock; e.g., 1400).
- Name and affiliation of person making entries and other field personnel and their duties, including the times that they are present.

The following information may be event specific and should be recorded in the field logbook when applicable:

- Health and Safety (tailgate) discussion topic and any issues encountered.
- The sample identifier and analysis code for each sample to be submitted for laboratory analysis, if not included on separate field data sheets (cross reference provided).
- All field measurements made (or reference to specific field data sheets used for this purpose), including the time that the measurement was collected and the date of calibration, if appropriate.
- The sampling location name, date, gear, water depth (if applicable), and sampling location coordinates, if not included on separate field data sheets.
- Specific information on each type of sampling activity and a sample description.
- The sample type, sample number, sample tag number, and preservatives used (if any), if not included on separate field data sheets.
- Weather conditions at the beginning of the field work and any changes that occur throughout the day, including the approximate time of the change (e.g., wind speed and direction, rain, thunder, etc.).
- The location and description of the work area, including sketches, map references, and photograph log, if appropriate.
- Level of personal protection being used.
- Onsite visitors (names and affiliations), if any, including the times that they are present (e.g., cultural resource personnel, agency observers, etc.).
- The name, affiliation, and telephone number(s) of any key field contacts.
- Notation of the coordinate system used to determine the station location information.
- Sample storage methods.
- Cross-references of numbers for duplicate samples.
- Photographs (uniquely identified) taken at the sampling location, if any.
- Details of the work performed.
- Variations, if any, from the project-specific Quality Assurance Project Plan (QAPP) or standard operating protocols, reasons for deviation, and project personnel (e.g., PM or STC) contacted to discuss the deviation.
- Details pertaining to unusual events which might have occurred during sample collection (e.g., possible sources of sample contamination, equipment failure, unusual appearance of sample integrity).
- References to other logbooks or field forms used to record information (e.g., field data sheets, health and safety log).
- Sample shipment information (e.g., shipping manifests, COC form numbers, carrier, air bill numbers, time addresses).
- A record of quantity of investigation derived wastes (if any) and storage and handling procedures.

A summary of all daily site activities should be recorded in the logbook. The information need not duplicate anything recorded in other field logbooks or field forms (e.g., Site Health and Safety Officer's logbook, calibration logbook, field data sheets), but should summarize the contents of the other logbooks and refer to the page locations in these logbooks for detailed information.

If measurements are made at any location, the measurements and equipment used must either be recorded in the field logbook or reference must be made to the logbook and page number(s) or data from on which they are recorded. All maintenance and calibration records for equipment should be traceable through field records to the person using the instrument and to the specific piece of instrumentation itself.

Field Data Forms

Upon completion of the field sampling event, the FS will be responsible for submitting all field data forms to be scanned and copied to the project folder.

Photographs

In certain instances, photographs (print or digital) of samples, activities, and/or sampling locations may be taken. Photographs should include an item of known size for scale, when practical (e.g., pencil, coin, ruler, etc.). Telephoto/zoom or wide-angle shots should not be used because they cannot be used in enforcement proceedings. The following items should be recorded in the field logbook for each photograph taken:

1. The photographer's name or initials, date and time of the photograph, and the general direction faced (orientation).
2. A brief description of the subject and the field work portrayed in the picture.
3. For print photographs, the sequential number of the photograph and the film roll number (if applicable) on which it is contained.
4. For digital photographs, the sequential number of the photograph, the file name, the file location, and any back-up (if applicable).

Upon completion of the field sampling event, the FS will be responsible for submitting all photographic materials to be developed (prints) or to be copied from electronic media, as appropriate. Digital copies of all photos and scans of photo logs or supporting documentation from the field logbook will be copied into in the project folder. Prints or electronic media, any associated negatives, and hard copies of supporting documentation will be held in the project files (at the CH2M PM's location).

SOP-7 DECONTAMINATION

Scope and Applicability

This standard operating procedure (SOP) provides the general technical requirements and operational guidelines associated with documenting environmental sampling and field investigations for SFPP Norwalk Pump Station Harbor Toxics TMDL (Total Maximum Daily Load) compliance sampling. All reusable sediment sampling and water sampling and processing equipment will be decontaminated prior to each use to prevent cross-contamination of samples from residual material on sampling devices. Decontaminated equipment will be wrapped in foil (shiny side out) and stored to avoid recontamination. Blanks will also be collected to confirm there is no potential for sample contamination from the equipment.

Acronyms

- DI – Deionized
- HSP – Health and Safety Plan
- IDW – Incident Derived Waste
- PPE – Personal Protective Equipment
- SOP – Standard Operating Procedure
- TMDL – Total Maximum Daily Load

Equipment and Materials

- Deionized (DI) water (ASTM Type II water or lab-grade DI water if available)
- Tap water or site water
- 2.5% (w/w) Liquinox® and water solution
- Scrub brushes
- Squirt bottles labelled to identify contents (e.g., site water, Liquinox)
- Polyethylene or polypropylene tub or bucket (to collect rinsate)
- Plastic garbage bag
- Aluminum foil
- Personal Protective Equipment (PPE) as specified by the Health and Safety Plan (HSP)

Procedures


Reusable sampling equipment is decontaminated before and after each use as follows.

1. Don nitrile gloves.
2. Rinse and scrub equipment thoroughly with site water or tap water to remove debris.
3. Wash all equipment surfaces that contacted the potentially contaminated soil/water with Liquinox® solution (e.g., about 0.5 tablespoon in 2.5 gallons of water).
4. Double-rinse with potable water or site water.
5. Rinse with distilled or DI water.
6. Set the equipment in a clean location to dry.

7. Equipment does not need to be dry before use.
8. Wrap equipment with aluminum foil (shiny side out) for transport and handling if equipment will not be used immediately.
9. Collect all rinsate and waste materials to dispose according to IDW plan.

Attachment 1

Field Form and COC Examples

SWAMP Field Data Sheet (Water Chemistry & Discrete Probe) - EventType=WQ							Entered in d-base (Initial/date)			Pg of Pgs			
*StationID: _____			*Date (mm/dd/yyyy): / /			*Group: _____			*Agency: _____				
*Funding: _____			ArrivalTime: _____		DepartureTime: _____		*SampleTime (1st sample): _____			*Protocol: _____			
*ProjectCode: _____			*Personnel: _____			*Purpose (circle applicable): WaterChem WaterTox Habitat FieldMeas			*PurposeFailure: _____				
*Location: Bank Thalweg Midchannel OpenWater			*GPS/DGPS		Lat (dd.dddddd)		Long (ddd.dddddd)		OCCUPATION METHOD: Walk-In Bridge RV _____ Other				
GPS Device: _____			Target: _____		-		STARTING BANK (facing downstream): LB / RB / NA						
Datum: NAD83		Accuracy (ft/m): _____		*Actual: _____		-		Point of Sample (if Integrated, then -88 in dbase)					
Habitat Observations (CollectionMethod = Habitat_generic)				WADEABILITY: Y / N / Unk		BEAUFORT SCALE (see attachment):		DISTANCE FROM BANK (m):		STREAM WIDTH (m):			
SITE ODOR: None, Sulfides, Sewage, Petroleum, Smoke, Other										WATER DEPTH (m):			
SKY CODE: Clear, Partly Cloudy, Overcast, Fog, Smoky, Hazy				WIND DIRECTION (from):				HYDROMODIFICATION: None, Bridge, Pipes, ConcreteChannel, GradeControl, Culvert, AerialZipline, Other LOCATION (to sample): US / DS / WI / NA					
OTHER PRESENCE: Vascular, Nonvascular, OilySheen, Foam, Trash, Other								PHOTOS (RB & LB assigned when facing downstream; RENAME to StationCode_yyyy_mm_dd_uniquecode[] 1: (RB / LB / BB / US / DS / ##)					
DOMINANT SUBSTRATE: Bedrock, Concrete, Cobble, Boulder, Gravel, Sand, Mud, Unk, Other								2: (RB / LB / BB / US / DS / ##)					
WATERCLARITY: Clear (see bottom), Cloudy (>4" vis), Murky (<4" vis)						PRECIPITATION: None, Fog, Drizzle, Rain, Snow		3: (RB / LB / BB / US / DS / ##)					
WATERODOR: None, Sulfides, Sewage, Petroleum, Mixed, Other						PRECIPITATION (last 24 hrs): Unknown, <1", >1", None							
WATERCOLOR: Colorless, Green, Yellow, Brown						EVIDENCE OF FIRES: No, <1 year, <5 years							
OVERLAND RUNOFF (Last 24 hrs): none, light, moderate / heavy, unknown													
OBSERVED FLOW: NA, Dry Waterbody Bed, No Obs Flow, Isolated Pool, Trickle (<0.1cfs), 0.1-1cfs, 1-5cfs, 5-20cfs, 20-50cfs, 50-200cfs, >200cfs													
Field Measurements (SampleType = FieldMeasure; Method = Field)													
	DepthCollec (m)	Velocity (fps)	Air Temp (°C)	Water Temp (°C)	pH	O ₂ (mg/L)	O ₂ (%)	Specific Conductivity (µS/cm)	Salinity (ppt)	Turbidity (ntu)			
SUBSURF/MID/BOTTOMREP													
SUBSURF/MID/BOTTOMREP													
SUBSURF/MID/BOTTOMREP													
Instrument:													
Calib. Date:													
Samples Taken (# of containers filled) - Method=Water_Grab						Field Dup YES / NO: (SampleType = Grab / Integrated; LABEL_ID = FieldQA; create collection record upon data entry)							
SAMPLE TYPE: Grab / Integrated			COLLECTION DEVICE:			Indiv bottle (by hand, by pole, by bucket); Teflon tubing; Kemmer; Pole & Beaker; Other							
	DepthCollec (m)	Inorganics	Bacteria	Chl a	TSS / SSC	TOC / DOC	Total Hg	Dissolved Mercury	Total Metals	Dissolved Metals	Organics	Toxicity	VOAs
Sub/Surface													
Sub/Surface													
COMMENTS:													

SWAMP Field Data Sheet (Sediment Chemistry) - EventType=WQ										Entered In d-base (Initial/date)		Pg of Pgs	
*StationID:			*Date (mm/dd/yyyy): / /			*Group:			*Agency:				
*Funding: _____			ArrivalTime:		DepartureTime:		*SampleTime (1st sample):			*Protocol:			
*ProjectCode:			*Personnel:			*Purpose (circle applicable): SedChem SedTox Habitat Benthic			*PurposeFailure:				
*Location: Bank Thalweg Midchannel OpenWater			*GPS/DGPS		Lat (dd.dddddd)		Long (ddd.dddddd)		OCCUPATION METHOD: Walk-In Bridge RV _____ Other				
GPS Device:			Target:		-		STARTING BANK (facing downstream): LB / RB / NA						
			*Actual:		-		Point of Sample (if Integrated, then -88 in dbase)						
Datum: NAD83 Accuracy (ft/m):			Same as Water/Probe Collection? YES NO			DISTANCE FROM BANK (m):		STREAM WIDTH (m):					
Habitat Observations (CollectionMethod = Habitat_generic) **Only complete Sed Observations (bolded) if WQ Observations are already recorded			WADABILITY: Y / N / Unk		BEAUFORT SCALE see Attachment		WATER DEPTH (m):						
SITE ODOR: None, Sulfides, Sewage, Petroleum, Smoke, Other _____			WIND DIRECTION (from):				HYDROMODIFICATION: None, Bridge, Pipes, Concrete Channel, Grade Control, Culvert, Aerial Zipline, Other						
SKY CODE: Clear, Partly Cloudy, Overcast, Fog, Smoky, Hazy							LOCATION (to sample): US / DS / WI / NA						
OTHER PRESENCE: Vascular, Nonvascular, Oily Sheen, Foam, Trash, Other _____							PHOTOS (RB & LB assigned when facing downstream; RENAME to StationCode_YYYY_MM_DD_UNIQUECODE)						
DOMINANT SUBSTRATE: Bedrock, Concrete, Cobble, Boulder, Gravel, Sand, Mud, Unk, Other _____									1: (RB / LB / BB / US / DS / ##)				
SEDODOR: None, Sulfides, Sewage, Petroleum, Mixed, Other _____			PRECIPITATION: None, Fog, Drizzle, Rain, Snow						2: (RB / LB / BB / US / DS / ##)				
SEDCOLOR: Colorless, Green, Yellow, Brown			PRECIPITATION (last 24 hrs): Unknown, <1", >1", None						3: (RB / LB / BB / US / DS / ##)				
SEDCOMPOSITION: Silt/Clay, Fine Sand, Coarse Sand, Gravel, Cobble, Mixed, Hard Pan Clay			EVIDENCE OF FIRES: No, <1 years, <5 years										
OBSERVED FLOW: NA, Dry Waterbody Bed, No Obs Flow, Isolated Pool, Trickle (<0.1cfs), 0.1-1cfs, 1-5cfs, 5-20cfs, 20-50cfs, 50-200cfs, >200cfs													
Samples Taken (# of containers filled) - Method=Sed_Grab					Field Dup YES / NO: (SampleType = Grab / Integrated; LABEL_ID = FieldQA; create collection record upon data entry)								
COLLECTION DEVICE:			Scoop (SS / PC / PE, Core (SS / PC / PE), Grab (Van Veen / Eckman / Petite Ponar)					COLLECTION DEVICE AREA (m2):					
Sample Type:	Depth Collec (cm)	Equipment Used	Sediment Only (Y / N)	Grain Size/TOC	Organics	Metals/HgT	Selenium	Toxicity	SWI	Archive Chemistry	Benthic Infauna	Benthic Coll. Area (m ²)	Sieve Size (mm)
Integrated Grab													
Integrated Grab													
Integrated Grab													
Integrated Grab													
COMMENTS:													

**Notes to Standardize SWAMP Field Data Sheets
(For in the field use)**

Key Reminders to identify samples:

1. **Sample Time** will be the actual sample time for each sample collected during the sampling event.
2. **Group**; many different ways to do a group, one suggestion is to create groups which assign trips to assess frequency of field QA

Collection Details

1. **Personnel**: S. Mundell, G Ichikawa (first person listed is crew leader)
2. **Location**: Use "openwater" in bay/estuary/harbor only if no distinguishable channel exists
3. **GRAB vs INTEGRATED**: GRAB samples are when bottles are filled from a single depth; INTEGRATED sample are taken from MULTIPLE depths and combined.
 - a. GRAB: use 0.1 for subsurface samples; if too shallow to submerge bottle; depth =0
 - b. INTEGRATED: -88 in depth sampled, record depths combined in sample comments
4. **TARGET LAT/LONG**: Refers to the existing station location that the sampling crew is trying to achieve; can be filled out prior to sampling
5. **ACTUAL LAT/ LONG**: is the location of the current sample event.
6. **HYDROMODIFICATION**: Describe existing hydromodifications such as a grade control, drainage pipes, bridge, culvert
7. **HYDROMOD LOC**: if there is an IMMEDIATE (with in range potentially effecting sample) hydromodification; Is the hydromodification upstream/downstream/within area of sample; if there is no hydromodification, NA is appropriate
8. **STREAM WIDTH and DEPTH**: describe in meters at point of sample.

FIELD OBSERVATIONS: (each one of these observations has a comment field in the database so use comment space on data sheet to add information about an observation if necessary)

1. **PICTURES**: use space to record picture numbers given by camera; be sure to rename accordingly back in the office. (StationCode_yyyy_mm_dd_uniquecode)
2. **WADEABILITY**: in general, is waterbody being sampled wadeable to the average person AT the POINT of SAMPLE
3. **DOMINANT SUBSTRATE**: if possible; describe DOMINANT substrate type; use UNK if you cannot see the dominant substrate type
4. **BEAUFORT SCALE**: use scale 0-12; refer to scales listed below.
5. **WIND DIRECTION**: records the direction from which the wind is blowing
6. **OTHER PRESENCE**: VASCULAR refers to terrestrial plants or submerged aquatic vegetation (SAV) and NONVASCULAR refers to plankton, periphyton etc. These definitions apply to vegetation IN the water at the immediate sampling area.
7. **OBSERVED FLOW**: Visual estimates in cubic feet/ second.
8. **WATER COLOR**: This is the color of the water from standing creek side
9. **WATER CLARITY**: this describes the clarity of the water while standing creek side; clear represents water that is clear to the bottom, cloudy may not be clear to bottom but greater than 4" can be seen through the water column.
10. **PRECIPITATION LAST24hrs**: refers to field crews best categorization of rainfall in the last 24 hrs; may or may not effect Overland Runoff Last 24 hrs
11. **OVERLAND RUNOFF LAST 24 hrs**: Light Precip = fog, drizzle, and/or light rain with no overland runoff; Mod to Heavy Precip = rain such that site probably or definitely received at least some overland runoff
12. **SedimentComp**: generally described sediments used for chemistry sample

Note: these reminders do not give all details needed to maintain equivalent SWAMP sampling protocols, they are strictly for "infield" use to help insure comparability of field observations.

BEAUFORT SCALE: Specifications and equivalent speeds for use at sea

FORCE	EQUIVALENT SPEED 10 m above ground		DESCRIPTION	SPECIFICATIONS FOR USE AT SEA
	miles/hour	knots		
0	0-1	0-1	Calm	Sea like a mirror.
1	1-3	1-3	Light air	Ripples with the appearance of scales are formed, but without foam crests.
2	4-7	4-6	Light breeze	Small wavelets, still short, but more pronounced. Crests have a glassy appearance and do not break.
3	8-12	7-10	Gentle breeze	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses.
4	13-18	11-16	Moderate breeze	Small waves, becoming larger; fairly frequent white horses.
5	19-24	17-21	Fresh breeze	Moderate waves, taking a more pronounced long form; many white horses are formed. Chance of some spray.
6	25-31	22-27	Strong breeze	Large waves begin to form; the white foam crests are more extensive everywhere. Probably some spray.
7	32-38	28-33	Near gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind.
8	39-46	34-40	Gale	Moderately high waves of greater length; edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind.
9	47-54	41-47	Severe gale	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility.
10	55-63	48-55	Storm	Very high waves with long over-hanging crests. The resulting foam, in great patches, is blown in dense white streaks along the direction of the wind. On the whole the surface of the sea takes on a white appearance. The 'tumbling' of the sea becomes heavy and shock-like. Visibility affected.

Source:

Last edited on 09 January, 1999 Dave Wheeler weatherman@zetnet.co.uk
Web Space kindly provided by Zetnet Services Ltd, Lerwick, Shetland.

BEAUFORT SCALE: Specifications and equivalent speeds for use on land

FORCE	EQUIVALENT 10 m above ground	SPEED	DESCRIPTION	SPECIFICATIONS FOR USE ON LAND
0	miles/hour 0-1	knots 0-1	Calm	Calm; smoke rises vertically
1	1-3	1-3	Light air	Direction of wind shown by smoke drift, but not by wind vanes
2	4-7	4-6	Light Breeze	Wind felt on face; leaves rustle; ordinary vanes moved by wind
3	8-12	7-10	Gentle Breeze	Leaves and small twigs in constant motion; wind extends light flag
4	13-18	11-16	Moderate Breeze	Raises dust and loose paper; small branches are moved.
5	19-24	17-12	Fresh Breeze	Small trees in leaf begin to sway crested wavelets form on inland waters
6	25-31	22-27	Strong Breeze	Large branches in motion; whistling heard in telegraph wires umbrellas used with difficulty
7	32-38	28-33	Neargale	Whole trees in motion; inconvenience felt when walking against the wind
8	39-46	34-40	Gale	Breaks Twigs and generally impedes progress

Source:

Last edited on 09 January, 1999 Dave Wheeler weatherman@zetnet.co.uk
Web Space kindly provided by Zetnet Services Ltd, Lerwick, Shetland.

Advanced Technology Laboratories
 3151 W. Post Road
 Las Vegas, NV 89118
 Tel: 702-307-2659 Fax: 702-307-2691
 Marlon Cartin (marlon@atl-labs.com)

CHAIN OF CUSTODY RECORD

DATE: _____
 PAGE: _____ of _____

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	Section D Sampler Information:
Company: Kinder Morgan Energy Partners Attention: Steve Defibaugh	Report To: Eric Davis	Attention: Steve Defibaugh	Sampler Name: James Dye
Address: 1100 Town & Country Road Orange, CA 92868	Copy To: Steve Defibaugh	Company Name: Kinder Morgan Energy Partners	Sampler Signature:
Email To: steve_defibaugh@kindermorgan.com eric_davis@krm.com	Purchase Order No.:	Address: 1100 Town & Country Road Orange, CA 92868	Sample Date:
Phone: 714-560-4802 Fax: 714-560-4801	Project Name: SFPF Norwalk	ATL Project Manager: Marlon Cartin	

Section E Required Sample Information		CONTAINER TYPE	# OF CONTAINERS	PRESERVATIVE	VOLUME (mL)	SAMPLING				TOTAL # OF CONTAINERS	SAMPLE TEMPERATURE (°F)	Analysis Test	Comments
ITEM #	SAMPLE ID					LOCATION/ DESCRIPTION	MATRIX	SAMPLE TYPE (S=GRAB C=COMP)	DATE				
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													

Relinquished by (Signature and Printed Name): _____ Date / Time: _____	Relinquished by (Signature and Printed Name): _____ Date / Time: _____	Turn Around Time (TAT): <input type="checkbox"/> A = Same Day <input type="checkbox"/> B = 24 Hours <input type="checkbox"/> C = 48 Hours <input type="checkbox"/> D = 72 Hours <input type="checkbox"/> E = 5 Workdays <input type="checkbox"/> F = 10 Workdays TAT Starts at 8 AM the following day if samples received after 3:00 PM.	Special Instruction:
Relinquished by (Signature and Printed Name): _____ Date / Time: _____	Relinquished by (Signature and Printed Name): _____ Date / Time: _____		
Relinquished by (Signature and Printed Name): _____ Date / Time: _____	Relinquished by (Signature and Printed Name): _____ Date / Time: _____		
Matrix: W = Water WW = Wastewater H = HCl N = HNO3 S = H2SO4 O = Oil P = Product S = Soil Z = Zn(AC)2 O = NaOH T = Na2S2O3		Preservatives: 	Container Type: T = Tube V = VOA P = Pint A = Amber J = Jar B = Tedlar G = Glass M = Metal P = Plastic C = Can
Others/Specify: _____		Others/Specify: _____	

Attachment 2

Contact List

Contact List – NPDES Compliance

SFPP Norwalk Pump Station

Name	Affiliation	Position	Phone	Email / Address
Paul Cho	Water Board	Case Manager	(213) 576-6721	Paul.Cho@waterboards.ca.gov
Ching Yin To	Water Board	Permit Contact	(213) 576-6696	Ching-Yin.To@waterboards.ca.gov 320 W. 4th Street, Suite 200 Los Angeles, CA 90013
Steve Defibaugh	Kinder Morgan Energy Partners	Client Project Manager	(714) 560-4802	Steve_Defibaugh@kindermorgan.com 1100 Town & Country Road Orange, CA 92868
Eric Davis	CH2M	Project Manager	(213) 228-8262	Eric.Davis@ch2m.com
Vladmir Carino	CH2M	Site Engineer	(714) 435-6017	Vladimir.Carino@ch2m.com
Benny Pataray	CH2M	Data Manager	(385) 474-8545	Benny.Pataray@ch2m.com
Jeffrey Johnson	CH2M	Senior Technical Coordinator	(513) 587-7041	jeffrey.johnson1@ch2m.com
Bernice Kidd	CH2M	Quality Assurance Manager and Laboratory Coordinator	(530) 229-3203	Bernice.Kidd@ch2m.com
Marlon Cartin	Asset Laboratories	Chemistry Lab - Norwalk Project Manager	(702) 307-2659 Ext. 410	marlon@assetlaboratories.com 3151 W. Post Road Las Vegas, NV 89118
Fern Rivera	Asset Laboratories	Chemistry Lab - Norwalk Data Manager	(702) 307-2659	reports.lv@assetlaboratories.com

Project files <\\Cheron\Proj\KinderMorgan\407609Norwalk>

Appendix B
Analytical and Monitoring Procedures

Analytical and Monitoring Procedures

Appendix B details the monitoring procedures that will be utilized to analyze samples to meet the goals and objectives of Harbor Toxics Total Maximum Daily Load (TMDL) required sampling. These details are described to ensure that consistent protocols and procedures are applied to chemical analysis. Appendix A describes the standard operating protocols for sample collection. This appendix is divided into the following sections:

- Analytical Procedures
- Laboratory Quality Assurance/Quality Control
- Data Validation and Management

B.1 Analytical Procedures

The following subsections detail the analytical procedures for data generated in the laboratory.

B.1.1 Analytical Methods and Method Detection and Reporting Limits

Analytical methods, method detection limits (MDL), and reporting limits (RLs) for parameters analyzed in the laboratory are described in Tables B-1 and B-2 for water and sediment. Analyses will be performed by Asset Laboratories (Las Vegas, NV, contact Marlon Cartin, marlon@assetlaboratories.com, 702-307-2659).

The MDL is a minimum analyte concentration of an analyte that can be measured and reported with a 99 percent confidence that the concentration is greater than zero; whereas, an RL is the concentration that can be routinely measured in the sampled matrix within stated limits and with confidence in both identification and quantitation. RLs are established based on the verifiable levels and general measurement capabilities demonstrated for each method.

The laboratory has demonstrated the ability to meet the minimum performance requirements for each analytical method, including precision and accuracy. Data quality objectives for precision and accuracy are summarized in Table B-3. Asset Laboratories' certification is provided at the end of this Appendix.

B.1.2 Sample Containers, Storage, Preservation, and Holding Times

Sample container, storage, preservation, and holding time requirements are presented in Table B-4. The analytical laboratory will provide sample containers that are pre-cleaned and certified to be free of contamination, and containing preservative, where necessary. Samples will be stored at 4 ± 2 °C upon collection and until received by the analytical laboratory.

B.2 Laboratory Quality Assurance/Quality Control

B.2.1 Method Blank

Blanks are used to monitor each preparation or analytical batch for interference and/or contamination from glassware, reagents, and other potential sources within the laboratory. A method blank is an analyte-free matrix (i.e., laboratory reagent water for aqueous samples or Ottawa sand, sodium sulfate, or glass beads (metals) for soil samples) to which all reagents are added in the same amount or proportions as are added to the samples. It is processed through the entire sample preparation and analytical procedures along with the samples in the batch. There will be at least one method blank

per preparation or analytical batch. If a target analyte is found at a concentration that exceeds the reporting limit, corrective action must be performed to identify and eliminate the contamination source. All associated samples must be re-prepared and reanalyzed after the contamination source has been eliminated. No analytical data may be corrected for the concentration found in the blank.

B.2.2 Laboratory Control Sample

The laboratory control sample (LCS) will consist of an analyte-free matrix (laboratory reagent water for aqueous samples or Ottawa sand, sodium sulfate, or glass beads (metals) for soil samples spiked with known amounts of analytes that come from a source different than that used for calibration standards). All target analytes specified for each method will be spiked into the LCS. The spike levels will be less than or equal to the mid-point of the calibration range. If LCS results are outside the specified control limits, corrective action must be taken, including sample re-preparation and reanalysis, if appropriate. If more than one LCS is analyzed in a preparation or analytical batch, the results of all LCSs must be reported. Any LCS recovery outside quality control limits affects the accuracy for the entire batch and requires corrective action. A LCS duplicate must be analyzed if an analytical batch does not contain a laboratory duplicate or project-specific matrix spike/matrix spike duplicate (MS/MSD).

B.2.3 Surrogates

Surrogates are organic analytes that behave similarly to the analytes of interest but are not expected to occur naturally in the samples. They are spiked into the standards, samples, and quality control samples prior to sample preparation. Recoveries of surrogates are used to indicate accuracy, method performance, and extraction efficiency. If surrogate recoveries are outside the specified control limits, corrective action must be taken, including sample re-preparation and reanalysis, if appropriate.

B.2.4 Internal Standards

Some methods require the use of internal standards to compensate for losses during injection or purging or losses due to viscosity. Internal standards are compounds that have similar properties as the analytes of interest but are not expected to occur naturally in the samples. A measured amount of the internal standard is added to the standards, samples, and quality control samples following preparation. When the internal standard results are outside the control limits, corrective action must be taken, including sample reanalysis, if appropriate.

B.2.5 Laboratory Sample Duplicate

A sample duplicate selected by the laboratory is called a laboratory sample duplicate. It is subjected to the same preparation and analytical procedures as the native sample. The relative percent difference (RPD) between the results of the native sample and laboratory sample duplicate measures the precision of sample results. The data collected may also yield information regarding whether the sample matrix is heterogeneous.

B.2.6 Interference Check Samples

The interference check samples are used in inductively-coupled plasma (ICP) analyses to verify background and inter-element correction factors. They consist of two solutions: A and AB. Solution A contains the interfering analytes, and Solution B contains both the analytes of interest and the interfering analytes. Both solutions are analyzed at the beginning and at the end of each analytical sequence. When the interference check samples results are outside the control limits, corrective action must be taken, including sample reanalysis, if appropriate.

B.2.7 Retention Time Windows

Retention time windows for gas, ion and liquid chromatographic analyses must be established by replicate injections of the calibration standard over multiple days, as described in SW846 8000B, analytical method, or appropriate laboratory SOP. The absolute retention time of the calibration verification standard at the start of each analytical sequence will be used as the centerline of the window. For an analyte to be reported as positive, its elution time must be within the retention time window.

B.3 Data Validation and Management

Analytical results of the data collection effort will be validated. In general, there are four levels of validation. Levels I and II may be performed by the project chemist (PC) or other program team members. Level III and IV validation will always be performed by the PC or their designee. Harbor Toxics TMDL sampling results will be validated to Level II.

- Level I – Verification that samples were analyzed for the methods requested and review of the data for outliers and anomalies.
- Level II – Verification that samples were analyzed for the methods requested, review of the laboratory case narrative for events in the laboratory that affect the accuracy or precision of the data, review of quality control indicator data and a “reasonableness” review of the data.
- Level III – Validation of the analytical data as described below without review of any raw data or analyte verification.
- Level IV – Validation of the analytical data will be performed as described below, including review of the analytical raw data.

B.3.1 Level II, III and IV Validation Procedures

Personnel involved in the data validation function will be independent of any data generation effort. The PC will have responsibility for oversight of the data validation effort. Data validation will be carried out when the data packages are received from the laboratory. It will be performed on an analytical batch basis using the summary results of calibration and laboratory quality control, as well as those of the associated field samples. Data packages will be reviewed for all constituents of concern. Raw data will be reviewed when deemed necessary by the PC.

Level II data validation will most often be performed and the data validation procedures will include:

- A review of the data set narrative to identify any issues that the lab reported in the data deliverable;
- A check of sample integrity (sample collection, preservation, and holding times);
- An evaluation of basic quality control (QC) measurements used to assess the accuracy, precision and representativeness of data including QC blanks, LCS, MS/MSD, surrogate recovery when applicable, and field or laboratory duplicate results.
- A review of sample results, target compound lists, and detection limits to verify that project analytical requirements are met.
- Initiation of corrective actions, as necessary, based on the data review findings.
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations.

Level III validation procedures will also include review of;

- Evaluation of calibration and quality control summary results against the project requirements.
- Other method specific QC requirements

Level IV validation will include a review of sample chromatograms and,

- Verification of analyte identification and calculations for at least 10 percent of the data.

Data validation will be patterned after the latest versions of the United States Environmental Protection Agency Contract Laboratory Program National Functional Guidelines.

Table B-1. Analytical Methods, MDLs, and RLs for Laboratory Analysis of Water Samples and their Water Column Targets (Marine)

Parameter/Constituent	Method ⁽¹⁾	Units	Target MDL	Target RL	Target	Reference
Solids						
Total Suspended Solids (TSS)	SM 2540D	mg/L	10	10	n/a	n/a
Metals						
Copper	EPA200.8	µg/L	0.25	0.5	3.1	CTR
Lead	EPA200.8	µg/L	0.05	0.5	8.1	CTR
Zinc	EPA200.8	µg/L	0.1	1.0	81	CTR
Pesticides						
2,4'-DDT	SW8081A	µg/L	0.1	0.1	0.001	CTR
4,4'-DDT	SW8081A	µg/L	0.0072	0.05	0.001	CTR
PAHs						
1-Methylnaphthalene	SW8270A-SIM	µg/L	0.0177	0.2	n/a	CTR
2-Methylnaphthalene	SW8270A-SIM	µg/L	0.022	0.2	n/a	
Acenaphthene	SW8270A-SIM	µg/L	0.0177	0.2	n/a	
Acenaphthylene	SW8270A-SIM	µg/L	0.017	0.2	n/a	
Anthracene	SW8270A-SIM	µg/L	0.018	0.2	110000	
Benz(a)anthracene	SW8270A-SIM	µg/L	0.015	0.2	0.049	
Benzo(a)pyrene	SW8270A-SIM	µg/L	0.03	0.2	0.049	
Benzo(b)fluoranthene	SW8270A-SIM	µg/L	0.043	0.2	0.049	
Benzo(g,h,i)perylene	SW8270A-SIM	µg/L	0.015	0.2	n/a	
Benzo(k)fluoranthene	SW8270A-SIM	µg/L	0.015	0.2	0.049	
Chrysene	SW8270A-SIM	µg/L	0.026	0.2	0.049	
Dibenz(a,h)anthracene	SW8270A-SIM	µg/L	0.015	0.2	0.049	
Fluoranthene	SW8270A-SIM	µg/L	0.017	0.2	370	
Fluorene	SW8270A-SIM	µg/L	0.017	0.2	14000	
Indeno(1,2,3-cd)pyrene	SW8270A-SIM	µg/L	0.017	0.2	0.049	
Naphthalene	SW8270A-SIM	µg/L	0.022	0.2	n/a	
Phenanthrene	SW8270A-SIM	µg/L	0.018	0.2	n/a	
Pyrene	SW8270A-SIM	µg/L	0.015	0.2	11000	

Table B-1. Analytical Methods, MDLs, and RLs for Laboratory Analysis of Water Samples and their Water Column Targets (Marine)

Parameter/Constituent	Method ⁽¹⁾	Units	Target MDL	Target RL	Target	Reference
PCB Congeners						
Total PCBs	EPA 1668A	pg/L	40	250	170	CTR

µg/L – microgram(s) per liter; CTR – California Toxics Rule; MDL – Method Detection Limit; mg/L – milligram(s) per liter; n/a – Not applicable; PAH – Polynuclear Aromatic Hydrocarbons; PCB – polychlorinated biphenyls; RL – Reporting Limit

1. Methods may be substituted by an equivalent method that is lower than or meets the project RL.

Table B-2. Analytical Methods, MDLs and RLs for Laboratory Analysis of Sediment and their Sediment Targets (Marine)

Parameter/Constituent	Method ⁽¹⁾	Units	Target MDL	Target RL	Target	Reference
General Parameters						
Total Organic Carbon (TOC)	Lloyd Kahn	mg/kg	40	100	n/a	n/a
Metals						
Cadmium	SW6010B	mg/kg	0.0362	1	1.2	Harbor Toxics TMDL (target for marine sediment)
Copper	SW6010B	mg/kg	0.0399	2	34	
Lead	SW6010B	mg/kg	0.0399	1	46.7	
Mercury	SW7471A	mg/kg	0.012	0.1	0.15	
Zinc	SW6010B	mg/kg	0.0625	1	150	
Pesticides						
alpha-Chlordane	SW8081A	µg/kg	0.139	1	0.5 µg/kg (dw) (Total Chlordanes)	Harbor Toxics TMDL (target for marine sediment)
gamma-Chlordane	SW8081A	µg/kg	0.189	1		
trans-Nonachlor	SW8081A	µg/kg	TBD	TBD		
Dieldrin	SW8081A	µg/kg	0.364	2	0.02 µg/kg (dw)	
2,4'-DDD	SW8081A	µg/kg	4	4	1.58 µg/kg (dw) (Total DDT)	
2,4'-DDE	SW8081A	µg/kg	4	4		
2,4'-DDT	SW8081A	µg/kg	4	4		
4,4'-DDD	SW8081A	µg/kg	0.421	2		
4,4'-DDE	SW8081A	µg/kg	0.248	2		
4,4'-DDT	SW8081A	µg/kg	0.222	2		

Table B-2. Analytical Methods, MDLs and RLs for Laboratory Analysis of Sediment and their Sediment Targets (Marine)

Parameter/Constituent	Method ⁽¹⁾	Units	Target MDL	Target RL	Target	Reference
PAHs						
1-Methylnaphthalene	SW8270A- SIM	µg/kg	1.02	5	552 µg/kg (dw) LMW) ⁽²⁾	Harbor Toxics TMDL (target for marine sediment)
1-Methylphenanthrene	SW8270A- SIM	µg/kg	TBD	TBD	552 µg/kg (dw) (LMW) ⁽²⁾	
2-Methylnaphthalene	SW8270A- SIM	µg/kg	1.68	5	201	
2,6-Dimethylnaphthalene	SW8270A- SIM	µg/kg	TBD	TBD	552 µg/kg (dw) (LMW) ⁽²⁾	
Acenaphthene	SW8270A- SIM	µg/kg	0.82	5	552 µg/kg (dw) (LMW) ⁽²⁾	
Anthracene	SW8270A- SIM	µg/kg	0.79	5	552 µg/kg (dw) (LMW) ⁽²⁾	
Benzo(a)anthracene	SW8270A- SIM	µg/kg	1	5	261	
Benzo(a)pyrene	SW8270A- SIM	µg/kg	1.7	5	430	
Benzo(e)pyrene	SW8270A- SIM	µg/kg	1.41	5	1700 µg/kg (dw) (HMW) ⁽³⁾	
Biphenyl	SW8270A- SIM	µg/kg	TBD	TBD	552 µg/kg (dw) (LMW) ⁽²⁾	
Chrysene	SW8270A- SIM	µg/kg	1.48	5	384	
Dibenz(a,h)anthracene	SW8270A- SIM	µg/kg	1.7	5	260	
Fluoranthene	SW8270A- SIM	µg/kg	1.7	5	1700 µg/kg (dw) (HMW) ⁽³⁾	
Fluorene	SW8270A- SIM	µg/kg	TBD	TBD	552 µg/kg (dw) (LMW) ⁽²⁾	
Naphthalene	SW8270A- SIM	µg/kg	1.7	5	552 µg/kg (dw) (LMW) ⁽²⁾	
Perylene	SW8270A- SIM	µg/kg	1.31	5	1700 µg/kg (dw) (HMW) ⁽³⁾	
Phenanthrene	SW8270A- SIM	µg/kg	1.33	5	240	
Pyrene	SW8270A- SIM	µg/kg	1.21	5	665	

Table B-2. Analytical Methods, MDLs and RLs for Laboratory Analysis of Sediment and their Sediment Targets (Marine)

Parameter/Constituent	Method ⁽¹⁾	Units	Target MDL	Target RL	Target	Reference
PCB Congeners						
2,4'-Dichlorobiphenyl (PCB-8)	EPA 1668A	ng/kg	4.39	25	22.7 ng/g (dw) Total PCBs	Harbor Toxics TMDL (target for marine sediment)
2,2',5-Trichlorobiphenyl (PCB-18)	EPA 1668A	ng/kg	25.00	50		
2,4,4'-Trichlorobiphenyl (PCB-28)	EPA 1668A	ng/kg	20.87	130		
2,2',3,5'-Tetrachlorobiphenyl (PCB-44)	EPA 1668A	ng/kg	14.37	300		
2,2',5,5'-Tetrachlorobiphenyl (PCB-52)	EPA 1668A	ng/kg	18.17	123		
2,3',4,4'-Tetrachlorobiphenyl (PCB-66)	EPA 1668A	ng/kg	10.5	84		
2,2',4,5,5'-Pentachlorobiphenyl (PCB-101)	EPA 1668A	ng/kg	14.4	300		
2,3,3',4,4'-Pentachlorobiphenyl (PCB-105)	EPA 1668A	ng/kg	3.89	100		
2,3',4,4',5-Pentachlorobiphenyl (PCB-118)	EPA 1668A	ng/kg	9.46	50		
2,2',3,3',4,4'-Hexachlorobiphenyl (PCB-128)	EPA 1668A	ng/kg	6.80	100		
2,2',3,4,4',5'-Hexachlorobiphenyl (PCB-138)	EPA 1668A	ng/kg	27.3	300		
2,2',4,4',5,5'-Hexachlorobiphenyl (PCB-153)	EPA 1668A	ng/kg	12.9	200		
2,2',3,3',4,4',5-Heptachlorobiphenyl (PCB-170)	EPA 1668A	ng/kg	5.96	50		
2,2',3,4,4',5,5'-Heptachlorobiphenyl (PCB-180)	EPA 1668A	ng/kg	7.46	100		
2,2',3,4',5,5',6-Heptachlorobiphenyl (PCB-187)	EPA 1668A	ng/kg	8.30	50		
2,2',3,3',4,4',5,6-Octachlorobiphenyl (PCB-195)	EPA 1668A	ng/kg	6.50	75		
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (PCB-206)	EPA 1668A	ng/kg	7.79	75		

µg/kg – microgram(s) per kilogram; mg/kg – milligram(s) per kilogram; ng/kg – nanogram(s) per kilogram TBD – to be determined

- 1 Methods may be substituted by an equivalent method that is lower than or meets the project RL.
- 2 Low Molecular Weight PAHs include: Acenaphthene, Anthracene, Phenanthrene, Biphenyl, Naphthalene, 2,6-dimethylnaphthalene, Fluorene, 1-methylnaphthalene, 2-methylnaphthalene, 1-methylphenanthrene, with PAH specific targets for: Phenanthrene = 240 µg/kg; 2-methylnaphthalene = 201.
- 3 High Molecular Weight PAHs: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(e)pyrene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Perylene, Pyrene, with PAH specific targets for: Dibenz(a,h)anthracene = 260; Chrysene = 384; Pyrene = 665; Benzo(a)anthracene = 261; Benzo(a)pyrene = 430.

Table B-3. Data Quality Objectives

Parameter	Accuracy	Precision	Completeness
Field Measurements			
pH	+ 0.2 pH units	+ 0.5 pH units	90%
Temperature	+ 0.5 oC	+ 5%	90%
Dissolved Oxygen	+ 0.5 mg/L	+ 10%	90%
Conductivity	5%	5%	90%
Laboratory Analyses – Water			
Total Suspended Solids	80-120	5	90%
Copper	85-115	20	90%
Lead	85-115	20	90%
Zinc	85-115	20	90%
1-Methylnaphthalene	35-131	30	90%
2-Methylnaphthalene	36-121	30	90%
Acenaphthene	39-125	30	90%
Acenaphthylene	43-140	30	90%
Anthracene	41-132	30	90%
Benz(a)anthracene	58-141	30	90%
Benzo(a)pyrene	31-142	30	90%
Benzo(b)fluoranthene	42-156	30	90%
Benzo(g,h,i)perylene	12-171	30	90%
Benzo(k)fluoranthene	49-165	30	90%
Chrysene	51-155	30	90%
Dibenz(a,h)anthracene	28-153	30	90%
Fluoranthene	47-158	30	90%
Fluorene	40-140	30	90%
Indeno(1,2,3-cd)pyrene	20-167	30	90%
Naphthalene	39-125	30	90%
Phenanthrene	46-144	30	90%
Pyrene	39-158	30	90%
Alpha Chlordane	63-123	30	90%
Gamma Chlordane	67-120	30	90%
Trans Nonachlor	TBD	30	90%
Dieldrin	62-129	30	90%
2,4-DDT	70-130	30	90%
4,4-DDT	47-138	30	90%
Total PCBs	50-150	20	90%

Table B-3. Data Quality Objectives

Parameter	Accuracy	Precision	Completeness
Aroclor-1248	50-150	20	90%
Aroclor-1254	50-150	20	90%
Aroclor-1260	50-150	20	90%
Laboratory Analyses – Sediment			
Total Organic Carbon	70-130	20	90%
Cadmium	85-115	20	90%
Copper	85-115	20	90%
Lead	85-115	20	90%
Mercury	75-125	20	90%
Zinc	85-115	20	90%
1-Methylnaphthalene	30-111	30	90%
1-Methylphenanthrene	TBD	TBD	90%
2-Methylnaphthalene	30-111	30	90%
2,6-Dimethylnaphthalene	TBD	TBD	90%
Acenaphthene	28-110	30	90%
Acenaphthylene	23-126	30	90%
Anthracene	28-136	30	90%
Benzo(a)anthracene	31-146	30	90%
Benzo(a)pyrene	28-128	30	90%
Benzo(e)pyrene	TBD	TBD	90%
Benzo(b)fluoranthene	30-139	30	90%
Benzo(g,h,i)perylene	21-149	30	90%
Benzo(k)fluoranthene	42-129	30	90%
Biphenyl	TBD	TBD	90%
Chrysene	39-134	30	90%
Dibenz(a,h)anthracene	30-138	30	90%
Fluoranthene	30-142	30	90%
Fluorene	27-116	30	90%
Indeno(1,2,3-cd)pyrene	17-164	30	90%
Naphthalene	29-106	30	90%
Phenanthrene	32-127	30	90%
Perylene	TBD	TBD	90%
Pyrene	28-130	30	90%
Alpha Chlordane	63-121	50	90%
Gamma Chlordane	48-124	50	90%
Trans Nonachlor	TBD	50	90%
Dieldrin	67-125	50	90%

Table B-3. Data Quality Objectives

Parameter	Accuracy	Precision	Completeness
2,4-DDE	70-130	50	90%
2,4-DDD	70-130	50	90%
2,4-DDT	70-130	50	90%
4,4-DDE	68-126	50	90%
4,4-DDD	50-139	50	90%
4,4-DDT	46-135	50	90%
2,4'-Dichlorobiphenyl (PCB-8)	50-150	20	90%
2,2',5-Trichlorobiphenyl (PCB-18)	50-150	20	90%
2,4,4'-Trichlorobiphenyl (PCB-28)	50-150	20	90%
2,2',3,5'-Tetrachlorobiphenyl (PCB-44)	50-150	20	90%
2,2',5,5'-Tetrachlorobiphenyl (PCB-52)	50-150	20	90%
2,3',4,4'-Tetrachlorobiphenyl (PCB-66)	50-150	20	90%
2,2',4,5,5'-Pentachlorobiphenyl (PCB-101)	50-150	20	90%
2,3,3',4,4'-Pentachlorobiphenyl (PCB-105)	50-150	20	90%
2,3',4,4',5-Pentachlorobiphenyl (PCB-118)	50-150	20	90%
2,2',3,3',4,4'-Hexachlorobiphenyl (PCB-128)	50-150	20	90%
2,2',3,4,4',5'-Hexachlorobiphenyl (PCB-138)	50-150	20	90%
2,2',4,4',5,5'-Hexachlorobiphenyl (PCB-153)	50-150	20	90%
2,2',3,3',4,4',5-Heptachlorobiphenyl (PCB-170)	50-150	20	90%
2,2',3,4,4',5,5'-Heptachlorobiphenyl (PCB-180)	50-150	20	90%
2,2',3,4',5,5',6-Heptachlorobiphenyl (PCB-187)	50-150	20	90%
2,2',3,3',4,4',5,6-Octachlorobiphenyl (PCB-195)	50-150	20	90%
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (PCB-206)	50-150	20	90%

Table B-4. Sample Container, Volume, Preservation, and Holding Times

Parameter	Sample Container	Sample Volume ⁽¹⁾	Storage	Holding Time	Sample Preservative
Water (total)					
Total Suspended Solids (TSS)	HDPE	250 mL	Store at 4±2 °C	7 days	None
Metals	HDPE	500 mL	Store at 4±2 °C	6 months	HNO ₃ to pH<2
Total PCBs, Pesticides	Amber glass	4 x 1 L	Store at 4±2 °C	7/40 days ⁽²⁾	None
PAHs	Amber glass	2 x 1 L	Store at 4±2 °C	7/40 days ⁽²⁾	None

Table B-4. Sample Container, Volume, Preservation, and Holding Times

Parameter	Sample Container	Sample Volume ⁽¹⁾	Storage	Holding Time	Sample Preservative
Water (dissolved)⁽³⁾					
Metals	HDPE	500 mL	Store at 4±2 °C	Filter within 72 hours; analyze within 6 months	HNO ₃ to pH<2
Total PCBs, Pesticides	Amber glass	4 x 1 L	Store at 4±2 °C	Filter within 72 hours; 7/40 days ⁽²⁾	None
PAHs	Amber glass	2 x 1 L	Store at 4±2 °C	Filter within 72 hours; 7/40 days ⁽²⁾	None
Sediment					
% Solids				7 days	None
Metals				6 months	None
Total Organic Carbon (TOC)	Glass	2 x 8-ounce jars	Store at 4°C	28 days	None
Pesticides, PCBs, PAHs				14/40 days ⁽⁴⁾	None

Notes:

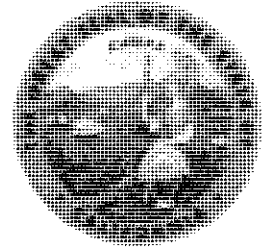
- 1 Additional volume may be required for QC analyses.
- 2 7/40 = 7 days to extract and 40 days from extraction to analysis.
- 3 Collected unpreserved and filtered at the laboratory.
- 4 14/40 = 14 days to extract and 40 days from extraction to analysis.

°C – degree(s) Celsius; HDPE – high density polyethylene; L – liter(s); mL – milliliter(s); HNO₃ – nitric acid



STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

CALIFORNIA STATE



ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

ASSET Laboratories

3151 West Post Road

Las Vegas, NV 89118

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site inspection,
proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2676**

Expiration Date: **7/31/2018**

Effective Date: **7/1/2017**

Sacramento, California
subject to forfeiture or revocation

Christine Sotelo, Chief
Environmental Laboratory Accreditation Program



State Water Resources Control Board

August 11, 2017

Puri Romualdo
ASSET Laboratories
3151 West Post Road
Las Vegas, NV 89118

Dear Puri Romualdo:

Certificate No. 2676

This notice advises that the laboratory named above has been certified as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, *et seq.*

The Fields of Testing for which this laboratory has been certified are indicated on the enclosed "Fields of Testing" list. The certificate shall remain in effect until **July 31, 2018** unless it is revoked. This certificate is subject to an annual fee as determined by HSC 100860.1(a).

The application for renewal of this certificate must be received 90 days prior to the expiration date to remain in force according to HSC 100845(a). You must submit annual Proficiency Testing results before the due date of your annual fee to remain in compliance.

Any change in laboratory location or alteration to laboratory structure that could adversely affect quality of analysis in certified methods require notification prior to the change. Notification is also required for a transfer in ownership or appointment of new laboratory director within 30 days of the change (HSC, Section 100845(b) and (d)).

Your continued cooperation with the above requirements is essential for maintaining the high quality of the data produced by environmental laboratories certified by the State of California.

Please contact our office at (916) 323-3431 or elapca@waterboards.ca.gov with questions.

Sincerely,

Christine Sotelo, Chief
Environmental Laboratory Accreditation Program

Enclosure



**CALIFORNIA STATE
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing**



ASSET Laboratories

3151 West Post Road
Las Vegas, NV 89118
Phone: (702) 307-2659

Certificate No. 2676
Expiration Date 7/31/2018

Field of Testing: 101 - Microbiology of Drinking Water

101.050	005	Total Coliform P/A	SM9223B (Colilert 18)
101.050	006	E. coli P/A	SM9223B (Colilert 18)
101.050	007	Total Coliform (Enumeration)	SM9223B (Colilert 18 Quantity Tray)
101.050	008	E. coli (Enumeration)	SM9223B (Colilert 18 Quantity Tray)

Field of Testing: 102 - Inorganic Chemistry of Drinking Water

102.015	001	Hydrogen Ion (pH)	EPA 150.1
102.026	001	Calcium	EPA 200.7
102.026	002	Magnesium	EPA 200.7
102.026	003	Potassium	EPA 200.7
102.026	006	Hardness (calculation)	EPA 200.7
102.030	003	Chloride	EPA 300.0
102.030	005	Fluoride	EPA 300.0
102.030	006	Nitrate (as N)	EPA 300.0
102.030	007	Nitrite (as N)	EPA 300.0
102.030	008	Phosphate, Ortho (as P)	EPA 300.0
102.030	009	Sulfate	EPA 300.0
102.045	001	Perchlorate	EPA 314.0
102.100	001	Alkalinity	SM2320B-1997
102.120	001	Hardness (calculation)	SM2340B-1997
102.130	001	Conductivity	SM2510B-1997
102.140	001	Residue, Filterable TDS	SM2540C-1997
102.150	001	Chloride	SM4110B-2000
102.150	002	Fluoride	SM4110B-2000
102.150	003	Nitrate	SM4110B-2000
102.150	004	Nitrite	SM4110B-2000
102.150	005	Phosphate, Ortho	SM4110B-2000
102.150	006	Sulfate	SM4110B-2000
102.262	001	Total Organic Carbon TOC	SM5310C-2000
102.263	001	Dissolved Organic Carbon (DOC)	SM5310C-2000

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.130	001	Aluminum	EPA 200.7
103.130	003	Barium	EPA 200.7
103.130	004	Beryllium	EPA 200.7
103.130	005	Cadmium	EPA 200.7
103.130	007	Chromium	EPA 200.7
103.130	008	Copper	EPA 200.7
103.130	009	Iron	EPA 200.7

As of 8/11/2017, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

103.130	011	Manganese	EPA 200.7
103.130	012	Nickel	EPA 200.7
103.130	015	Silver	EPA 200.7
103.130	017	Zinc	EPA 200.7
103.130	018	Boron	EPA 200.7
103.140	001	Aluminum	EPA 200.8
103.140	002	Antimony	EPA 200.8
103.140	003	Arsenic	EPA 200.8
103.140	004	Barium	EPA 200.8
103.140	005	Beryllium	EPA 200.8
103.140	006	Cadmium	EPA 200.8
103.140	007	Chromium	EPA 200.8
103.140	008	Copper	EPA 200.8
103.140	009	Lead	EPA 200.8
103.140	010	Manganese	EPA 200.8
103.140	012	Nickel	EPA 200.8
103.140	013	Selenium	EPA 200.8
103.140	014	Silver	EPA 200.8
103.140	015	Thallium	EPA 200.8
103.140	016	Zinc	EPA 200.8
103.140	017	Boron	EPA 200.8
103.140	018	Vanadium	EPA 200.8
103.160	001	Mercury	EPA 245.1
103.311	001	Chromium (VI)	EPA 218.7

Field of Testing: 106 - Radiochemistry of Drinking Water

106.092	001	Uranium	EPA 200.8
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Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.020	001	Conductivity	EPA 120.1
108.112	001	Boron	EPA 200.7
108.112	002	Calcium	EPA 200.7
108.112	003	Hardness (calculation)	EPA 200.7
108.112	004	Magnesium	EPA 200.7
108.112	005	Potassium	EPA 200.7
108.112	006	Silica, Dissolved	EPA 200.7
108.112	007	Sodium	EPA 200.7
108.113	001	Boron	EPA 200.8
108.113	002	Calcium	EPA 200.8
108.113	003	Magnesium	EPA 200.8
108.113	004	Potassium	EPA 200.8
108.113	005	Silica, Dissolved	EPA 200.8
108.113	006	Sodium	EPA 200.8
108.120	001	Bromide	EPA 300.0
108.120	002	Chloride	EPA 300.0
108.120	003	Fluoride	EPA 300.0
108.120	008	Sulfate	EPA 300.0
108.120	012	Nitrate (as N)	EPA 300.0

108.120	013	Nitrate-Nitrite (as N)	EPA 300.0
108.120	014	Nitrite (as N)	EPA 300.0
108.120	015	Phosphate, Ortho (as P)	EPA 300.0
108.264	001	Phosphate, Ortho	EPA 365.3
108.265	001	Phosphorus, Total	EPA 365.3
108.381	001	Oil and Grease	EPA 1664A
108.381	002	Oil & Grease Total	EPA 1664 Rev. B
108.410	001	Alkalinity	SM2320B-1997
108.420	001	Hardness (calculation)	SM2340B-1997
108.442	001	Residue, Non-filterable TSS	SM2540D-1997
108.443	001	Residue, Settleable	SM2540F-1997
108.448	001	Bromide	SM4110B-2000
108.448	002	Chloride	SM4110B-2000
108.448	003	Fluoride	SM4110B-2000
108.448	004	Nitrate	SM4110B-2000
108.448	006	Nitrate-nitrite	SM4110B-2000

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	Aluminum	EPA 200.7
109.010	002	Antimony	EPA 200.7
109.010	003	Arsenic	EPA 200.7
109.010	004	Barium	EPA 200.7
109.010	005	Beryllium	EPA 200.7
109.010	006	Boron	EPA 200.7
109.010	007	Cadmium	EPA 200.7
109.010	009	Chromium	EPA 200.7
109.010	010	Cobalt	EPA 200.7
109.010	011	Copper	EPA 200.7
109.010	012	iron	EPA 200.7
109.010	013	Lead	EPA 200.7
109.010	015	Manganese	EPA 200.7
109.010	016	Molybdenum	EPA 200.7
109.010	017	Nickel	EPA 200.7
109.010	019	Selenium	EPA 200.7
109.010	021	Silver	EPA 200.7
109.010	023	Thallium	EPA 200.7
109.010	024	Tin	EPA 200.7
109.010	025	Titanium	EPA 200.7
109.010	026	Vanadium	EPA 200.7
109.010	027	Zinc	EPA 200.7
109.020	001	Aluminum	EPA 200.8
109.020	002	Antimony	EPA 200.8
109.020	003	Arsenic	EPA 200.8
109.020	004	Barium	EPA 200.8
109.020	005	Beryllium	EPA 200.8
109.020	006	Cadmium	EPA 200.8
109.020	007	Chromium	EPA 200.8
109.020	008	Cobalt	EPA 200.8

109.020	009	Copper	EPA 200.8
109.020	010	Lead	EPA 200.8
109.020	011	Manganese	EPA 200.8
109.020	012	Molybdenum	EPA 200.8
109.020	013	Nickel	EPA 200.8
109.020	014	Selenium	EPA 200.8
109.020	015	Silver	EPA 200.8
109.020	016	Thallium	EPA 200.8
109.020	017	Vanadium	EPA 200.8
109.020	018	Zinc	EPA 200.8
109.020	021	Iron	EPA 200.8
109.020	022	Tin	EPA 200.8
109.020	023	Titanium	EPA 200.8
109.104	001	Chromium (VI)	EPA 218.6
109.190	001	Mercury	EPA 245.1
109.445	002	Chromium (VI)	SM3500-Cr B-2009
109.446	001	Chromium (VI)	SM3500-Cr C-2009

Field of Testing: 110 - Volatile Organic Chemistry of Wastewater

110.040	000	Purgeable Organic Compounds	EPA 624
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Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater

111.100	000	Base/Neutral & Acid Organics	EPA 625
111.170	000	Organochlorine Pesticides and PCBs	EPA 608

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.010	001	Antimony	EPA 6010B
114.010	002	Arsenic	EPA 6010B
114.010	003	Barium	EPA 6010B
114.010	004	Beryllium	EPA 6010B
114.010	005	Cadmium	EPA 6010B
114.010	006	Chromium	EPA 6010B
114.010	007	Cobalt	EPA 6010B
114.010	008	Copper	EPA 6010B
114.010	009	Lead	EPA 6010B
114.010	010	Molybdenum	EPA 6010B
114.010	011	Nickel	EPA 6010B
114.010	012	Selenium	EPA 6010B
114.010	013	Silver	EPA 6010B
114.010	014	Thallium	EPA 6010B
114.010	015	Vanadium	EPA 6010B
114.010	016	Zinc	EPA 6010B
114.020	001	Antimony	EPA 6020
114.020	002	Arsenic	EPA 6020
114.020	003	Barium	EPA 6020
114.020	004	Beryllium	EPA 6020
114.020	005	Cadmium	EPA 6020
114.020	006	Chromium	EPA 6020
114.020	007	Cobalt	EPA 6020

114.020	008	Copper	EPA 6020
114.020	009	Lead	EPA 6020
114.020	010	Molybdenum	EPA 6020
114.020	011	Nickel	EPA 6020
114.020	012	Selenium	EPA 6020
114.020	013	Silver	EPA 6020
114.020	014	Thallium	EPA 6020
114.020	015	Vanadium	EPA 6020
114.020	016	Zinc	EPA 6020
114.103	001	Chromium (VI)	EPA 7196A
114.106	001	Chromium (VI)	EPA 7199
114.140	001	Mercury	EPA 7470A
114.141	001	Mercury	EPA 7471A
114.241	001	Corrosivity - pH Determination	EPA 9045C

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.021	001	TCLP Inorganics	EPA 1311
115.022	001	TCLP Extractables	EPA 1311
115.023	001	TCLP Volatiles	EPA 1311
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II
115.040	001	Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312

Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste

116.030	001	Gasoline-range Organics	EPA 8015B
116.080	000	Volatile Organic Compounds	EPA 8260B
116.080	120	Oxygenates	EPA 8260B
116.110	001	Total Petroleum Hydrocarbons - Gasoline	LUFT

Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B
117.110	000	Extractable Organics	EPA 8270C
117.210	000	Organochlorine Pesticides	EPA 8081A
117.220	000	PCBs	EPA 8082
117.240	000	Organophosphorus Pesticides	EPA 8141A

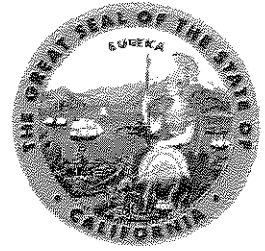
Field of Testing: 120 - Physical Properties of Hazardous Waste

120.020	001	Ignitability	EPA 1020A
120.080	001	Corrosivity - pH Determination	EPA 9045C



STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

CALIFORNIA STATE



ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

ASSET Laboratories

3151 West Post Road

Las Vegas, NV 89118

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site inspection,
proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2676**

Expiration Date: **7/31/2018**

Effective Date: **7/1/2017**

Sacramento, California
subject to forfeiture or revocation

Christine Sotelo, Chief
Environmental Laboratory Accreditation Program

Appendix C
Health and Safety Plan

Health and Safety Plan

SFPP Norwalk Pump Station Norwalk, California

Prepared for
Kinder Morgan Energy Partners, L.P. (SFPP)

15306 Norwalk Blvd., Norwalk, CA 90650

August 2017 (Revision 1)



Los Angeles Office

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

CH2M- Injury Care for Employees (ICE)

WorkCare

800-455-6155/866-893-2514

Fire/Spill Emergency – 911

Facility Fire Response #: 911

Local Fire Dept #: 911

Local Occupational Physician: Contact WorkCare for non-emergency injuries or illnesses and they will refer the team to a local work comp clinic.

Security & Police – 911

Local Police #:911

CH2M HILL Responsible Health and Safety Manager (RHSM)

Name: William Berlett

Phone: 847.770.0209

Utilities Emergency Phone Numbers

Water: 911

Gas: 911

Electric: 911

CH2M HILL Project Environmental Manager

Name: Malcolm Maxwell/BAO

Phone: 530.570.0260 (cell)

CH2M HILL Project Manager

Name: Eric Davis/LAC

Phone: 404.323.1600(cell)

CH2M HILL Worker's Compensation:

Contact Business Group HR dept. to have form completed or contact Jennifer Rindahl after hours: 720-891-5382

CH2M HILL Safety Coordinator (SC)

Name: Vladimir Carino/SCO

Phone: 619.621.9406 (cell)

Name: Nils Orliczky/SCO

Phone: 562.882.9676

Media Inquiries Corporate Strategic Communications

Name: Lorrie Paul Crum

Phone: 720 286 0255; cell 303 525 2916

Automobile Accidents: In the event of a car accident, field staff should first treat any medical issues (9-1-1 if emergency), then contact the Project Manager and RHSM. **Refer to Vehicle Accident Guidance document included in the Attachment 6.**

Rental: Mary Ellegood-Oberts/DEN (720-286-2291)

CH2M owned or fleet vehicle: Linda George/DEN
720-286-2057

Worker's Compensation:

Complete HITS to initiate process. For immediate assistance contact assistance contact Vicki Finke/ANV at 907-762-1554 or for an after-hours emergency contact Mary Ellegood-Oberts/DEN (720-286-2291)

Federal Express Dangerous Goods Shipping

Phone: 800/238-5355

CHEMTEL (hazardous material spills)

Phone: 800/255-3924

Facility Alarms:

None

Evacuation Assembly Area(s): Outside gate Near Norwalk Blvd.

Facility/Site Evacuation Route(s): To be determined

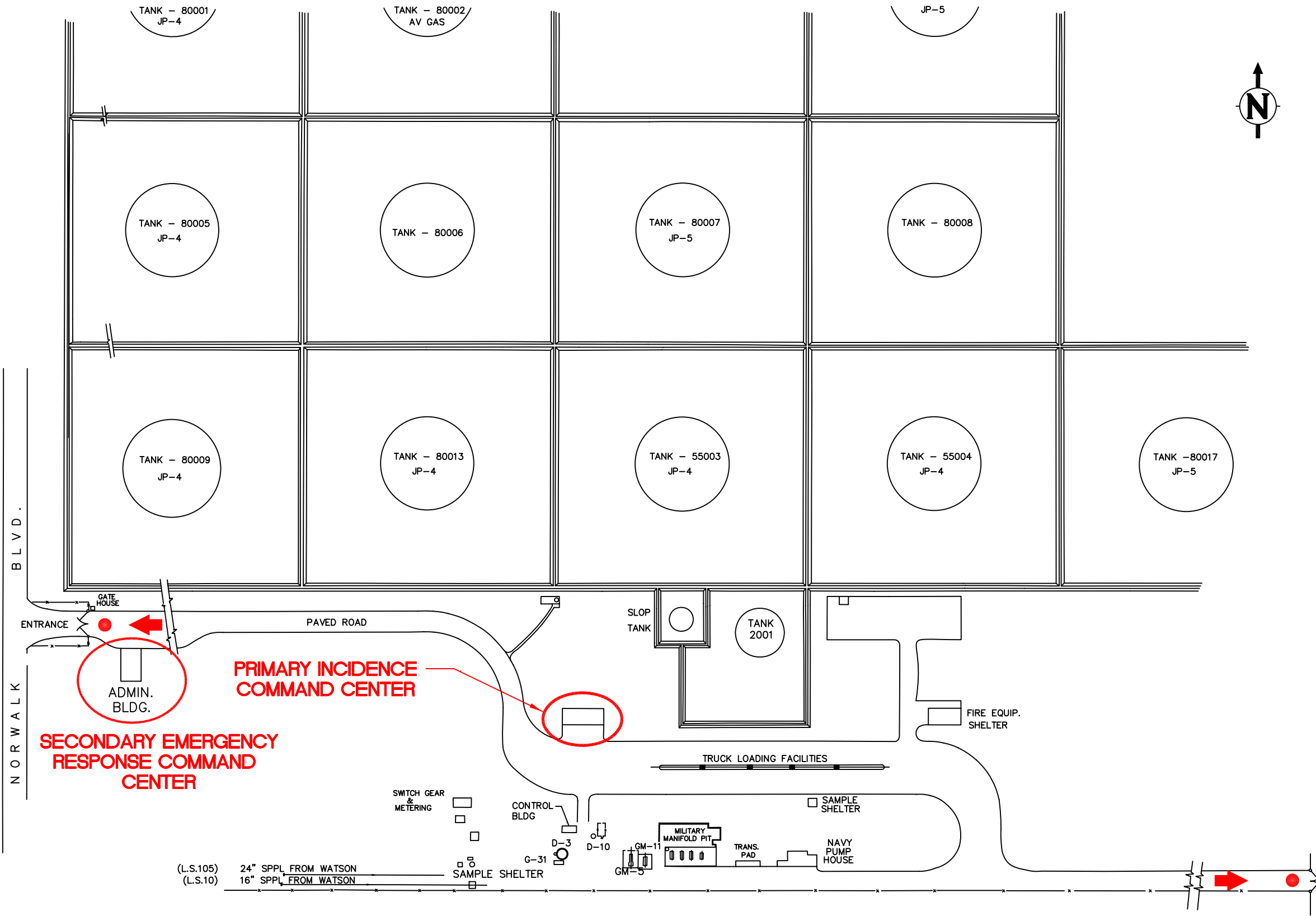
Directions and MAP to Local Hospital

Local Hospital:

Coast Plaza Doctors Hospital

Right on Norwalk Blvd. which becomes Foster Rd, Right on Studebaker Road, Hospital at 13100 Studebaker Rd.

EVACUATION PLAN



- LEGEND:**
- SINGLE GATE
 - DOUBLE GATE
 - STAIR/LADDER
 - ➔ MAIN EXITS

(L.S.105) 24" SPPL FROM WATSON
 (L.S.10) 16" SPPL FROM WATSON

SFPP, L.P.		LOS ANGELES CALIFORNIA
EVACUATION DIAGRAM NORWALK STATION		
CADD	SCALE: NONE	RECORD DRAWING NO.
FILE: EVAC-NW	DESIGN SUPT	EVAC-NW
BY: AKC	MGR. SAFETY	
DATE: 4-9-95	AREA SUPR.	

← from 15306 Norwalk Blvd, Norwalk, CA 90650
to Coast Plaza Hospital, 13100 Studebaker Rd, Norwalk, CA 90650

8 min (2.6 miles)

via Norwalk Blvd and Foster Rd
Fastest route, the usual traffic

15306 Norwalk Blvd

Norwalk, CA 90650

↑ Head north on Norwalk Blvd toward Hopland St

0.9 mi

↑ Norwalk Blvd turns left and becomes Foster Rd

1.6 mi

↘ Turn right onto Studebaker Rd

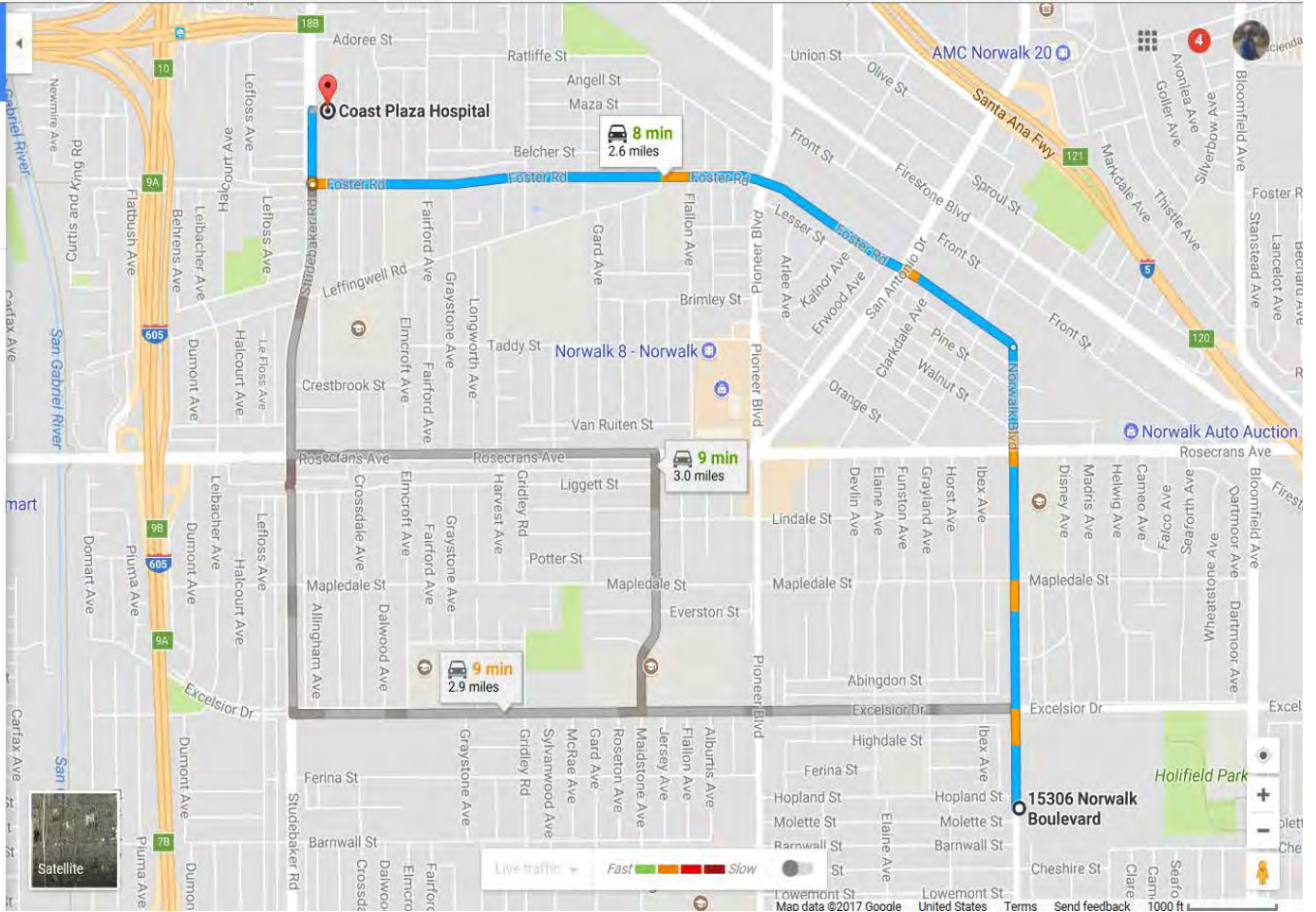
Destination will be on the right

0.1 mi

Coast Plaza Hospital

13100 Studebaker Rd, Norwalk, CA 90650

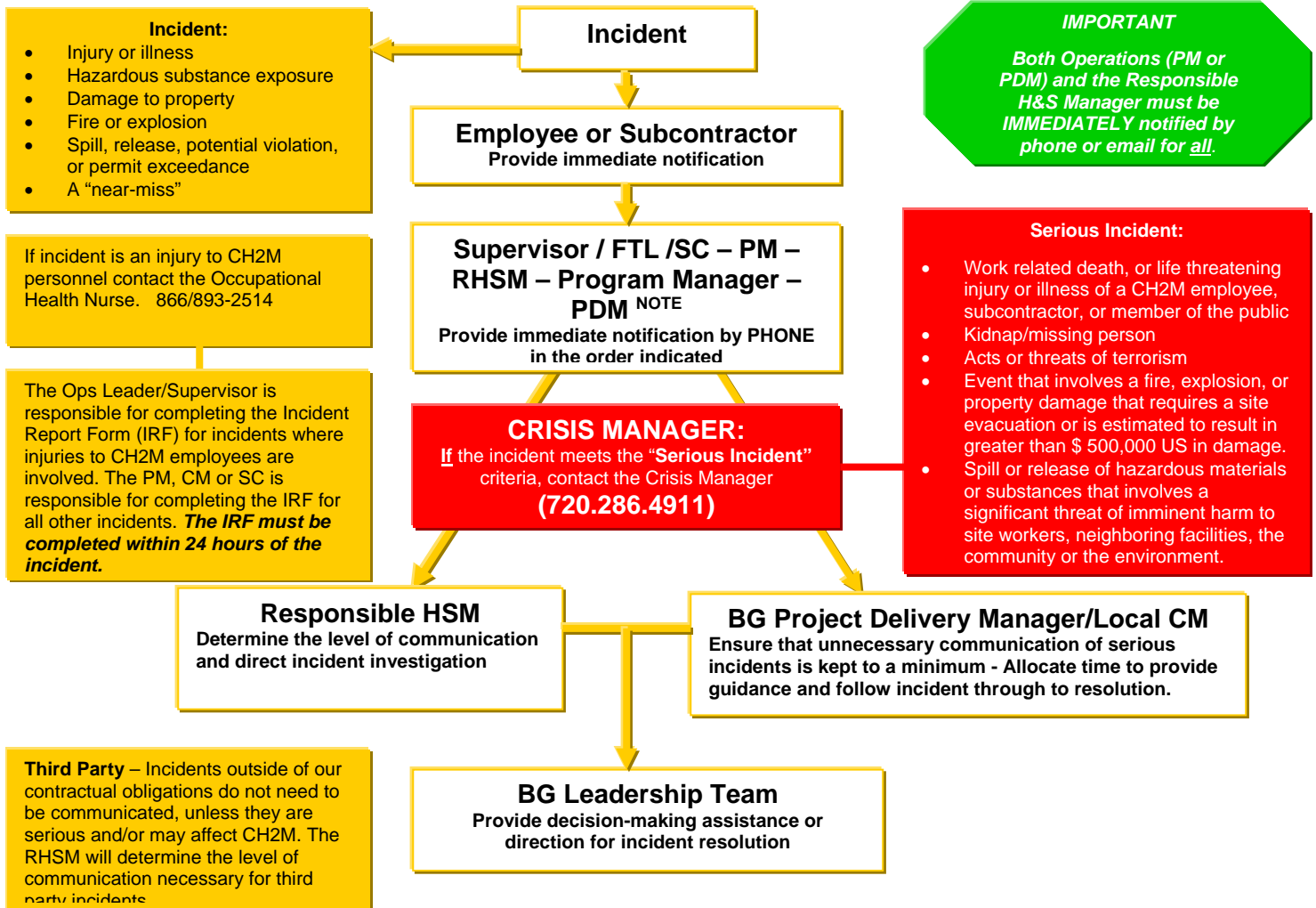
These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.



Incident Reporting Flow Diagram

(Refer to Emergency Contact list and Section 18.0 - Incident Notification, Reporting, and Investigation)

The purpose of this basic flowchart is to provide direction on the standard notification and reporting process for incidents and serious incidents. This process ensures timely notification to the appropriate Business Group Management and allows for **positive control** over flow of information, so that the incident is handled effectively, efficiently, and in conjunction with appropriate corporate entities.



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

Note: FTL – Field Team Lead; SC – Safety Coordinator; PM – Project Manager; RHSM – Responsible Health and Safety Manager; Program Manager; PDM – Project Delivery Manager

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ATTACHMENTS

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Attachment 2	Chemical Inventory/Register Form
Attachment 3	Chemical-Specific Training Form
Attachment 4	Project Activity Self-Assessment Checklists/Forms/Permits
Attachment 5	Key Target Zero Program Elements Forms
Attachment 6	Fact Sheets
Attachment 7	Observed Hazard Form
Attachment 8	Stop Work Order Form
Attachment 9	Agency Inspection Target Zero Bulletin
Attachment 10	Completed CH2M HILL AHAs
Attachment 11	Material Safety Data Sheets
Attachment 12	Kinder Morgan California Notification Guide for Releases

Approval

This 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 project and site conditions and identified scope(s) of work and must be amended if those conditions or scope(s) of work change.

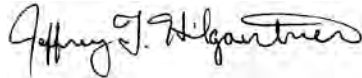
By approving this HSP, the Responsible Health and Safety Manager (RHSM) certifies that the personal protective equipment has been selected based on the project-specific hazard assessment.

ORIGINAL PLAN

Original Plan Written by: Jeffrey T. Hilgaertner

Date: June 18, 2014

RHSM Approval:



Date: June 18, 2014

Project Manager Approval: Dan Jablonski

Date: June 19, 2014

Revision 1

Revisions Made By: Vladimir Carino and Eric Hamm

Date: August 24, 2017

Description of Revisions to Plan: Updated the following – Cover; Emergency Contacts; Incident Reporting Flow Diagram; TOC; Sections 2.0; 3.0; 5.0; 6.0; 8.0; 9.0; 10.0; 11.0; 12.0; 13.0; 14.0; 16.0; 17.0; 18.0; 19.0 and Attachments

Revisions Approved By: Eric Hamm



Date: August 24, 2017

Revision 2

Revisions Made By:

Date:

Description of Revisions to Plan:

Revisions Approved By:

Date:

1. Applicability

This HSP applies to:

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

In addition, Subcontractors and tiered subcontractors shall also follow any of their company HSE programs, and site-specific HSPs and AHAs.

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 revised as project activities or conditions change or when supplemental information becomes available. The HSP adopts, by reference, the CH2M HILL Enterprise-wide Core Standards and Standard Operating Procedures (SOPs), as appropriate. In addition, applicable requirements contained in the Environmental Services Business Group (ESBG) Health, Safety, Security, and Environment (HSSE) Guidelines (Guidelines) will be implemented. The Guidelines are available as a stand-alone handbook at the project site. 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.

This HSP incorporates the regulatory requirements described in the State of California OSHA agency – Cal/OSHA Title 8 CCR, Section 3203, Injury and Illness Prevention Program (IIPP), and section 1509, Construction Injury and Illness Prevention Program. The current version of [CH2M HILL Cal/OSHA IIPP written program](#) can be accessed on the HSSE website under Programs.

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

2. General Project Information

2.1 Project Information and Background

Project Number:	Various	Project/Site Name:	SFPP Norwalk Pump Station
Client:	Kinder Morgan Energy Partners	Site Address:	15306 Norwalk Blvd. Norwalk, CA
CH2M HILL Project Manager:	Eric Davis	CH2M HILL Office:	LAC
DATE HSP Prepared:	Revision 1 – July 2017	Date(s) of Site Work:	July 2017 to July 2018

2.2 Site Background, Setting, and Map

The DFSP facility is located at 15306 Norwalk Boulevard in Norwalk, California. The DFSP is owned by DLA Energy (formerly Defense Energy Support Center [DESC]) and was formerly occupied by 12 inactive aboveground fuel storage tanks and associated piping and facilities. The tanks had a maximum capacity of 35 million gallons and were used to store and distribute refined petroleum products including jet propellant numbers 5 and 8 (JP-5 and JP-8), and reportedly also stored aviation gasoline and jet propellant number JP-4. DLA Energy also previously operated truck fill stands and various fuel transfer systems. The facility was decommissioned in 2001 and is no longer used to handle fuel. The aboveground tanks and the main infrastructure were demolished in 2011; demolition of the subsurface piping was completed in 2012.

SFPP has equipment within 2 acres at the DFSP facility and easements for its pipelines along the southern and eastern boundaries of the facility. Previously, SFPP operated a pump station near the south-central area of the site. The pump station was used to transfer fuel to and from the DFSP facility, and as an in-line pumping station for portions of the SFPP pipeline network. The pump station was decommissioned in 2001, but three pipelines heading eastward along the southern boundary of the DFSP facility (one of which bends at the southeastern corner of the facility and continues northward within the eastern easement) remain in service and continue to convey refined petroleum fuels including gasoline, diesel, and jet fuel. The pipelines are fitted with block valves, two of which are located along a 24-inch-diameter pipeline and within areas currently undergoing remediation. One block valve is located in the south-central portion of the site and is referred to as the “intermediate 24-inch block valve.” The other block valve is located offsite near the southeastern area of the site and is referred to as the “southeastern 24-inch block valve” or “offsite 24-inch block valve.”

Subsurface assessments have been performed at the DFSP facility since 1986. Groundwater monitoring and remediation wells have been installed at the site for monitoring and as components of groundwater remediation systems. The investigations have evaluated and defined subsurface soil and groundwater within the uppermost groundwater zone that has been impacted by fuel-related hydrocarbons from historical releases from SFPP’s pipelines at the DFSP facility. The primary impacts are to groundwater associated with fuel product that historically leaked from block valves and migrated vertically downward to the water table. Separate-phase floating product, or LNAPL, as well as sorbed-phase and dissolved-phase fuel hydrocarbons have been delineated in areas beneath the DFSP facility and at offsite properties to the south, west, and east. Site assessments indicated that the COPCs are total petroleum hydrocarbons (TPH), including TPH quantified as gasoline (TPH-g), diesel fuel (TPH-d), JP-4, JP-5, and JP-8; benzene, toluene, ethylbenzene, and total xylenes (BTEX); 1,2-dichloroethane (1,2-DCA); methyl tertiary butyl ether (MTBE); and tertiary butyl alcohol (TBA). A groundwater Monitoring and Reporting Program (MRP) has been in effect at the site since 1995.

Site remediation systems operated by DLA are related to former tank farm and truck fill stand operations. Site remediation systems operated by SFPP are related to historical leaks from pipeline operations. The remediation systems are described below.

SFPP Remediation Systems

SFPP operates remediation systems consisting of SVE, total fluids extraction (TFE; extraction of free product and/or groundwater using a top-loading pump), groundwater extraction (GWE; extraction of groundwater using a bottom-loading pump), and treatment of extracted soil vapors and groundwater to address the following three areas.

- **South-Central Area.** LNAPL and dissolved-phase hydrocarbons occur in the south-central area beneath the DFSP facility and offsite beneath the residential area to the south. These impacts occurred from a historical release from the “intermediate 24-inch block valve” and potentially other unidentified sources at the former pump station.
- **Southeastern Area.** LNAPL and dissolved-phase hydrocarbons occur in the southeast area beneath the DFSP facility and offsite in the Holifield Park area. These impacts occurred from a historical release from the “southeastern 24-inch block valve” or “offsite 24-inch block valve” in this area.
- **Western Area.** Dissolved-phase hydrocarbons occur in the western area beneath the DFSP facility and offsite beneath the residential area to the west.

South-Central and Southeastern Areas

Remediation in the south-central and southeastern areas consists of SVE and TFE (GWE is also performed at one well location in the southeastern area). At several well locations, SVE is coupled with TFE (or GWE) in a process referred to as dual-phase extraction.

The objectives of the remediation system are to contain and control the migration of hydrocarbon constituents in groundwater and soil vapor and to remove hydrocarbon mass from soil and groundwater. The remediation system includes the following wells, which are shown in Figure 2:

- South-Central Area
 - 18 TFE wells (product and groundwater)
 - 24 onsite and 6 offsite SVE wells (most collocated with TFE wells)
 - 2 GWE wells
- Southeastern Area (24-inch Block Valve Area)
 - 3 TFE wells (GMW-O-15, GMW-O-18, and GMW-36)
 - 3 SVE wells (collocated with TFE wells)
 - 2 GWE wells (GMW-SF-9 and GMW-SF-10)

SVE is performed using a blower to remove soil vapors from the south-central and southeastern areas. The extracted vapors are conveyed to a knock-out tank that separates entrained moisture from the soil vapors. Accumulated moisture in the knock-out tank is treated by the main groundwater treatment system described below. The soil vapors are then preheated by a regenerative thermal oxidizer (RTO) where volatile organic compounds (VOCs) are converted to carbon dioxide and water prior to being discharged to the atmosphere. Operation of the SVE and RTO is conducted in accordance with Permit to Operate No. G46187 A/N 578777, ID 110835, issued by the South Coast Air Quality Management District (SCAQMD).

SFPP recently completed installation of a horizontal biosparge system in the south-central area of the site. The biosparge well is constructed of 4-inch-diameter Schedule 80 polyvinyl chloride (PVC) casing and screen completed to a vertical depth of approximately 45 feet below ground surface. The lateral distance of the screen interval is 600 feet; the screen interval is situated below the central portion of the south-central area hydrocarbon plume. Further details regarding the construction of the biosparge well are documented in the report titled, *Horizontal Biosparge Well and Soil Vapor Monitoring Probe Completion Report, SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California* (prepared by CH2M, dated February 8, 2015).

The compressor used to deliver ambient air to the biosparge well has a maximum design rate of approximately 500 standard cubic feet per minute (scfm). SFPP's SVE system has an interlock that ensures the biosparge system cannot operate unless the SVE system is operating. Operation of the SVE system reduces the potential for off-gassing of VOCs during biosparge operations. Pilot testing of the biosparge system commenced in early January 2016 and continued through October 2016. Soil vapor data collected as part of the pilot testing have been submitted to the Regional Water Quality Control Board (Water Board) and Restoration Advisory Board (RAB) under separate cover. Preparation of a comprehensive evaluation report that incorporates soil vapor and groundwater data is currently in process.

The main groundwater treatment system handles free product and groundwater recovered from the south-central and southeastern parts of the site. Free product and groundwater recovered by pneumatically operated top-loading total fluids pumps and bottom-loading groundwater pumps are piped to an oil-water separator (OWS). Free product, if any, from the OWS is collected in a storage tank and recycled at an offsite location. Water from the OWS is treated using liquid-phase granular activated carbon (LGAC). Treated water is routed through an onsite 3,000-gallon equalization tank. Two fluidized bed bioreactors (FBBRs) installed downstream of the equalization tank treat fuel oxygenates such as TBA and MTBE. The treated groundwater then passes through polishing LGAC units prior to discharge in accordance with a National Pollutant Discharge Elimination System (NPDES) permit (NPDES No. CA0063509, CI No. 7497, Order No. R4-2016-0309).

Western Area

The West Side Barrier (WSB) system was installed in 1996 to provide hydraulic control and reduce the potential for further migration of dissolved COPCs offsite. This system consists of eight groundwater extraction wells installed near the western boundary of the site. The groundwater extraction pumps in these wells are also operated using compressed air. The extracted liquids are conveyed by belowground piping to a treatment system separate from the treatment system that treats liquids from the south-central and southeastern areas.

Since 1996, more than 26 million gallons of groundwater have been extracted from the WSB wells. Operation of the WSB for remediation of the western offsite area was discontinued in August 2008 based on the reduced lateral extent and low concentrations of MTBE and 1,2-DCA west of the site. MTBE and 1,2-DCA concentrations in the western area continue to be monitored; other wells in the WSB system will be restarted in the future if necessary.

Physical Characteristics

The DFSP facility is located in the central portion of the Los Angeles Basin at an elevation of approximately 75 feet above mean sea level (msl). The ground surface at the site generally slopes to the southwest. The DFSP facility is bounded to the west by Norwalk Boulevard, to the north by Excelsior Street, to the east by Holifield Park, and to the south by a residential area.

Geologic Setting

The site is located within the central portion of the Los Angeles Basin on the Downey Plain. This area is referred to the "Central Basin" as defined by California Department of Water Resources (CDWR) Bulletin 118. Geologic materials to a depth of approximately 50 feet below ground surface (bgs) within this portion of the Downey Plain generally comprise Recent alluvium consisting predominantly of sand and silt, with some clay lenses. The Lakewood Formation, consisting predominantly of Upper Pleistocene alluvial sediments, extends from the base of the Recent alluvium to a depth of approximately 250 feet beneath the Downey Plain. The Lakewood Formation is underlain by the San Pedro Formation, which consists of more than 800 feet of Pleistocene sediments of marine and nonmarine origin (CDWR, Bulletin 104).

Local Hydrogeologic Setting

The hydrogeologic units underlying the 50-acre tank farm area are shown in the CSM diagrams and consist of the following units:

- Uppermost groundwater zone

- Bellflower aquitard
- Exposition aquifer

The uppermost groundwater zone in the site vicinity is a semiperched unit with a vadose zone from ground surface to approximately 25 feet bgs and a saturated zone approximately between 25 and 50 feet bgs. The lithology within the uppermost zone consists of poorly graded sand, silty sand, clayey sand, and sandy silt. Overall, there is a general pattern that the lower 20 feet (from 30 to 50 feet bgs) consist of mostly sandy or clean sand materials, while the upper 30 feet (from ground surface to 30 feet bgs) consist of more interbedded sand, silty sand, clayey sand, and sandy silt.

Groundwater flow within this uppermost unconfined zone, as interpreted during previous assessments and monitoring at DFSP, is generally to the north under a horizontal gradient of approximately 0.002 foot per foot (ft/ft). Hydraulic conductivity of the uppermost groundwater zone has been reported to range between 12 and 73 feet per day (ft/day) in the south-central area to 20 to 60 ft/day in the southeastern area (AMEC, 2010b).

The uppermost groundwater zone overlies the Bellflower aquitard of the Lakewood Formation. Based on lithologic logs from previous assessments at and near DFSP, the Bellflower aquitard lies between depths of approximately 50 and 80 feet bgs beneath the site and consists of predominantly clay, silty clay, and sandy clay with some interbedded sand with silt.

The uppermost regional water-bearing zone beneath the site is the Exposition aquifer. The Exposition aquifer underlies the Bellflower aquitard between depths of approximately 80 and 220 feet bgs. The potentiometric surface in the Exposition aquifer is approximately 20 feet lower than that in the semiperched uppermost groundwater zone. This relatively consistent difference in hydraulic heads between the semiperched upper groundwater zone and the Exposition aquifer indicates that the Bellflower aquitard inhibits the vertical movement of groundwater in the site area. The horizontal hydraulic gradient in the Exposition aquifer beneath the site area has a magnitude of approximately 0.0004 ft/ft and a generally southeastward direction. The generally southeastward direction of the horizontal hydraulic gradient (and interpreted direction of horizontal groundwater flow) in the Exposition aquifer is roughly opposite the general direction of interpreted groundwater flow in the uppermost groundwater zone. These distinctly different hydraulic conditions consistently interpreted over time above and below the Bellflower aquitard support the interpretation that the Bellflower aquitard in this area comprises a unit that is laterally continuous and has a relatively low bulk vertical hydraulic conductivity.

Annual precipitation is also shown from the Long Beach, California CIMIS No. 174 weather station (<http://www.ipm.ucdavis.edu/weather/sites/losangeles.html>). The average annual rainfall between July 1993 and July 2013 is 14.41 inches.

- Groundwater elevations in the uppermost groundwater zone are approximately 20 feet higher than the Exposition aquifer, demonstrating that the Bellflower aquitard impedes vertical groundwater flow between these two units.
- Groundwater elevations in the uppermost groundwater zone fluctuate seasonally and over the longer-term in response to recharge by precipitation and extraction from the DLA and SFPP remediation systems. Annually, groundwater elevations increase during the winter rainy season and decrease during the summer dry season. Over the long-term, groundwater elevations are higher during successive wetter-than-average rainfall years and lower during successive drier-than-average rainfall years. The current groundwater elevations in the uppermost groundwater zone are at historical lows since groundwater monitoring began in the mid-1990s.

Groundwater elevations in the Exposition aquifer also fluctuate seasonally and over the longer-term in response to recharge by precipitation. They also fluctuate in response to regional water supply pumping in the Central Basin.

2.3 Description of Tasks

Below is a description of the tasks covered by this plan. Any additions or changes in scope will require a revision to this HSP; see Change Management below.

Scope of work covered by this HSP includes:

- Groundwater, surface water, soil, soil vapor sampling for site investigation or remediation system compliance
- LNAPL and groundwater level gauging
- Drilling and installation of groundwater wells, soil vapor probes, CPT (hydropunch) borings using direct push or hollow stem auger methods
- Drilling and installation of horizontal biosparge wells using horizontal (rotary) drilling techniques
- Well abandonment using hollow stem auger methods and pressure grouting of cement
- Trenching, hand augering, and air knifing
- Weed abatement or brush clearance
- Geophysical utility clearance
- Inspections of remediation systems
- Operations and maintenance of the remediation systems including the RTO, the FBBR, OWS, pumps, blowers, and several air compressors at the site.
- Land surveying, staking, and routine site walks

2.4 Change Management

Changes to this HSP shall be documented and approved by the CH2M HILL Responsible Health and Safety Manager for the project. 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.

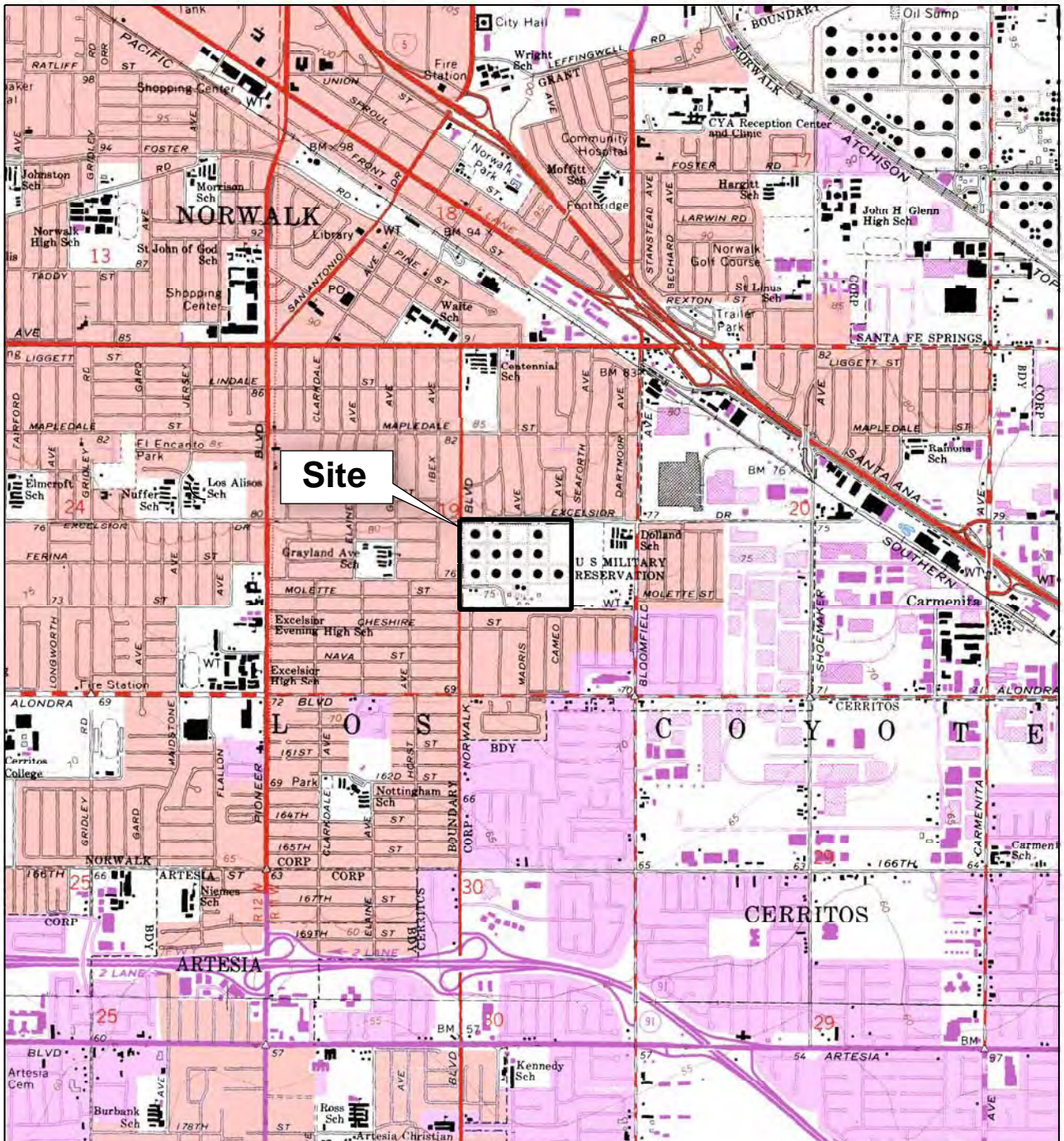
2.5 Changes to Health and Safety Plans

Changes to the HSP shall be documented and accepted by using the Health and Safety Field Change Request (FCR) form (included in Attachments) or by resubmitting a revised HSP for acceptance. A revised HSP should be produced when a large number of changes (e.g., 15 or more not including AHAs) using FCRs has been employed. The CH2M HILL Project Manager (PM) and RHSM shall be responsible for the review and acceptance of the FCR, and the RHSM will maintain an FCR log of approved changes. Field Change Requests are not required for safety-related changes that a Safety Coordinator (SC) or RHSM would normally make in the field, such as upgrade or downgrade to PPE within pre-established action levels, expansion or reduction of work control zones based on air monitoring results, and similar changes made within the operating parameters of the HSP. The field copy of the HSP shall be kept up to date by annotating the appropriate section (i.e., update to AHA) to indicate that an FCR is in effect; copies of FCRs should be kept with the HSP. The FCR number must be referenced in the HSP and available for review.

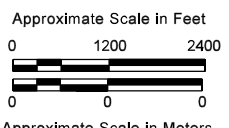
2.6 Daily Safety Meetings and Pre-Task Safety Plans

Safety meetings are to be held with all project personnel in attendance to review the hazards, controls, and required procedures/AHAs that apply for each day's activities:

- Everyone involved in the day's work needs to sign a sign-in form to show they've had a briefing/attended a meeting.
- Pre-Task Safety Plans (PTSPs) serve the same purpose as general safety meetings, but the PTSPs are completed by individual crews to focus on those hazards posed by their specific work.
- For smaller crews, or if there is just one activity, the PTSP is often used as a means to document the overall Safety Meeting.
- A copy of the PTSP and Daily Safety Meeting sign-in sheet is included as an Attachment.



Site



SITE LOCATION MAP

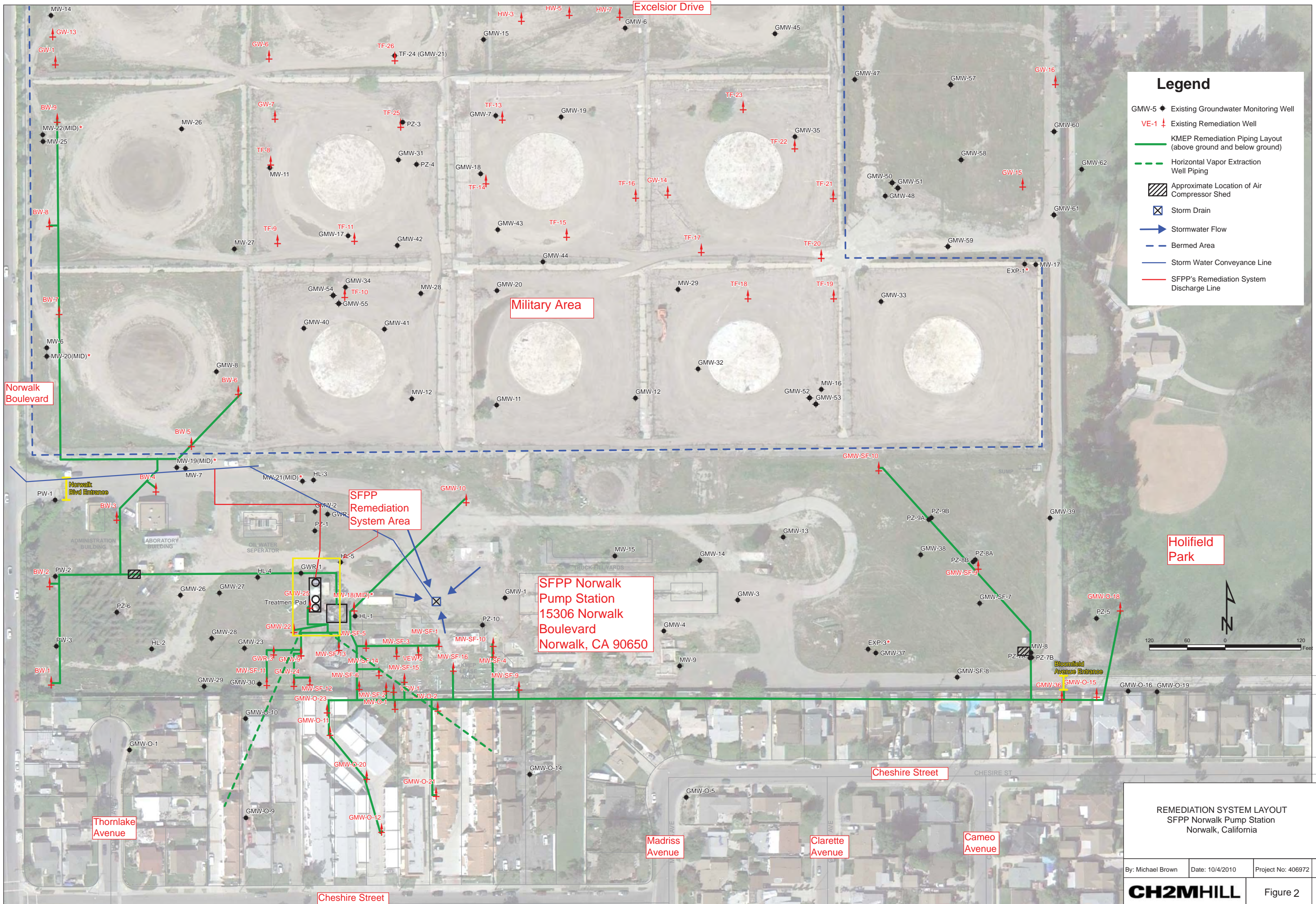
SFPP Norwalk Pump Station
Norwalk, California

By: Andy Vollmar	Date: July 21, 2010	Project No: 407609
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CH2MHILL	Figure 1
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BASEMAP MODIFIED FROM U.S.G.S. 7.5 MINUTE QUADRANGLE MAP
LOS ALAMITOS 1964, CALIFORNIA. PHOTO-REVISED 1981.
WHITTIER 1965, CALIFORNIA. PHOTO-REVISED 1981.

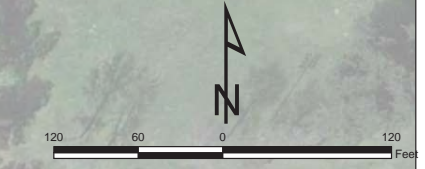
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Legend

- GMW-5 ◆ Existing Groundwater Monitoring Well
- VE-1 † Existing Remediation Well
- KMEP Remediation Piping Layout (above ground and below ground)
- - - Horizontal Vapor Extraction Well Piping
- ▨ Approximate Location of Air Compressor Shed
- ⊠ Storm Drain
- ➔ Stormwater Flow
- - - Bermed Area
- Storm Water Conveyance Line
- SFPP's Remediation System Discharge Line

SFPP Norwalk Pump Station
 15306 Norwalk Boulevard
 Norwalk, CA 90650

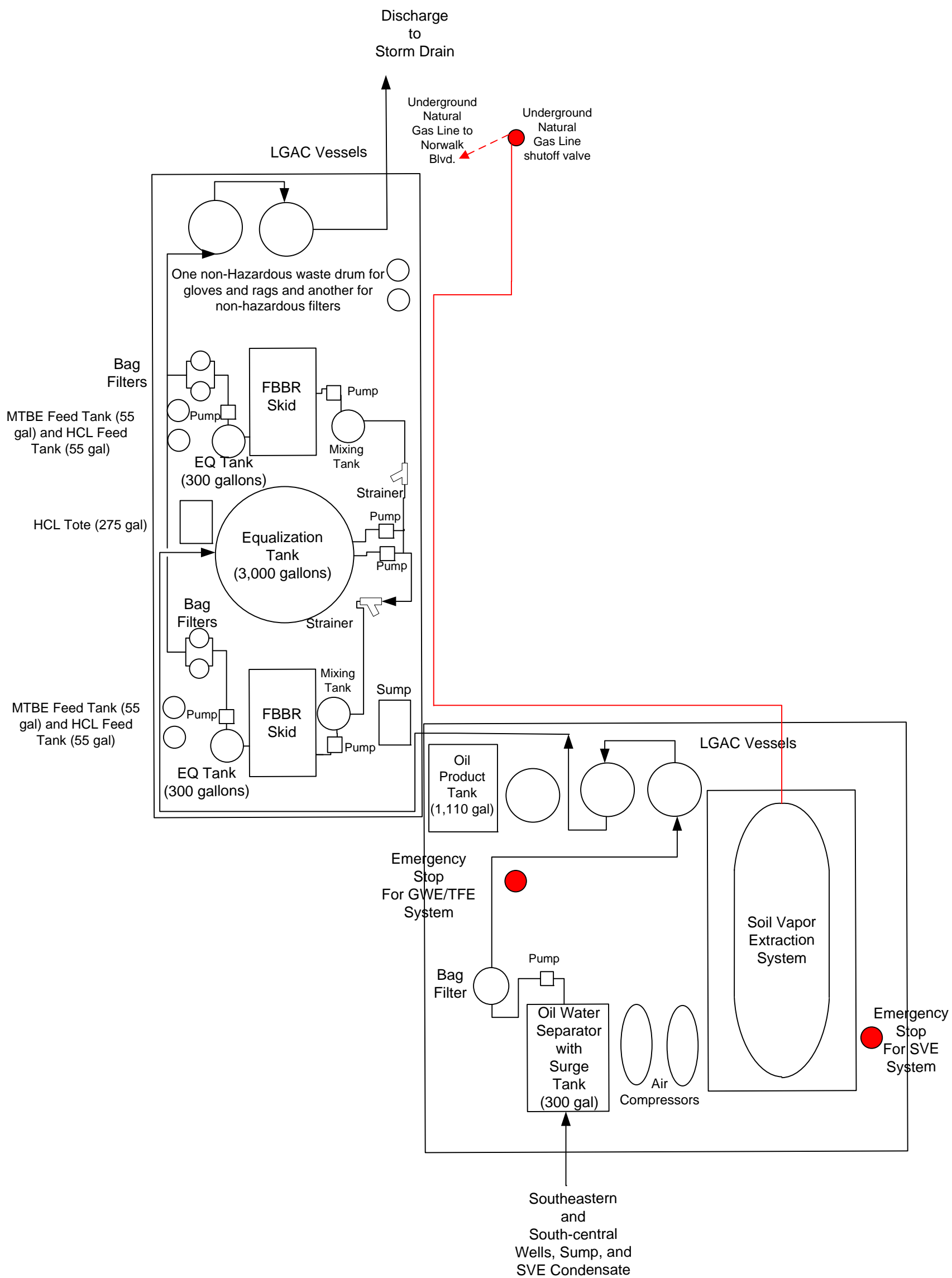


REMEDATION SYSTEM LAYOUT
 SFPP Norwalk Pump Station
 Norwalk, California

By: Michael Brown Date: 10/4/2010 Project No: 406972

5/20/2010 8:10:11 Figure 2 Remediation System Layout.rvt

Figure 3
Equipment Layout
 SFPP Groundwater and Soil Remediation System
 Defense Fuel Support Point – Norwalk, California



3. Project Organization and Responsibilities

A full description of responsibilities, including Employee Responsibilities and Authority, can be found in the Guidelines, Section 3, "Roles and Responsibilities."

3.1 Client

Contact Name:	Steve Defibaugh/KMEP
Phone:	714.560.4802 (office); 949.283.4596 (cell)
Facility Contact Name:	James Dye/KMEP
Phone:	909.631.0231 (cell)

3.2 CH2M HILL

Project Manager:	
PM Name:	Eric Davis
Office:	LAC
Telephone number:	213.228.8262
Cellular Number:	404.323.1600

Environmental Manager:	
EM Name:	Alison Brown
Office:	SCO
Telephone number:	714.435.6167
Cellular Number:	949.547.8969

Responsible Health and Safety Manager:	
RHSM Name:	Jeff Hilgaertner
Office:	PHX
Telephone number:	
Cellular Number:	714.552.1971

Safety Coordinator:	
SC Name:	Vladimir Carino and Nils Orliczky
Office:	SCO
Telephone	714.435.6017
Cellular Number:	619.621.9406 or 562.882.9676

3.3 CH2M HILL Subcontractors

Subcontractor: Spectrum Geophysics	
Contact Name:	Brett Baker
Telephone number:	818.565.3590
Cellular Number:	

Subcontractor: BC2	
Contact Name:	Chris Vargus
Telephone	714.389.8147
Cellular Number:	

Subcontractor: DTD (Directed Technologies Drilling)	
Contact Name:	Mike Lubrecht
Telephone number:	253.389.2707
Cellular Number:	

Subcontractor: Gregg Drilling and Testing	
Contact Name:	Bian Savela
Telephone	562.427.6899
Cellular Number:	

Subcontractor: Dulin and Boynton	
Contact Name:	Edson Chavez
Telephone number:	562.426.6464
Cellular Number:	

Subcontractor: EST	
Contact Name:	Anthony Severini
Telephone	949.679.9500
Cellular Number:	

Subcontractor: California Arborist	
Contact Name:	Josh Mundt
Telephone number:	562.698.3280
Cellular Number:	

Subcontractor: Calvada	
Contact Name:	Saul Melgarejo
Telephone	951.280.9960
Cellular Number:	

Subcontractor: Northstar	
Contact Name:	Colin Kreller
Telephone number:	949.422.4300
Cellular Number:	

Subcontractor: Cardno ERI	
Contact Name:	Joe O'Connell
Telephone	949.355.7909
Cellular Number:	

Subcontractor: American Analytics	
Contact Name:	George Havalius
Telephone number:	818.998.5547
Cellular Number:	

Subcontractor: Landscape Systems, Inc.	
Contact Name:	Carl Clifton
Telephone	909.627.2000 x 103
Cellular Number:	

3.4 Client Contractors

Client Contractor: Belshire	
Contact Name:	Erin Mahler
Telephone number:	949.460.5200
Cellular Number:	

Client Contractor: Alpha Analytical	
Client Name:	Randy Gardner
Telephone	775.355.1044, ext. 157
Cellular Number:	

Client Contractor: Asset Laboratories	
Contact Name:	Marlon Cartin
Telephone number:	702.307.2659, ext. 410
Cellular Number:	

Client Contractor: Blaine Tech	
Client Name:	Cody Sharborough
Telephone	310.885.4455, ext. 110
Cellular Number:	

Subcontractor: Northstar	
Contact Name:	Colin Kreller
Telephone number:	949.422.4300
Cellular Number:	

Subcontractor: Cardno ERI	
Contact Name:	Joe O'Connell
Telephone	949.355.7909
Cellular Number:	

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 client contractor's work, and we must never assume such responsibility through our actions (such as advising on health and safety issues).

4. Standards of Conduct

All individuals associated with this project must work injury-free and drug-free and must comply with the standards of conduct stated in the Guidelines, (Section 4, “Standards of Conduct”), comply with all requirements of this HSP, and Subcontractors must also comply with the safety requirements of the Subcontractor HSP. Forms related to Subcontractor Safety (i.e., Observation Hazard Form and Stop Work Order Form) are attached to this HSP.

5. Project Hazard Analysis

A health and safety risk analysis (Table 1) has been completed for this project. Specific project activities are listed in Table 1 with a designation of who performs the task, CH2M HILL (C) or Subcontractor (S). An Activity Hazard Analysis has been developed for each project activity. AHAs prepared for CH2M HILL activities are included as an attachment to this HSP. **The HSE Handbook included in the Attachment 1, must be utilized to reference information for the topics covered in Table 5-1.**

CH2M HILL subcontractors are required to provide AHAs specific to their scope of work on the project for acceptance by CH2M HILL prior to the start of work. 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
Health and Safety Risk Analysis Table

Associated Hazard Section	Project Activity	Oversight, site walks	Drilling, air knifing and decontamination	Sampling, gauging	Waste Removal	Utility Clearance, Well Surveying	Well or probe installation	Brush Clearance	Hand auger, Trenching	O&M of Remediation Systems
General Hazards – Refer to General Hazards and Controls in HSE Guidelines, Section 7.										
Bloodborne Pathogens		CS	CS	CS	CS	CS	CS	CS	CS	CS
Chemical Storage			S	C,S	S				C,S	CS
Driving Safety		C,S	C,S	C,S	C,S	C,S	C,S	C,S	C,S	CS
Electrical Safety			S	C,S			S		C,S	CS
Field Vehicles		C,S	C,S	C,S	C,S	C,S	C,S	C,S	C,S	CS
Fire Prevention		C,S	C,S	C,S	C,S	C,S	C,S	C,S	C,S	CS
General Practices and Housekeeping			S				S	S		CS
Hazard Communication		C,S	C,S	C,S	C,S	C,S	C,S	C,S	C,S	CS
Knife Use	Open bladed knives are not allowed – any changes to this policy must be approved by the HSM									
Lighting		CS	CS	CS	CS	CS	CS	CS	CS	CS

TABLE 1
Health and Safety Risk Analysis Table

Associated Hazard Section	Project Activity	Oversight, site walks	Drilling, air knifing and decontamination	Sampling, gauging	Waste Removal	Utility Clearance, Well Surveying	Well or probe installation	Brush Clearance	Hand auger, Trenching	O&M of Remediation Systems
Manual Lifting			S	C,S	S	S	S	S	C,S	CS
Personal Hygiene		CS	CS	CS	CS	CS	CS	CS	CS	CS
Personal Security		CS	CS	CS	CS	CS	CS	CS	CS	CS
Shipping and Transportation of Hazardous Waste				C,S	C,S					CS
Substance Abuse		CS	CS	CS	CS	CS	CS	CS	CS	CS
Project-Specific Hazards – Refer to HSE Guidelines, Section 8, and the additional project-specific controls in this plan when specified.										
Aerial Lifts										CS
Benzene		C,S	C,S	C,S	C,S		C,S		C,S	CS
Compressed Gas Cylinders										CS
Confined Space Entry										S
Drilling			S							
Drum and Portable Tank Handling			C,S	C,S	C,S		C,S		C,S	CS
Drum Sampling Safety					C,S					CS
Fall Protection			S				S			S
Forklifts Operations			S		S		S	S	S	S
Groundwater Sampling/Water Level Measurements				C,S						CS
Hand and Power Tools			S	C,S	C,S		S	S	C,S	CS
Lockout /Tagout Activities			CS							CS
Pressure Washer			S							
Process Safety Management										CS
Stairways and Ladders		C,S								CS
Traffic Control		CS	CS	CS	CS	CS	CS	CS	CS	CS
Utilities (overhead)			S				S			CS
Utilities (underground)			S			S	S			CS

TABLE 1

Health and Safety Risk Analysis Table

Associated Hazard Section	Project Activity	Oversight, site walks	Drilling, air knifing and decontamination	Sampling, gauging	Waste Removal	Utility Clearance, Well Surveying	Well or probe installation	Brush Clearance	Hand auger, Trenching	O&M of Remediation Systems
Vacuum Truck/Pumping Operations					S					CS
Working Alone	C			C					C	C
Physical Hazards – Refer to Physical Hazards in HSE Guidelines, Section 9, and the additional project-specific controls in this plan when specified.										
Noise	C,S	C,S					C,S	C,S		CS
Ultraviolet Light exposure (sunburn)	C,S	C,S	C,S	C,S	C,S	C,S	C,S	C,S	C,S	CS
Temperature Extremes	C,S	C,S	C,S	C,S	C,S	C,S	C,S	C,S	C,S	CS
Biological Hazards – Refer to Biological Hazards in HSE Guidelines, Section 10, and the additional project-specific controls in this plan when specified.										
Africanized Honey Bees	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S
Bees and Other Stinging Insects	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S
Coyotes	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S
Feral Dogs	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S
Mosquito Bites	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S
Poison Ivy, Oak and Sumac	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S
Snakes	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S
Spiders – Brown Recluse and Black Widow	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S
Ticks	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S	C, S

C – Hazard section applicable to CH2M HILL personnel

S – Hazard section applicable to Subcontractor personnel

6. Hazards and Controls

Safe work practices and hazard control measures to reduce or eliminate potential hazards as identified in Table 1 are stated in the Handbook, Sections 7-10, the associated CH2M SOP, and are addressed in project AHAs. Any additional project-specific control measures, or those hazards requiring additional emphasis, are identified in the following sections.

Always consult the appropriate CH2M Enterprise SOP to ensure all requirements are implemented. CH2M employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M employees and subcontractors who do not understand any of these provisions should contact the RHSM for clarification.

6.1 Chemical and Physical Hazards and Controls

6.1.1 Fatigue and Journey Management

Managing fatigue and the journey to remote locations is of concern. When travel takes longer than expected due to conditions that require slow speeds, it can make a long day longer. CH2M has prepared a Journey Management Process, attached to this HSP, to mitigate hazards associated with travel.

In addition, workers need to consciously assess themselves as to their personal “fitness for duty” for completing field work during the day. Terrain during this field effort can be demanding and may take much focus and effort. A short checklist is included as an attachment to the HSP that asks simple questions to engage the worker and to help them decide when to keep working and when not to and should be completed twice a day—once before field work, and once after lunch.

As a rule of thumb, field work shall not be scheduled for more than 10 hours a day and workers shall not be conducting field work before dawn or after dusk. Make sure you leave plenty of time when on foot or on UTV to get back to the field vehicle before it gets dark. Work days should not exceed 12 hours per day when commute time is added in. If work hours are exceeding these times, contact the PM and RHSM. Additional fatigue management measures may be required.

See also the Extended Work Hours and Fatigue Management section of the E&N Market HSSE Handbook for fatigue information.

Definition of Fatigue

Fatigue is defined as a state of being tired. It can be caused by long hours of work, long hours of physical or mental activity, inadequate rest, excessive stress, or combinations of these factors. The signs, symptoms, and affect fatigue has on workers varies from one person to the next, however fatigue may affect the individual worker’s ability to perform mental and physical tasks, including driving and working with tool and equipment. The resultant fatigue can lead to any of the following hazardous conditions, effects, or behaviors:

- Inability to see properly;
- Slower reflexes and reactions;
- Micro sleeps (up to 60 seconds where the brain goes to sleep and worker blacks out no matter what they are doing);
- Automatic behavior (where worker does routine tasks but is not having any conscious thoughts);
- Inability to make good decisions or plans;
- Inability to solve problems;
- Inability to concentrate, including wandering thoughts;
- Decreased alertness and watchfulness;
- Inability to remember things just done, seen, or heard;
- Inability to notice things the worker usually would notice;

- More mistakes than usual;
- Failure to respond to changes in surroundings or situation;
- Poor logic and judgment, including taking risks the worker usually would not take;
- Inability to respond quickly or correctly to changes;
- Inability to communicate well;
- Inability to handle stress;
- Moodiness (example -irritable, restlessness, depression, giddiness, grouchiness, and impatience).

All CH2M workers, supervisors, and management by way of this HSP, will be trained to recognize and respond to fatigue issues at the workplace. It is the responsibility of the supervisor to make corresponding changes to work requirements if fatigue impairment signs are evident. All concerns should be communicated to management and corresponding changes should be documented for review and follow-up.

Responsibilities of Management

- To ensure fatigue management is implemented throughout the project;
- Ensure crews are strategically positioned for work the following day;
- Communicate expectations to the workers;
- Monitor the effects of extended work hours;
- Monitor expected weather conditions for suitability of travel;
- Support workers who are experiencing concerns with fatigue;
- Investigate any problems and/or concerns;
- Review the HSP.

Responsibilities of Supervisors

- Scheduling of work and rest days;
- Ensure all crewmembers understand signs and symptoms of fatigue;
- Conduct safety meetings discussing fatigue management;
- Solicit short-term help to minimize the need for extended hours;
- Ensure tasks are performed in safe and healthy manner;
- Be aware of the possible risks associated with extended hours and/or consecutive days of work;
- Give workers as much notice as possible if extended hours are anticipated;
- Account for workers returning from sickness, absences and/or modified work;
- In conjunction with workers, identify health problems which may affect a workers ability to work extended hours i.e. diabetes;
- Consider travel time to and from work;
- Observe and record how individuals respond to extended hours;
- Recognize individual and crew fatigue;
- Get feedback from individual crewmembers and the crew as a whole;
- Assess and control hazards and risks and take prompt action if a risk develops;
- Relay information to and from management & workers;
- Report any FMP problems, concerns and/or issues.

Responsibilities of Workers

- Actively participate in fatigue management training by way of this HSP;
- Take short and frequent breaks;
- Recognize symptoms of fatigue;
- Promptly report any fatigue related concerns;
- Report any individual medical or personal situations, which may have an effect on fatigue;

- To get proper rest during time off;
- Identify personal stress and seek assistance if required.
- Rotate and perform various functions of short duration during extended hours;
- Perform complex tasks earlier in the shift, if possible.

6.1.2 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.

Lightning

Lightning can strike more than 10 miles away from the center of a thunderstorm - well beyond the audible range of thunder. Therefore, if you hear thunder, you're already within striking range of a storm and should seek shelter immediately, especially if in an open area.

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:

- Avoid close contact with others. Spread out at least 50 feet apart in order to minimize the chance of everyone in a group being struck.
- 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;
- With no other options, use the field vehicle or take shelter under a group of shorter trees among larger trees. A thick forest is far better than a lone tree or a small group of trees. 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 typical 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. This may not give you enough time to find an optimal shelter, given the location. When you hear thunder, look for shelter.

Flash Flooding

Flash flooding is a result of heavy localized rainfall such as that from slow moving intense thunderstorms. Flash floods often result from small creeks and streams overflowing during heavy rainfall. These floods often become raging torrents of water which rip through river beds, city streets, and valleys or canyons, sweeping everything with them. Flash Flooding usually occurs within 6 hours of a heavy rain event.

- In hilly or mountainous terrain, flash floods can strike with little or no advance warning. Distant rain may be channeled into gullies and ravines, turning a quiet stream into a rampaging torrent in minutes. Never set up base camp or park on low ground next to streams.

- Do not cross flowing stream on foot where water is above your ankles.
- If you are driving, don't try to cross water-filled areas of unknown depths. If your vehicle stalls, abandon it immediately and go to higher ground. Rapidly rising water may sweep the vehicle and its occupants away. Many deaths have been caused by attempts to move stalled vehicles.
- Don't try to outrace a flood on foot. If you see or hear it coming, move to higher ground immediately.
- Be familiar with the land features and watch for drainage ditches or small streams.
- Stay tuned to weather forecasts and NOAA Weather Radio for the latest statements, watches and warnings concerning heavy rain and flash flooding in your area. The National Weather Service will issue a Flash Flood Watch when heavy rains may result in flash flooding in a specific area. In this case you should be alert and prepare for the possibility of a flood emergency which will require immediate action. A Flash Flood Warning will be issued when flash flooding is occurring or is imminent in a specified area. If your locale is placed under a warning, you should move to safe ground immediately.

Windy Conditions

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. If wind kicks up potentially impacted soils at claim sites, suspend work and move upwind. Do not commence work unless wind is not causing dust to be airborne.

Winter Weather

Work will not commence if winter weather is forecasted. Contact the PM.

6.1.3 Security Policy

CH2MHILL policy prohibits the use, possession or storage of any weapon, ammunition or explosive device on company property or in any company vehicle or vehicle being used for company business. No individual may have in his or her possession, bring to the project site, or maintain on CH2M property, concealed or otherwise, any weapon, explosive device or substance, firearm, ammunition or instrument that could be used as a weapon. All weapons, explosive devices or substances, firearms, and ammunition are banned from all project sites, properties, vehicles and/or any CH2M activities or events.

Weapons specified in the CH2MHILL Security/Asset Protection Manual include:

- Firearm, gun, pistol, rifle, or shotgun
- Knife with a blade longer than 3 inches, a switchblade, stiletto, or knife having an automatic spring release device
- Night stick/club/baton, martial arts weapons, bow and arrow or crossbow
- Malicious intent explosive device
- Concealed Weapon

Concealed weapons permit holders are not allowed to bring any weapon to CH2M property or CH2M site, project, office or facility. All project personnel are required to sign-off on the "Weapons Policy" at the back of the HSP.

6.1.4 Steep Slopes and Uneven Walking Surfaces

Employees walking in ditches, swales and other drainage structures adjacent to roads or across undeveloped land must use caution to prevent slips and falls which can result in twisted or sprained ankles, knees, and backs. Whenever possible observe the conditions from a flat surface and do not enter a steep ditch or side of a steep road bed. Wear sturdy shoes or boots that provide ankle support.

Stay away from edge of roadways and trails which border steep slopes, uneven ground and rock and shale slopes. "Climbing" in these areas must be avoided and limited to that which does not require climbing equipment. Exercise caution when relying on rocks and trees/tree stumps to support yourself – many times they are loose. Whenever possible, switchback your way up/down steep areas, and maintain a slow pace with firm footing. The need for ropes to provide stability should be evaluated and considered as a last resort for ascending or descending slopes.

7. Hazard Communication

As indicated in Section 7, "Hazard Communication," in the Guidelines, the hazard communication (HazCom) coordinator (the SC or qualified designee) must perform the following (additional HazCom duties are outlined in the Guidelines):

- 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;
- Before or as the chemicals arrive on site, obtain a Safety Data Sheet (SDS) for each hazardous chemical and include on the chemical inventory sheet (attached to this HSP) and add the SDS to the SDS attachment section of this HSP;
- Give employees required chemical-specific HazCom training using the chemical-specific training form included as an attachment to this HSP.

8. 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 Concentration (ppm)	Exposure Limits	IDLHc	Symptoms and Effects of Exposure	PIPd (eV)
Benzene	GW: 7.9 SB: SS:	0.5 ppm	500 Ca	Eye, nose, skin, and respiratory irritation; headache; nausea; dermatitis; fatigue; giddiness; staggered gait; bone marrow depression	9.24
1,2-Dichloroethane (Ethylene Dichloride)	GW: 0.019 SB: SS:	1 ppm	50 Ca	CNS depression, nausea, vomiting, dermatitis, eye irritation, liver, kidney, and CNS damage; corneal opacity	11.05
Ethyl Benzene	GW: 8.9 SB: SS:	100 ppm	800	Eye, skin, and mucous membrane irritation; headache; dermatitis; narcotic; coma	8.76

Contaminants of Concern

Contaminant	Location and Maximum Concentration (ppm)	Exposure Limits	IDLH ^c	Symptoms and Effects of Exposure	PIP ^d (eV)
Diesel Range Organics	GW: 240 SB: SS:	100 mg/m ³ (REL)	NL	Primary system effect is CNS depression. Inhalation of vapors may cause nausea, confusion, drowsiness, convulsions, and coma. Liquid may cause skin and eye irritation.	UK
Gasoline Range Organics	GW: 560 SB: SS:	300 ppm	ND Ca	Eye, skin and mucous membrane irritation; dermatitis, headache, fatigue, blurred vision, dizziness, slurred speech, confusion, convulsions, chemical pneumonia on aspiration, possible liver and kidney damage	UK
Methyl Tertiary Butyl Ether (MTBE)	GW: 4.8 SB: SS:	40 ppm (ACGIH)		Breathing small amounts of MTBE for short periods may cause nose and throat irritation. Is a flammable liquid with a distinctive, disagreeable odor	10.2
Tertiary Butyl Alcohol (TBA)	GW: 83 SB: SS:	300 Mg/M3	100	Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.	9.82
Toluene	GW: 20 SB: SS:	20 ppm	500	Eye and nose irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, excessive tearing, nervousness, muscle fatigue, paresthesia, dermatitis, liver and kidney damage	8.82
Xylenes	GW: 50 SB: SS:	100 ppm	900	Irritated eyes, skin, nose, and throat; dizziness; excitement; drowsiness; incoherence; staggering gait; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; dermatitis	8.56

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 value (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/m³ = milligrams per cubic meter

ug/m³ = 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).

9. Site Monitoring

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

For each task listed in the table below, perform the associated monitoring ensuring the equipment is calibrated daily according to the manufacturer’s recommendations. Use the Daily Site Monitoring Form (or equivalent) to document the calibration and the readings taken. Retain area monitoring readings with project records.

Exposure records (breathing zone and personal air sampling) must be preserved for the duration of employment plus thirty years. Copies of all project exposure records (e.g., copies of Daily Site Monitoring form or field logbook pages where breathing zone readings are recorded along with associated calibration) shall be sent to the Sector Safety Program Assistant (SPA) for retention and also maintained in the project files.

Subcontractors are responsible for monitoring and performing integrated personal sampling for their employees as documented in their HSP or, if permitted, according to the table below.

9.1 Direct Reading Monitoring Specifications

Instrument	Tasks	Action Levels ^a	Action to be Taken when Action Level reached	Frequency ^b	Calibration
Toxic Gas Monitor: MultiRAE Plus with 11.7 eV lamp (VOCs, O ₂ , LEL)	Drilling, installation, development, sampling and surveying of wells	<0.5 ppm 0.5-5 ppm	Level D Level C Stop work, let the area ventilate	Initially & periodically	Daily
	Free product vacuum truck operations	0-10 % :	No explosion hazard		
	Remedial system O&M	10-25 % LEL: >25% LEL:	Potential explosion hazard Explosion hazard; evacuate or vent		
	Investigation-derived waste (drum) sampling and disposal	20.9 % ^c O ₂ : <19.5% ^c O ₂ : >23.5 % ^c O ₂ :	Normal O ₂ O ₂ deficient; vent or use SCBA Increased explosion or fire hazard		
Detector Tube: Drager benzene specific 0.5/c (0.5 to 10 ppm range) with pre-tube, or equivalent	PID reading > 1 ppm	<0.5 ppm 0.5-5 ppm >5 ppm	Level D Level C and continue benzene monitoring Suspend operations and allow vapors to dissipate to < 10 ppm before continuing in Level C with benzene monitoring	Initially and periodically when PID/FIB >1 ppm	Not applicable

^a Action levels apply to sustained breathing-zone measurements above background.

^b The exact frequency of monitoring depends on field conditions and is to be determined by the SC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate.

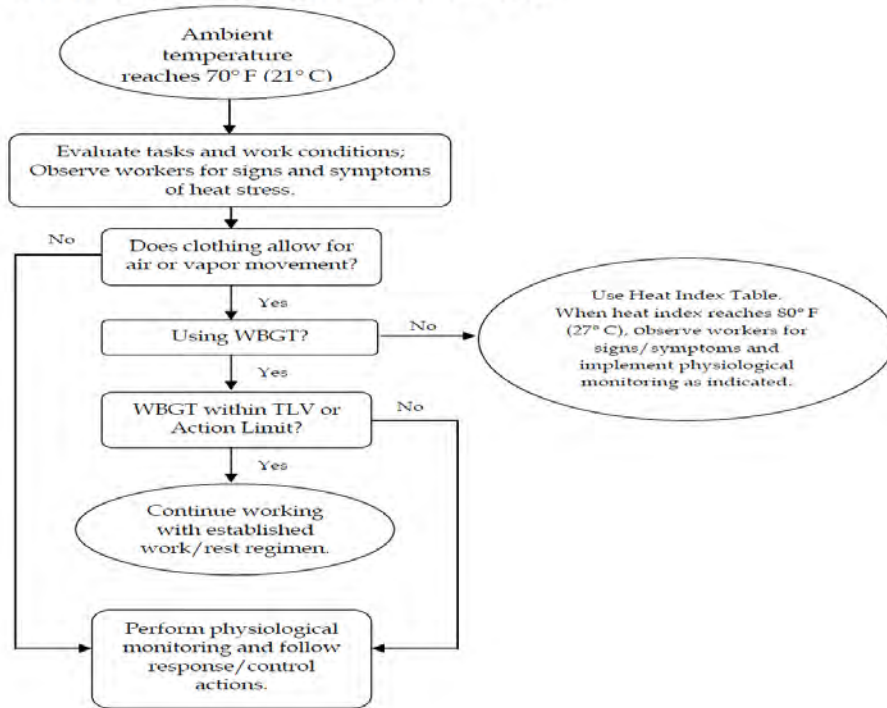
^c If the measured percent of O₂ is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O₂ action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O₂ action levels are required for confined-space entry.

^d Noise monitoring and audiometric testing also required.

9.2 Heat Stress Monitoring Flow Chart

Use the flow chart below and refer to the applicable protocol in Section 9 of the Handbook for heat stress monitoring.

Thermal Stress Monitoring Flow Chart



- Heat stress monitoring must be instituted at 80F and the team must utilize the “Heat Stress Physiological Monitoring Form” in Attachment 4, to track breaks, fluid intake, pulse and rest in shade or AC.
- Each CH2MHILL employee and subcontractor must have and utilize the following equipment and additional items of PPE to reduce heat stress:
 - Personal ice chest, ice, water and electrolyte replacement fluids
 - Cooling neck bandana with gel
 - Wide brim hard hat with extension
 - Neck capes
 - Lightweight long sleeve shirts

9.3 Heat Stress Prevention and Precautions

- Drink 16 ounces of water before beginning work. Try to maintain water at 50°Fahrenheit (10 degrees Celsius [C]) to 60°Fahrenheit (F) (15.6 degrees C). This can be accomplished by filling up “hydration packs” or other water containers with ice and filling the void with cold water. Have a chest of ice for keeping water cool (and can also be used for first aid treatment). Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Remind employees to drink water throughout their work shift.
- Most of the time water is the best hydration source; however, certain situations may contribute to electrolyte losses, in which case proper replacement becomes important. Electrolytes are lost from the body through sweat. Sodium and potassium are lost in the greatest amounts via sweat, while magnesium and chloride are

lost in only small amounts. The more you sweat, the more electrolytes you may be losing. If you sweat a lot and/or you seem to be caked with salt, you're losing a fair amount of electrolytes and need to pay special attention to replacing them. Water is not necessarily always sufficient to ensure hydration. CH2M's occupational medicine provider recommends a mixture of 50:50 water: electrolyte fluids. The 50:50 can be achieved either by alternating or mixing electrolyte fluid and water

- Sports drinks contain supplement electrolyte replacement, but the usual foods we eat contain far more electrolytes than sports drinks. For example, a medium banana contains about 450 mg of potassium, whereas Gatorade provides 30 mg per 8-ounce serving. After a long field day, a meal consisting of 8 ounces of yogurt and a can of chicken noodle soup would adequately replace lost electrolytes (potassium and sodium). If using foods for electrolyte replacement, it's important to continue to hydrate completely.
- Begin physiological monitoring for heat stress when temperatures reach 80 degrees Fahrenheit, even if that means simply taking a baseline measurement.
- Engage occupational health (ICE) to provide guidance when symptoms are observed; occupational health should be engaged whenever possible in decisions to seek medical assistance.
- If an employee's condition is in question, do not have them operate a vehicle or be alone. These are judgment calls in the field, but generally a person exhibiting heat stress symptoms should not be operating heavy equipment nor alone.

9.4 Cold Stress Monitoring

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.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- 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.

- NSC Guidelines for Work and Warm-Up Schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- 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.

T_{air} (°C)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
V_{10} (km/h)												
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	-38	-44	-51	-57	-64	-70
30	0	-6	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	-76
55	-2	-8	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

10. Personal Protective Equipment

(Reference CH2M HILL- SOP HSE-117, Personal Protective Equipment, and Section 11 of the Guidelines)

10.1 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. Refer to the Guidelines, Section 11, "Personal Protective Equipment," for requirements on the use, care, and maintenance of PPE.

The table below outlines PPE to be used according to task based on project-specific hazard assessment. If a task other than the tasks described in this table needs to be performed, contact the RHSM so this table can be updated.

Project-Specific Personal Protective Equipment Requirements ^a				
Task	Level	Body	Head	Respirator ^b
General field work outside in Support Zone	D	<input checked="" type="checkbox"/> Work clothes (sleeved shirt, long pants) <input type="checkbox"/> Cotton Coveralls <input checked="" type="checkbox"/> Safety-toed Boots <input checked="" type="checkbox"/> Gloves (leather) <input checked="" type="checkbox"/> ANSI/ISEA 107-2010 high visibility vest <input type="checkbox"/> Other: (specify)	<input checked="" type="checkbox"/> ANSI Z89.1 Hardhat ^c <input checked="" type="checkbox"/> ANSI Z87.1 Safety glasses <input type="checkbox"/> Hearing protection ^d	None required
General field work (non-intrusive or dust producing) inside of facility exclusion Zones or restricted areas such as site walks, surveys, or accessing minimally impacted areas through these zones.	D	<input checked="" type="checkbox"/> Work clothes <input type="checkbox"/> Cotton coveralls <input checked="" type="checkbox"/> ANSI/ISEA 107-2010 high visibility vest <input checked="" type="checkbox"/> Safety-toed boots <input type="checkbox"/> Safety-toed rubber boots (can be deconned in a boot wash) <input type="checkbox"/> Outer boot covers <input type="checkbox"/> Inner surgical-style nitrile <input type="checkbox"/> Outer chemical-resistant nitrile gloves. <input type="checkbox"/> Other: (specify)	<input checked="" type="checkbox"/> ANSI Z89.1 Hardhat ^c <input checked="" type="checkbox"/> ANSI Z87.1 Safety glasses <input checked="" type="checkbox"/> Hearing protection ^d	None required
Sampling when contact with contaminant is possible	Modified D	<input checked="" type="checkbox"/> Work clothes <input checked="" type="checkbox"/> Cotton coveralls <input checked="" type="checkbox"/> Uncoated Tyvek <input type="checkbox"/> ANSI/ISEA 107-2010 high visibility vest <input checked="" type="checkbox"/> Safety-toed boots <input type="checkbox"/> Safety-toed rubber boots (can be deconned in a boot wash) <input checked="" type="checkbox"/> Outer boot covers <input checked="" type="checkbox"/> Inner surgical-style nitrile <input checked="" type="checkbox"/> Outer chemical-resistant nitrile gloves. <input type="checkbox"/> Other: (specify)	<input checked="" type="checkbox"/> ANSI Z89.1 Hardhat ^c <input checked="" type="checkbox"/> ANSI Z87.1 Safety glasses <input checked="" type="checkbox"/> Hearing protection ^d <input checked="" type="checkbox"/> Face shield – when dealing with liquids or pressurized systems <input checked="" type="checkbox"/> Chemical goggles	None required.

Project-Specific Personal Protective Equipment Requirements^a

Task	Level	Body	Head	Respirator ^b
Equipment decontamination if using pressure washer	Modified D with splash protection	<input checked="" type="checkbox"/> Polycoated Tyvek <input type="checkbox"/> Rain Suit <input type="checkbox"/> ANSI/ISEA 107-2010 high visibility vest <input type="checkbox"/> Safety-toed boots <input checked="" type="checkbox"/> Safety-toed rubber boots (can be deconned in a boot wash) <input type="checkbox"/> Outer boot covers <input checked="" type="checkbox"/> Inner surgical-style nitrile <input checked="" type="checkbox"/> Outer chemical-resistant nitrile gloves. <input type="checkbox"/> Other: (specify)	<input checked="" type="checkbox"/> ANSI Z89.1 Hardhat ^c <input type="checkbox"/> ANSI Z87.1 Safety glasses <input checked="" type="checkbox"/> Hearing protection ^d <input checked="" type="checkbox"/> Face shield <input checked="" type="checkbox"/> Chemical goggles	None required.
When action levels above are exceeded – Contact RHSM prior to upgrade – an FCR will be required to determine cartridges, change-out schedule, need for personal monitoring	C	To be determined based on contaminant (FCR will be developed and approved as an addendum to this plan)		

Reasons for Upgrading or Downgrading Level of Protection (with approval of the RHSM)

Upgrade ^f	Downgrade
<ul style="list-style-type: none"> Request from individual performing tasks. Change in work tasks that will increase contact or potential contact with hazardous materials. Occurrence or likely occurrence of gas or vapor emission. Known or suspected presence of dermal hazards. Instrument action levels in the “Site Monitoring” section exceeded. 	<ul style="list-style-type: none"> New information indicating that situation is less hazardous than originally thought. Change in site conditions that decrease the hazard. Change in work task that will reduce contact with hazardous materials.

^a Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

^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.

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

^e See cartridge change-out schedule.

^f 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 RHSM, and an SC qualified at that level is present.

10.2 Respiratory Protection

(Reference CH2M HILL SOP HSE-121, Respiratory Protection)

Implement the following when using respiratory protection:

- Respirator use shall be limited to those activities identified in this plan. If site conditions change that alters the effectiveness of the specified respiratory protection, the RHSM shall be notified to amend the written plan;
- Tight-fitting facepiece respirator users shall be clean-shaven and shall perform a user seal check before each use;
- Canisters/cartridges shall be replaced according to the change-out schedule specified in this plan. Respirator users shall notify the SC or RHSM of any detection of vapor or gas breakthrough. The SC shall report any breakthrough events to the RHSM for schedule upgrade;

- Respirators in regular use shall be inspected before each use and during cleaning;
- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition;
- Respirators shall be properly stored to protect against contamination and deformation;
- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service; and
- The SC or designee shall complete the Self-Assessment Checklist – Respiratory Protection included in as attachment to this plan to verify compliance with CH2M HILL’s respiratory protection program.

Respirator Change-Out Schedule

Contaminant	Change-Out Schedule
Organic Vapors	End of shift

11. Worker Training and Qualification

11.1 CH2M HILL Worker Training

(Reference CH2M HILL SOP HSE-110, Training, and Section 12 of the Guidelines)

The following training is required for CH2M HILL personnel working onsite. Copies of training will either be available onsite, or readily available from the CH2M HILL Hands training database system. Refer to Section 12 of the Guidelines for a description of HAZWOPER-related and Safety Coordinator training.

Required CH2M HILL Worker Training	CH2M HILL Task or Equipment-Specific Training (if performing task)
<input checked="" type="checkbox"/> 40-hour HAZWOPER Training	<input type="checkbox"/> Aerial Lift Operator Training
<input checked="" type="checkbox"/> 8-hour HAZWOPER Refresher	<input type="checkbox"/> Confined Space Entry Training
<input checked="" type="checkbox"/> 3-day HAZWOPER OJT	<input type="checkbox"/> Excavation Competent Person
<input checked="" type="checkbox"/> CH2M HILL HSP Training	<input type="checkbox"/> Fall Protection (site-specific)
<input checked="" type="checkbox"/> CH2M HILL ESG HSSE Guidelines	<input checked="" type="checkbox"/> Forklift Operator
<input checked="" type="checkbox"/> CH2M HILL AHAs	<input checked="" type="checkbox"/> Hazard Communication
<input type="checkbox"/> Subcontractor HSP	<input type="checkbox"/> On-Track Railroad Safety Training
<input checked="" type="checkbox"/> 10-hour OSHA Construction Safety Training	<input type="checkbox"/> NFPA 70E Training (energized electrical safety training)
<input checked="" type="checkbox"/> At least one SC-HW (refer to worker category for all applicable training needed)	<input type="checkbox"/> Qualified Earthmoving Equipment Operator
<input type="checkbox"/> HWW (refer to worker category for all applicable training needed)	<input type="checkbox"/> Scaffold Training
<input type="checkbox"/> At least one SC-C (refer to worker category for all applicable training needed)	<input type="checkbox"/> Other (specify):

Project-Specific Required (VO) Training

Required CH2M HILL Worker Training	CH2M HILL Task or Equipment-Specific Training (if performing task)
<input type="checkbox"/> 3R Munitions Safety Awareness Training	<input checked="" type="checkbox"/> Hand Safety Training
<input type="checkbox"/> Arsenic Training	<input type="checkbox"/> Hydrogen Sulfide Hazard Recognition Training
<input type="checkbox"/> Asbestos Awareness Training	<input type="checkbox"/> Ionizing Radiation Training
<input type="checkbox"/> Bear Awareness Training	<input type="checkbox"/> Lead Exposure Training
<input checked="" type="checkbox"/> Benzene Training	<input checked="" type="checkbox"/> Lockout/Tagout Training
<input type="checkbox"/> Cadmium Training	<input checked="" type="checkbox"/> Manual Lifting Training
<input type="checkbox"/> Chromium Training	<input type="checkbox"/> Methylene Chloride Training
<input type="checkbox"/> Confined Space Awareness Training	<input checked="" type="checkbox"/> Noise Training
<input checked="" type="checkbox"/> Drum Handling Training	<input type="checkbox"/> Radio Frequency Safety Awareness
<input type="checkbox"/> Electrical Safety Training	<input type="checkbox"/> Railroad Safety On-line Training
<input type="checkbox"/> Excavation Safety Training	<input checked="" type="checkbox"/> Respirators Level C Training
<input checked="" type="checkbox"/> Fall Protection Training	<input checked="" type="checkbox"/> Stairways and Ladders
<input type="checkbox"/> Formaldehyde Training	<input checked="" type="checkbox"/> Traffic Safety Training
<input checked="" type="checkbox"/> Drum Handling Training	<input type="checkbox"/> Vinyl Chloride Training

11.2 Subcontractor Worker Training

The following training is required for Subcontractor personnel working onsite. Copies of training shall be available onsite.

Required Subcontractor Worker Training	Subcontractor Task or Equipment-Specific Training (required if performing this work)
<input checked="" type="checkbox"/> 40-hour HAZWOPER Training	<input type="checkbox"/> Aerial Lift Operator Training
<input checked="" type="checkbox"/> 8-hour HAZWOPER Refresher	<input type="checkbox"/> Asbestos Competent Person
<input checked="" type="checkbox"/> 8-hour HAZWOPER Supervisor	<input type="checkbox"/> Asbestos Training (Supervisor, Worker)
<input checked="" type="checkbox"/> 3-day HAZWOPER OJT	<input type="checkbox"/> Confined Space Entry Training
<input checked="" type="checkbox"/> CH2M HILL HSP Training	<input type="checkbox"/> Certified Crane Operator
<input checked="" type="checkbox"/> Subcontractor AHAs	<input type="checkbox"/> Crane Assembly/Disassembly Competent Person
<input checked="" type="checkbox"/> Subcontractor HSP	<input type="checkbox"/> Demolition Competent Person
<input checked="" type="checkbox"/> 10-hour OSHA Construction Safety Training	<input type="checkbox"/> Excavation Competent Person
<input type="checkbox"/> 30-hour OSHA Construction Safety Training	<input checked="" type="checkbox"/> Fall Protection (site-specific)
<input type="checkbox"/> Respiratory Protection Training	<input type="checkbox"/> Flagger Training
<input type="checkbox"/> CH2M HILL ESBG HSSE Guidelines	<input checked="" type="checkbox"/> Forklift Operator
<input checked="" type="checkbox"/> First Aid/CPR/BBP – at least 2 people	<input checked="" type="checkbox"/> Hazard Communication
<input type="checkbox"/> Other (specify)	<input checked="" type="checkbox"/> Ladder Safety Training

Required Subcontractor Worker Training	Subcontractor Task or Equipment-Specific Training (required if performing this work)
	<input checked="" type="checkbox"/> Lockout/Tagout Training
	<input checked="" type="checkbox"/> Qualified Drill Rig Operator
	<input type="checkbox"/> Other (specify):

11.3 HAZWOPER-Exempted Tasks

The following tasks are not within the scope of the HAZWOPER standard so HAZWOPER training is not required for workers performing these tasks:

Tasks	Controls
Access Agreement and Notifications	Brief on hazards, limits of access, and emergency procedures.
Site Walkthrough	Post areas of contamination as appropriate.
Daily mobilization/demobilization	Perform air sampling/monitoring as specified in this HSP.
Preparing samples for shipment to laboratory	
Utility Clearance and Surveying	

12. Medical Surveillance and Qualification

(Reference CH2M HILL SOP HSE-113, Medical Surveillance, and Section 13 of the Guidelines)

The following medical surveillance is required for CH2M HILL and subcontractor personnel working onsite. Copies of physician's medical opinion will either be available onsite, or for CH2M HILL staff, readily available from the CH2M HILL HandS training database system. Refer to Section 13 of the Guidelines for a description of HAZWOPER, respirator user, and hearing conservation medical surveillance.

General Required Medical Surveillance	Job or Activity-Specific Medical Surveillance (required if performing this work)
<input checked="" type="checkbox"/> HAZWOPER Medical Clearance	<input type="checkbox"/> Noise
<input checked="" type="checkbox"/> Respirator Medical Clearance	<input type="checkbox"/> Baseline Blood Lead
	<input type="checkbox"/> Asbestos Medical Clearance
	<input type="checkbox"/> Other (specify):

Personnel or Tasks Not Requiring Medical Surveillance	
Access Agreement and Notifications	Brief on hazards, limits of access, and emergency procedures.
Site Walkthrough	Post areas of contamination as appropriate.
Daily mobilization/demobilization	Perform air sampling/monitoring as specified in this HSP.
Preparing samples for shipment to laboratory	
Utility Clearance and Surveying	

13. Site-Control Plan

(Reference CH2M HILL SOP HSE-218, Hazardous Waste Operations, and Section 14 of the Handbook)

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. Task-specific control measures are listed below. **Use of the Buddy System will be implemented unless a Working Alone protocol has been established and approved as indicated in Sections 5 and 6 above.**

Site Control for General Work Area(s)			
<input checked="" type="checkbox"/> Perimeter fencing	Location:	<input type="checkbox"/> Barricades	Location:
<input checked="" type="checkbox"/> Signage	Location: Label all drums, containers, process lines and tanks	<input checked="" type="checkbox"/> Other: traffic cones	Location: Identify EZ/CRZ
<input checked="" type="checkbox"/> Traffic control devices	Location: Keep unnecessary traffic away from the work area.	<input type="checkbox"/> Other: _____	Location:

Location	Site Control Procedure (discuss important elements such as signs, barricades, briefings, qualifications, required supplies and equipment, sign-in/out logs, etc.)
Support Zone	NA
Contamination Reduction Zone	Traffic Cones and caution tape
Exclusion Zone	Traffic Cones and caution tape

14. Decontamination

(Reference CH2M HILL SOP HSE-218, Hazardous Waste Operations, and Section 15 of the Guidelines)

Refer to the Guidelines, Section 15, "Decontamination," for a complete description of decontamination activities and diagrams of typical decontamination areas. 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. No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones.

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 project plans.

TABLE 14-1
Decontamination Activities and Diagrams of Typical Decontamination Areas

Type of Decon	Activity	Equipment	Process/Protocol
Personnel	<input checked="" type="checkbox"/> Sampling	<input type="checkbox"/> Tubs/brushes for boot/glove wash <input checked="" type="checkbox"/> Solids disposal bag or drum (used PPE) <input checked="" type="checkbox"/> Liquid disposal drum (decon water)	<input type="checkbox"/> Boot wash/rinse <input checked="" type="checkbox"/> PPE disposal (no decon) <input checked="" type="checkbox"/> PPE waste area identified

Equipment	<input checked="" type="checkbox"/> Sampling, decon	<input checked="" type="checkbox"/> Table for equipment decon/staging	<input type="checkbox"/> Other: _____
		<input type="checkbox"/> Decon pad for vehicles	<input checked="" type="checkbox"/> Equipment wiped/cleaned before leaving CRZ
		<input type="checkbox"/> Pressure Washer	<input type="checkbox"/> Vehicle tires dry deconned prior to leaving site
		<input type="checkbox"/> PPE used during decon	<input type="checkbox"/> Vehicle tires washed prior to leaving site
		<input checked="" type="checkbox"/> Decon supplies	

14.1 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.

15. Communications

A primary and backup means of communication for field crews have been established as described below:

Type of Communication	Primary Means	Backup Means
Communication between field crew	<input checked="" type="checkbox"/> Voice <input type="checkbox"/> Radio <input type="checkbox"/> Phone	<input type="checkbox"/> Voice <input type="checkbox"/> Radio <input checked="" type="checkbox"/> Phone
Communication with Office crew	<input type="checkbox"/> Radio <input checked="" type="checkbox"/> Phone	<input type="checkbox"/> Radio <input type="checkbox"/> Phone
Communication with Fire and Emergency Services	<input type="checkbox"/> Radio <input checked="" type="checkbox"/> Phone	<input type="checkbox"/> Radio <input type="checkbox"/> Phone

16. Required Facilities and Equipment

Table 16-1 shows the facilities and equipment required and used for safe completion of work.

TABLE 16-1
Required Facilities and Equipment for Safe Completion of Work

Facility	Type	Location
<input checked="" type="checkbox"/> Restrooms		Public
<input checked="" type="checkbox"/> Emergency Eyewash	Bottles	Vehicle
<input checked="" type="checkbox"/> Emergency Eyewash & Shower	Must provide a 15-minute minimum flush whenever employees handle chemicals	Vehicle
<input checked="" type="checkbox"/> First aid kit/supplies	Standard	Vehicle
<input checked="" type="checkbox"/> Fire extinguishers	10 lb; 20 lb for drill rigs	Vehicle
<input checked="" type="checkbox"/> Potable water (ice chest, ice, water and electrolytes; warm fluids during cold weather)	Bottled as needed	Vehicle

17. Emergency Response Plan

(Reference CH2M SOP HSE-106, Emergency Planning, and Section 16 of the Handbook)

Table 17-1 identifies the personnel responsible for coordinating emergency situations during site activity are identified below. The Emergency Contacts Page is at the front of this Plan. A site map showing assembly points and directions to the authorized medical facility is attached. Documented rehearsal and critique of this plan is required at least once during the task, or more often as necessary.

TABLE 17-1
Personnel Responsible for Coordinating Emergency Situations

Responsibility	Name	Phone Number(s)
Emergency Response Coordinator (ERC)	CH2M Safety Coordinator	Refer to Emergency Contact Information
Alternate ERC	NA	NA
Type (desk or field) and frequency of rehearsal	Drive the hospital route prior to beginning site activities; discuss emergency response procedures during the morning tailboard	

If an emergency situation develops which requires evacuation of the work area, the following steps shall be implemented.

Evacuation Step	Methods and comments:
Notify affected workers	Voice
Evacuate to safe location	Walk / vehicle
Assemble and account for workers	PTSP form
Notify Supervisor/Manager	Cell
Complete incident report	Online

Potential emergency situations and response actions are identified below.

In case of:	Response actions:
Injury or illness	911 or Occ Nurse for non-medical emergencies; Notify PM and HSM within 1 hour
Chemical exposure	Notify PM and HSM within 1 hour
Fire or explosion	Call 911
Adverse weather	Tornado warning – evacuate to fixed facility
Heat Stroke	Call 911, have a designee give location and directions to ambulance service if needed. If CH2M employee, call occupational physician at 1-866-893-2514.
Material spill or release	Appropriate spill response materials for all chemicals must be present at the job site. Only qualified (by training and previous experience) who have proper PPE and equipment available shall provide spill response operations, when safe to do so.

Evacuation Signals:	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.

If an emergency situation develops, which requires evacuation of the work area, the following steps shall be implemented.

- | Evacuation Step | Methods and comments: |
|---|--|
| <ul style="list-style-type: none"> • Notify affected workers • Evacuate to safe location • Assemble and account for workers • Notify Supervisor/Manager • Complete incident report | <ul style="list-style-type: none"> • Voice • Walk / vehicle • PTSP form • Cell • Online |

Potential emergency situations and response actions are identified below.

- | In case of: | Response actions: |
|---|---|
| <ul style="list-style-type: none"> • Injury or illness • Chemical exposure • Fire or explosion • Adverse weather • Heat Stroke | <ul style="list-style-type: none"> • 911 or Occ Nurse for non-medical emergencies • Notify HSM within 1 hour • Call 911 • Tornado warning – evacuate to fixed facility • Call 911, have a designee give location and directions to ambulance service if needed. If CH2M employee, call occupational physician at 1-866-893-2514. |
| <ul style="list-style-type: none"> • Material spill or release | <ul style="list-style-type: none"> • Appropriate spill response materials for all chemicals must be present at the job site. Only qualified (by training and previous experience) who have proper PPE and equipment available shall provide spill response operations, when safe to do so. |

Evacuation Signals:	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.

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;
- Contact the RHSM and Project EM in the event of a spill or release immediately so evaluation of reportable quantity requirements and whether agency reporting is required;
- 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.

18. Incident Notification, Reporting, and Investigation

(Reference Section 16 of the Guidelines for complete definitions and protocol)

18.1 Incident Notification

All employees and subcontractors' employees shall immediately report any incident (including "near misses,") 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

If the incident was an environmental permit issue (potential permit non-compliance, other situation that result in a notice of violation) or a spill or release, contact the Project EM immediately so evaluation of reportable quantity requirements and whether agency reporting is required.

18.2 Drug and Alcohol Testing for CH2M HILL Employees

As required by CH2M HILL Policy 810, U.S. Employees are subject to post-incident and reasonable suspicion drug and alcohol testing. The Employee must submit to drug and alcohol testing if the supervisor has a reasonable suspicion, and when any of the following occur:

- Work-related injury requiring off-site medical attention;
- Incident resulting in property damage over USD\$500 as determined by the Employee's supervisor;
- Incident considered to be a serious near-miss injury that occurs in the field or in the office as determined by the supervisor;
- Other circumstances as dictated by Employee Relations; or
- An Employee contributes to any of the above Work-related injury requiring off-site medical attention;

Refer to the ESGG HSSE Guidelines and CH2M HILL Policy 810 for additional information and specific requirements.

18.3 Drug and Alcohol Testing for Subcontractors

The drug and alcohol testing requirements stated above apply to subcontractors when required by the subcontract.

18.4 HITS System and Incident Report Form

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.

18.5 Injury Care for Employees (ICE)

In the event of an injury, or potential injury (i.e., involvement in motor vehicle collision with no apparent injury; a puncture wound with no bleeding or apparent infection, etc.), the following actions shall be taken:

- Employee informs their supervisor.
- Employee calls the ICE 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. **Employees are encouraged to enter this phone number into their cell phones prior to starting field work.**
- Supervisor ensures employee immediately calls the ICE 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 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.

18.6 Serious Incident Reporting Requirements

Serious incidents include the following:

- 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.

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.

19. Inspections

19.1 Project Activity Self-Assessment Checklists

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

Biological safety
 Hand and Power Tools
 Hazardous Materials Handling
 Heat stress physiological monitoring form
 Manual Lifting
 Personal Protective Equipment
 Respiratory Equipment

19.2 Safe Behavior Observations

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.

E-mail completed forms to:

- Commercial Sector: [CH2M HILL ES COM Safe Behavior Observation](#)

20. Records and Reports

Refer to the Guidelines, Section 19, "Records and Reports," for a complete description of HSE recordkeeping requirements. Below are examples of records that must be maintained as the project progresses:

- Exposure records includes air monitoring data (including calibration records), SDSs, exposure modeling results
- Training records
- Respiratory fit test records
- Incident reports, investigations and associated back-up information
- Federal or state agency inspection records
- HSE audits and assessments
- Confined space entry permits
- Equipment inspections
- Equipment maintenance
- Emergency equipment inspection records
- SBOs
- Self-assessment checklists
- Daily Safety Meeting Sign-In forms/PTSPs

CH2MHILL Project-Specific Security Policy

CH2MHILL Weapons Policies

The following policies apply to all CH2MHILL staff and contingent staff, and CH2MHILL subcontractors working on CH2MHILL projects.

Project-Specific Weapons Policy

No individual may have in his or her possession, bring the project site, or maintain on CH2MHILL property, concealed or otherwise, any weapon, explosive device or substance, firearm, ammunition or instrument that could be used as a weapon. All weapons, explosive devices or substances, firearms, and ammunition are banned from all project sites, properties, vehicles, and/or any CH2MHILL activities or events. This policy applies to all CH2MHILL staff and contingent staff, and CH2MHILL subcontractors. Weapons specified in CH2MHILL's Security/Asset Protection Manual include:

- Firearm, gun, pistol, rifle, or shotgun
- Knife with a blade longer than 3 inches, a switchblade, stiletto, or knife having an automatic spring release device
- Night stick/club/baton, martial arts weapons, bow and arrow, or crossbow
- Malicious intent explosive device
- Concealed weapon**

** Concealed weapons permit holders are not allowed to bring any weapon to CH2MHILL property, project site, office or facility.

CH2MHILL Project-Specific Knife Policy

CH2MHILL policy prohibits having any fixed open bladed knives on CH2MHILL project sites. Scissors or auto-retractable safety knives are the only allowed tools for cutting. This policy regarding knives applies to all CH2MHILL staff and contingent staff, and CH2MHILL subcontractors.

Acknowledgment

By signing below, you are acknowledging that you have been given a copy of the company's weapons policy and the project specific weapons policy, have read and understand the requirements of the policies, agree to comply with all of its requirements, and understand that noncompliance with either of these policies will result in disciplinary action, up to and including termination for CH2MHILL employees and revocation of project/site access for CH2MHILL subcontractor employees.

Check One:

- CH2MHILL Employee
 Other (Company Name): _____

Project Name: _____

Signature

CH2MHILL Employee Number

Printed Name

Date

Witness Signature

(Please have someone sign that they did witness you signing this form.)

CH2M HILL Health and Safety Plan
Attachment 1

HSSE Handbook

CH2M Health, Safety, and Environment
Field Handbook

February 2017



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ATTACHMENTS:

- Employee Sign-Off Form
- Subcontractor Sign-Off Form

1. Introduction

1.1 CH2M Health, Safety, and Environment Policy Commitment and Goals

1.1.1 Health, Safety, and Environment Policy Commitment

Protection of people and the environment is a CH2M core value. It is our vision to create a culture that empowers employees to drive this value into all global operations and achieve excellence in health, safety, and environment (HSE) performance. CH2M deploys an integrated, enterprise-wide behavior based HSE 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 their fellow employees to prevent injuries, illnesses, and adverse environmental impacts, and create a safe, healthy, and environmentally-responsible workplace.
- We provide value to clients by tailoring HSE processes to customer needs and requiring CH2M employees and subcontractors to deliver projects that identify HSE requirements and commit to compliance with applicable HSE laws and regulations, company standards, and external requirements.
- We are committed to pollution prevention in conjunction with our Sustainability Policy and by offering our clients sustainable solutions.
- We aspire to continually improve our performance and influence others to redefine world-class HSE excellence.
- We evaluate our design engineering and physical work environment to verify safe work conditions and practices are established, followed, and corrected as needed.
- We assess and continually improve our HSE program to achieve and maintain world-class performance by setting and reviewing objectives and targets, reporting performance metrics, and routinely evaluating our program.
- We expect all employees to embrace our Target Zero 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.

1.1.2 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.

CH2M 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 project safety plan, environmental plan (or equivalent) through education, delegation, and team work;

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- Ensure 100 percent participation in HSE compliance;
 - Continuously improve our safety and environmental 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, safety, and environmental excellence.

2. Applicability

This CH2M Health, Safety, and Environment Field Handbook (Handbook) applies to:

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

This Handbook 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. This document does not apply to LLC companies within CH2M.

This Handbook defines the procedures and requirements for the health and safety of CH2M 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 Handbook will be kept onsite during field activities and will be reviewed as necessary. The Handbook will be amended or revised as project activities or conditions change or when supplemental information becomes available. The Handbook adopts, by reference, the Enterprise-wide Core Standards and Standards of Practice (SOPs), as appropriate. In addition, the Handbook may adopt procedures from the project Work Plan and any governing regulations. If there is a contradiction between this Handbook and any governing regulation, the more stringent and protective requirement shall apply.

For those working in the state of California in the United States, this Handbook incorporates the regulatory requirements described in the State of California OSHA agency – Cal/OSHA Title 8 CCR, Section 3203, Injury and Illness Prevention Program (IIPP), and section 1509, Construction Injury and Illness Prevention Program. The current version of [CH2M Cal/OSHA IIPP written program](#) can be accessed on the HSE website under HSE Programs.

When this Handbook is used to supplement the project health and safety plan, all CH2M staff and subcontractors must sign the employee sign-off form included at the end of this Handbook to acknowledge review of the document. CH2M employees will send a signed copy of the sign-off form to their SPA or will maintain it in project files. The subcontractor sign-off form will be maintained on site by the project Safety Coordinator (SC).

3. Roles and Responsibilities

The sections below describe the roles and responsibilities of personnel referred to in the project-specific safety plan.

3.1 CH2M Line Management (Program/Project Managers)

Line management safely manages and executes overall program, project, or site work. The Program or Project Manager (PM) may explicitly delegate specific tasks to other staff, but retains ultimate responsibility for HSE related responsibilities including:

- Coordinate and lead Subcontractor HSE Chartering meetings prior to the start of field work;
- Designate a qualified Safety Coordinator in conjunction with the RHSM/EM;
- Ensure CH2M safety plan (and environmental plan, if applicable) is current and provide approval alongside the HSE Manager/RHSM or EM, if applicable;
- Ensure CH2M Activity Hazard Analyses (AHAs) or AHA/Environmental Impact Assessment (EIA) are in place and verify HSE Manager/RHSM has reviewed and approved;
- Notify HSE staff if changes to scope have an effect on HSE plans, documents, or requirements; review and approve any field change requests (FCRs) to the safety plan.
- 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;
- Perform a Management Inspection at least once during short-term projects or once a month on long-term projects;
- Set an example for safe work practices, attitudes, and culture through personal action and participation in the HSE program, including HSE programs, rules, procedures, processes, and training
- Intervene or stop work when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition is encountered;
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on project work sites;
- Promptly report all work-related HSE incidents or near misses;
- Conduct, cooperate, or assist with HSE incident investigations;
- Wear any required personal protective equipment when visiting project site;
- Consult with the Human Resources Delivery Partner before taking any disciplinary action (other than verbal counseling) associated with [CH2M Policy 203](#), HSE Accountability, and/or HSE programs rules, procedures, processes and training;
- Has the overall responsibility for implementing the Drug-Free Workplace Program ([Policy 810](#)) on his/her project; and

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- Coordinate HSE needs of contingent labor as required by the [Contingent Worker Core Standard](#) and [Policy 809, Contingent Worker Policy](#).

3.2 CH2M Responsible Health and Safety Manager

The Responsible Health and Safety Manager (RHSM) is assigned by the client sector HSE Lead or designee to provide ongoing health and safety technical guidance and support to the project, program or facility. The RHSM is responsible for the following:

- Develop or review and approve CH2M safety plan(s) and revisions or amendments as well as AHAs or AHA/EIA;
- Review and accept subcontractor training and medical monitoring records prior to start of field operations;
- Review subcontractor statements of work to include project H&S requirements before they are sent to potential subcontractors ;
- Review and accept subcontractor site-specific safety procedures (including safety plans and AHAs or AHA/EIAs) for adequacy prior to start of subcontractor's field operations;
- Provide input to the PM on the selection of the SC;
- Support the oversight (or SC's direct oversight) of subcontractor and tiered subcontractor HSE practices;
- Permit upgrades and downgrades in personal protective equipment (PPE), including respiratory protection, in accordance with the site safety plan;
- Conduct audits as determined by project schedule and coordination with PM; and
- Participate in incident investigations, lessons learned, loss and near loss reporting.

3.3 CH2M Project Environmental Manager

The Responsible Project EM (REM), also referred to as the Program or Project EM, is assigned by the client sector HSE Manager or sector EM to provide ongoing environmental protection and compliance guidance and support the project, program or facility. The REM is responsible for the following:

- Provide project/task-specific environmental compliance input to include in statements of work before they are sent to potential subcontractors (when requested by the project team);
- 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 or equivalent plan;
- Assist the PM to identify environmental requirements, including those described in the CH2M Target Zero Management System Manual, environmental risks, environmental permits and similar documents that CH2M is responsible for complying with (e.g., notices, approvals or other documents that legally bind CH2M);
- Verify that a Field Project Start-up Form (FPSF) has been submitted and that an Environmental Plan or equivalent document is available;
- Assist the PM in preparing or coordinating the preparation of regulatory-required environmental plans (e.g., SPCC, SWPPP) and contract-required environmental plans (e.g., Environmental Protection Plan);
- Review revised scopes of work and changes in project conditions to identify new environmental issues and requirements;
- Review/approve waste characterizations and client waste profiles, or engage the project Waste Coordinator to review and approve;

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- 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, advice, and training to the project team as needed during the course of the project.

3.4 CH2M Safety Coordinator

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

- Participate in Subcontractor HSE Chartering meetings prior to the start of field work;
- Verify the project safety plan, and environmental plan, if applicable, is current and amended when project activities or conditions change;
- Verify CH2M site personnel and subcontractor personnel read this Handbook, the project safety plan, and applicable AHAs or AHA/EIA and sign the accompanying sign-off forms for each, prior to commencing field activities;
- Verify CH2M site personnel have completed any required specialty training (for example, fall protection, confined space entry, among others) and medical surveillance as identified in the project safety plan;
- Verify that project files include copies of accepted subcontractor 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 project safety plan;
- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in the project safety plan;
- Post the required workplace labor posters. In the US, post the Occupational Safety and Health Administration (OSHA) job-site poster. The poster is required at sites where project field offices, trailers, or equipment-storage boxes are established. If you work in the US in a state with an OSHA State Plan, make sure the State Plan poster is posted, if required. In Canada, check the provincial Ministry of Labour website to determine which posters are required;
- 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);
- Assist in implementing environmental plan requirements at the project as assigned by the PM or project EM;
- Verify that project health and safety forms and permits are being used as outlined in the project safety plan;
- 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 in the project safety plan;
- Ensure that deficiencies identified in self-assessment checklists are tracked through completion and closed out;
- Coordinate with the RHSM regarding CH2M 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;
- Calibrate and conduct air monitoring in accordance with the project safety plan; maintain all air monitoring records in project file;

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- Maintain HSE records and documentation at the project site;
 - Facilitate government agency inspections (e.g., OSHA, Occupational Health and Safety [OH&S]) including accompanying inspector and providing all necessary documentation and follow-up;
 - Deliver field HSE training as needed based on project-specific hazards and activities;
 - Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on project work sites;
 - Wear any required personal protective equipment;
 - Contact the RHSM and PM in the event of an incident;
 - Contact the RHSM and Project EM in the event of a spill or release immediately so evaluation of reportable quantity requirements and whether agency reporting is required;
 - Conduct, cooperate, or assist with HSE incident investigations;
 - Contact the PM and RHSM when standards of conduct or CH2M Policy 203 has been violated by a CH2M employee;
 - When an apparent imminent danger exists, immediately remove all affected CH2M 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 verbal health and safety-related communications in project field logbook, daily reports, or other records.

3.5 CH2M Employees

All personnel have the responsibility for performing work in a safe manner and to:

- Understand and abide by CH2M and client HSE programs, rules, procedures, processes, and training, including any that are project-specific;
- Complete all required HSE training made available and accessible within established timelines;
- Always wear any required personal protective equipment;
- Intervene or stop CH2M work when an unsafe condition or behavior is encountered or observed, and/or when an environmentally compromising condition exists;
- Promptly pause work and notify a supervisor, PM, SC, or RHSM when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition exists;
- Promptly report to supervisor, PM, SC, or HSE Manager/RHSM/EM all work-related health, safety, and environmental incidents or near misses;
- Attend required project HSE pre-task briefings and meeting prior to performing work;
- Cooperate or assist with HSE incident investigations; and
- Encourage safe work practices and attitudes by setting a personal example and participate in the site HSE program and meetings.

3.5.1 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.

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3.6 CH2M Subcontractors

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

- Participate in Subcontractor HSE Chartering meetings;
- Implement and comply with all HSE requirements in their subcontract;
- Comply with all local, state, provincial, and federal safety standards;
- Comply with project and owner safety requirements;
- Maintain up-to-date health and safety training, medical, and competent person qualification records at the project site, readily available for inspection;
- Assign a competent site HSE representative who has the appropriate level of authority to act on HSE issues;
- Actively participate in the project safety program and either hold or attend and participate in all required safety meetings;
- Develop and implement site- and activity-specific HSE plans and/or procedures for work they will be performing;
- Maintain safety equipment and PPE for their employees;
- Determine and implement necessary controls and corrective actions to correct unsafe conditions;
- Maintain and replace safety protection systems damaged or removed by the subcontractor's operations;
- Notify the SC of any incidents including, injury, spills or releases, environmental permit issues, near misses or property damage immediately and submit report to CH2M within 24 hours;
- Install contractually required general conditions for safety (for example, handrail, fencing, fall protection systems, floor opening covers);
- Conduct site-specific and job-specific training for all subcontractor employees, including review of the CH2M safety plan, subcontractor safety plans, and subcontractor AHAs or AHA/EIA, and sign appropriate sign-off forms;
- Provide subcontractor staff with the appropriate HSE training, qualifications, PPE, supplies and equipment necessary to safely complete assigned work; and
- Provides reports and maintains records of HSE-related activities in accordance with contract requirements and HSE Plans.

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

Subcontractors are also required to prepare AHAs or AHA/EIAs before beginning each activity posing hazards to their personnel. The AHA or AHA/EIA shall identify the principle steps of the activity, potential HSE hazards or impacts 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.

3.7 Client Contractors

CH2M project safety plans do not cover contractors that are contracted directly to the client or the owner. CH2M 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 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 team members to review the contractor's performance only as it pertains to evaluating CH2M exposure and safety. The RHSM is the only person who is authorized to comment on or accept contractor safety procedures.

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

- Request the contractor to brief CH2M 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 team members:
 - Notify the contractor safety representative;
 - Request that the contractor determine and implement corrective actions;
 - If necessary, stop affected CH2M 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'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'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.

4. Standards of Conduct

All individuals associated with this project must strive to work injury-free and must work drug-free and comply with the following standards of conduct, and the safety requirements of CH2M. 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.

4.1 HSE Accountability

(Reference CH2M Policy 203, *HSE Accountability*)

4.1.1 Prohibited Behaviors and Actions

Managers, supervisors, and employees who openly or recklessly exhibit a disregard, defiance, or disrespect for CH2M's HSE programs, rules, procedures, processes, and training, or who violate established HSE programs, rules, procedures, processes or training endangering themselves or other employees, will be subject to disciplinary actions. Without limitation, behaviors and actions that warrant disciplinary action include the following:

- Requiring, requesting, demanding, asking, or threatening another person in any manner to entice the person to engage in or work around a patently unsafe or environmentally compromising act or condition.
- Condoning or knowingly allowing a person to engage in or work around a patently unsafe or environmentally compromising act or condition.
- Recklessly, knowingly, or purposely failing to wear required PPE.
- Failing to successfully complete any required HSE training that is scheduled and made available for completion.
- Failing to promptly notify a supervisor, project safety manager, coordinator, lead, or the project manager when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition is encountered.
- Failing to promptly report to a supervisor, project safety manager, coordinator, lead, or the project manager, a work-related HSE incident or near miss.
- If required of the position, failing to maintain as active and in good standing necessary health, safety, and/or environmental licenses or permits needed to support CH2M work and projects.
- Knowingly falsifying any HSE record or investigative document (whether internal to CH2M or external), or providing false testimony, during an HSE or outside agency incident investigation.
- Refusing to cooperate in an HSE incident investigation.
- Knowingly falsifying any inspection or sampling records (whether internal to CH2M or external).
- Performing field work without the required site HSE plan approved by a HSE manager.
- Engaging in any form of workplace violence described in Policy 201 Workplace Violence Awareness and Prevention, including physical encounters, destruction of property, and verbal threats of violence, harm, or mayhem.
- Failing to comply with any HSE procedures contained in any contract, subcontract, site health safety and environment plan, or any federal, state, provincial, or local health, safety, or environmental laws and regulations creating actual or potential significant risk for CH2M (whether monetary or otherwise).

In addition, no individual may have in his or her possession, bring to the project site, or maintain on CH2M property, concealed or otherwise, any weapon, explosive device or substance, firearm, ammunition or instrument that could be used as a weapon. All weapons, explosive devices or substances, firearms, and ammunition are banned from all project sites, properties, vehicles and/or any CH2M activities or events.

4.1.2 Disciplinary Actions

When CH2M employees neglect to fulfill their responsibilities and/or project-specific HSE requirements, CH2M may discipline its employees. All CH2M employees, including management and supervisory employees, are equally subject to disciplinary action for failing to meet the expectations associated with this Policy and/or HSE programs, rules, procedures, processes, and training. CH2M reserves the right in its sole discretion to determine the appropriateness of any discipline imposed, but such disciplinary action may include, without limitation, denial of access to the worksite, verbal and/or written warnings/reprimands, and termination of employment.

4.2 Subcontractor Safety Performance

CH2M should continuously endeavor to observe subcontractors' safety performance and adherence to their plans and AHAs or AHA/EIAs. 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 oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

4.2.1 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 the project safety plan, 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.

4.2.2 Stop Work Order

CH2M has the authority, as specified in the contract, and the responsibility to stop work in the event any CH2M 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 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, Buyer, 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 the project safety plan) until adequate corrective measures are implemented. Consult the Buyer 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.

4.3 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.

4.4 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. Incident prevention requires a proactive 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 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.

5. Safety Planning and Change Management

5.1 Subcontractor HSE Chartering Meeting

A subcontractor HSE chartering meeting shall be held with subcontractors performing field work on the project. The purpose of the meeting is to discuss and agree on key HSE requirements on a project, and to emphasize and reinforce CH2M expectations for subcontractor HSE performance. The target audience includes key CH2M project staff with HSE responsibilities (e.g., PM, RHSM, SC, Field Team Leader (FTL)) and key Subcontractor staff (e.g., project manager, supervisors, designated field HSE contact, drill team leads, foreman). For small scale projects (e.g., small drill crew and limited CH2M staff), all the subcontractor crew members should attend if available. The meeting should be held prior to mobilization with enough time to ensure that HSE issues identified can be addressed prior to the start of work. The meeting can be held over the phone or in person depending on project needs. An example agenda can be found at following link [Program Element Guideline, "Subcontractor HSE Chartering Meeting."](#)

5.2 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 or AHA/EIAs that apply for each day's project activities. The Pre-Task Safety Plans (PTSPs) serve to supplement these general assembly safety meetings; 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 the project safety plan, with input from the work crew. 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 this Handbook and AHA or AHA/EIA. 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. The PTSP can be completed either with the daily safety meeting or, if there are multiple crews, separately with each crew and their supervisor after the general daily safety meeting.

5.3 Change Management

This Handbook and the project safety plan address known activities and associated hazards. As work progresses, if significant changes are identified which could affect health, safety, or environmental conditions at the site, coordinate with the RHSM or EM to determine whether an update to the safety plan and/or environmental plan are necessary. Follow the change management protocol in the safety plan.

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

- Change in CH2M 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 Handbook or the project safety plan.

5.4 Agency Inspection Guidance

(Reference CH2M SOP HSE-201, Agency Inspections and Enforcement)

Agency inspections (e.g., OSHA, EPA, Federal Aviation Administration (FAA), and in Canada, Workplace Health and Safety, Provincial Ministry of Labour, Provincial Ministry of the Environment) are on the rise. CH2M implements safety and environmental programs in order to ensure safety to workers, the public, and the environment. Field personnel need to contact the RISM to update the project safety plan if hazards are encountered that are not addressed.

[SOP HSE-201, Agency Inspections and Enforcement](#), addresses agency inspections in detail. It is critical to make immediate notification to the RISM if an inspector arrives (and EM if it is environmental-related); they can help facilitate and make additional notifications.

Review the SOP and make it a topic at a safety meeting and keep it readily available in the event of an inspection.

6. Project Hazard Analysis

A health and safety risk analysis is performed for each task of a given project. 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 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).

Employees are trained on the hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects.

6.1 Hazard Identification and Control – The 10 Energies

Hazards are created when an object interacts with a type of energy or combination of energies. The first step in incident prevention is recognizing the energy source(s) and the potential for an uncontrolled release of, or contact with, that energy source. Identifying potential energy sources associated with a piece of equipment or a task allows us to mitigate the hazard correctly.

The 10 types of energy to consider are:

- Chemical
- Electrical
- Gravity
- Mechanical
- Motion
- Pressure
- Sound
- Radiation
- Temperature
- Biological



As described in the hierarchy of controls above, there are four basic options available to prevent unwanted exposure of the energy or energies:

- Eliminate the energy,
- Control the energy,
- Provide a protective barrier or,
- Use stop work authority

When possible, plan or do work that does not require exposure to an energy source. Take action to remove or control the energy source, or be sure that barriers are adequate to mitigate the resulting hazard (engineering controls, PPE, etc.). Use safe work observations to look for body position and placement and use of safety equipment with respect to energy sources present and the potential for an uncontrolled release or contact (line of fire incidents!).

Identify the energy source(s) in the safety plan and AHA or AHA/EIA or during the pre-task safety briefing and **verify** controls are in place for each task or STOP work until they are.

6.2 Activity Hazard Analysis

An AHA must be developed for each CH2M field activity. The AHA or AHA/EIA shall define the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard, incorporating the hazardous energies described above. 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 or AHA/EIA 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.

6.3 Subcontractor Activity Hazard Analysis

CH2M subcontractors are required to provide AHAs or AHA/EIAs specific to their scope of work on the project for acceptance by CH2M. Each subcontractor shall submit AHAs or AHA/EIA for their field activities, as defined in their scope of work, along with their project 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 or AHA/EIAs requires either a new AHA or AHA/EIA to be prepared or an existing one to be revised.

7. 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 Core Standard and/or SOP to ensure all requirements are implemented.

7.1 Bloodborne Pathogens

(Reference CH2M 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'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 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.

7.2 Chemical Storage

The following is general guidance 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.

7.2.1 Storage of Flammable/Combustible Liquids

- Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids.

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- Approved safety cans shall be used for the handling and use of flammable liquids in quantities of 5 gallons (19 liters) or less. Do not use plastic gas cans. In Canada, use only the appropriate and approved gas cans for your specific province. In addition, the client may have specific requirements.
 - For quantities of 1 gallon (3.78 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.

7.2.2 Indoor Storage of Flammable/Combustible Liquids

- No more than 25 gallons (95 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 (95 liters) shall be stored in an acceptable or approved cabinet.
- Cabinets shall be conspicuously lettered: "FLAMMABLE: KEEP FIRE AWAY."
- Not more than 60 gallons (228 liters) of flammable or 120 gallons (456 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.

7.2.3 Outside Storage of Flammable/Combustible Liquids

- Storage of containers (not more than 60 gallons [228 liters] each) shall not exceed 1,100 gallons (4,180 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.

7.2.4 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.

7.2.5 Storage of Chemical Injection Chemicals/Materials

- When chemical injection remediation technologies are being used at a site, the following storage guidelines must be followed:
- Some injection chemicals, such as strong oxidizers, may have stringent storage requirements per local or National Fire Codes. Verify that appropriate storage provisions are in place prior to starting work.
- NOTE: Counties and cities may have requirements specific to storing these chemicals. Also, storage and use of certain chemicals such as potassium permanganate and hydrogen peroxide may be subject to state, provincial, or federal regulations (e.g., the Chemical Facility Anti-Terrorism Standards of the Department of Homeland Security in the United States). The applicability depends on the chemical,

quantity/concentration, and type of facility. Please contact the project EM to determine whether chemicals are subject to these standards.

- Injection chemicals must be stored in a designated, secured area with spill prevention capabilities. Review Safety Data Sheet (SDS) or other information to determine potential incompatible materials. Incompatible materials shall not be stored together. Ensure all containers are labeled.

7.3 Driving Safety

(Reference CH2M HSE Policy 205, Distracted Driving – Wireless Devices, Vehicle Safety Core Standard)

All CH2M employees are prohibited from using wireless devices while operating a motor vehicle when conducting company business regardless of the location or vehicle ownership and whether or not during regular working hours.

All CH2M contractors and subcontractors are prohibited from using wireless devices while operating a CH2M- or CH2M client-owned, leased, or rented motor vehicle, or while operating any other motor vehicle on the project site.

Motorcycles, motorbikes, or other motorized devices with two or three wheels, all-terrain vehicles (ATVs) or quads are not allowed to be used for company related business. See the all-terrain vehicle (ATV)/utility-type vehicle (UTV) section of this Handbook for more information on ATVs/UTVs.

Avoid distractions from wireless devices (e.g., mobile phones, smartphones, voice recognition systems, PDAs, notebook, tablets, or laptops) by turning off or silencing the wireless devices before operating a motor vehicle.

- Prohibited use includes the following:
 - Dialing or speed dialing
 - Using a hands-free or voice recognition (blue tooth) device to dial or speed dial
 - Engaging in conversation or listening to a conversation using a wireless device
 - Checking emails or surfing the internet using a wireless device
 - Texting or e-mailing (reading, sending, or screening) with a wireless device
 - Programming or entering coordinates into a global positioning system (GPS) device (following directions by a GPS is permitted)
 - Using a wireless device for voice recording or dictation
 - Employees, contractors, and subcontractors who need to use a wireless device must pull off the road to a safe location, with the vehicle securely stopped and emergency flashers on, or wait until they reach their destination.

Follow the guidance below when operating a vehicle:

- All vehicles have blind spots to the side and the rear. Follow these safe practices for backing up:
 - Walk around your vehicle prior to moving
 - Try to position your vehicle so that you don't have to back up
 - Back into the space if possible when you're parking
 - Back to the left, if possible, so that you can see objects on the driver's side
 - Have a spotter guide your vehicle when you're backing up

– Apply GOAL (Get Out And Look)

- 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 not drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep;
- Ensure seatbelts are worn at all times, and by all passengers
- 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.

Driving in Areas with Tall Grass/Brush

- Driving in areas with tall grass/brush can present a potential fire hazard if the grass/brush gets caught under and/or remains in contact with the vehicle exhaust system. Employees should exercise the following precautions:
- When stopping vehicle, ensure it is in an area where grass is not tall.
- Do not leave vehicle idling once stopped.
- When possible, try to drive through areas where grass is not tall or grass has been beaten down.
- Ensure that a fire extinguisher is available for each vehicle.
- Keep fire extinguisher readily available in passenger area of vehicle while driving.
- Keep fire extinguisher outside of vehicle upon stopping.
- Address fire hazards and controls in daily safety briefings as appropriate.

7.4 Electrical Safety

(Reference CH2M 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 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 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;

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- CH2M 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-ampere receptacle outlets which are not part of the permanent wiring of the building or structure.
 - An assured equipment grounding conductor program may be used on construction projects under the following scenarios:
 - GFCIs cannot 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 0.4 inches (1.0 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.

7.5 Extended Work Hours and Fatigue Management

(Reference CH2M Core Standard, *Fatigue Management*)

A normal work shift is considered to be eight consecutive hours during the day, five days a week, with at least an eight hour rest period. Any shift that incorporates more continuous hours, requires more consecutive days of work, or requires work during the evening should be considered extended or unusual.

Extended or unusual work shifts are typically more stressful for workers physically, mentally, and emotionally, and can lead to increased fatigue, stress, and lack of concentration. These effects can lead to an increased risk of worker error, incidents, and injuries.

If field work exceeds either criteria listed below, you must consult with your PM and HSM for approval of the extended hours/days, and fatigue management requirements must be addressed in the project Health and Safety Plan (HASP), Field Safety Instruction, or project-specific Fatigue Management Plan (FMP):

- Planning field work or vehicle operation for more than 10 hours per day, up to 14 hours total including commute time.
 - Note: Working over 12 field hours in one day should be for emergency situations only and would require Project Manager and RHSM approval.
- Working more than 10 consecutive days.

- A Fatigue Management Evaluation Form can be found on the [Enterprise HSE Website](#) under Forms & Templates.

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7.6 Field Ergonomics and Manual Lifting

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

Some of the most common injuries during field work are the result of performing work in an awkward body position (poor ergonomics) or pushing the body beyond its natural limits. Workers who have to lift, stoop, kneel, twist, grip, stretch, reach overhead, or work in other awkward positions regularly are at risk of developing discomfort or even an injury. Additionally, back injuries are one of the leading causes of work disability and most back injuries are the result of improper lifting techniques or overexertion.

Contact the RHSM to determine hazard control measures if your task involves:

- Repetitive motions;
- Lifting and carrying items over long distances (100 feet) or on uneven, steep, or sloped terrain;
- Heavy lifting;
- Use of vibrating tools or equipment; or
- Being in a static position for extended periods of time;

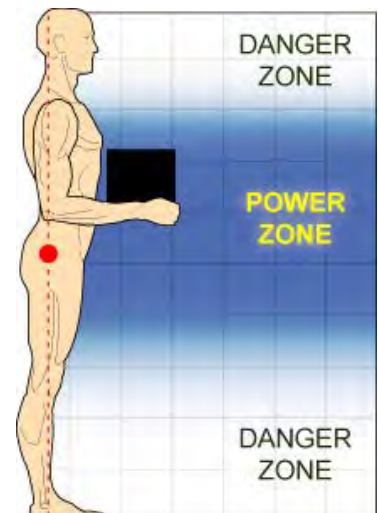
There are a variety of ergonomically designed tools and work practices that can reduce the potential for discomfort and injury. Following are requirements (“must” or “shall”) and recommendations (“should”) to aid in the prevention of discomfort or injuries while working in the field.

Fitness for Duty

If manual lifting and repetitive activities are not part of your normal work duties, contact your PM and/or RHSM to help determine if you have the physical capability to perform the work. In many cases adding lifting or repetitive tasks to a subcontractor’s scope of work is desirable to prevent injury. If the work task causes any pain or discomfort stop and get assistance.

Manual Lifting

- All CH2M workers must have training in proper manual lifting either through New Employee Orientation or through the Manual Lifting module located on the VO;
- When possible, the task should be modified to minimize manual lifting hazards or awkward body positions;
- Lifting occasional loads weighing more than 40 pounds (18 kilograms) should be evaluated by the SC using the Lifting Evaluation Form contained in SOP HSE-112;
- When performing repetitive lifting tasks with loads over 40 pounds, the Lifting Evaluation Form contained in SOP HSE-112 shall be used, and mechanical means used where possible;
- Personnel shall seek assistance when performing manual lifting tasks that appear beyond their physical capabilities;
- Using mechanical lifting devices such as forklifts; cranes, hoists, and rigging; hand trucks; and trolleys; is the preferred means of lifting heavy objects;



- Lift and Work in the Power Zone - The power zone for lifting or working is close to the body, between mid-thigh and mid-chest height. This zone is where arms and back can lift the most with the least amount of effort. This zone is sometimes referred to as the “strike zone”;
- Work near elbow height to avoid excessive bending (avoid working above the shoulder and below the knees); Source: OSHA
- Plan before carrying:
 - Wear appropriate shoes to avoid slips, trips or falls
 - If you wear gloves, wear gloves that fit. Tight-fitting gloves can put pressure on the hands, while loose-fitting gloves reduce grip strength and pose other safety hazards.
 - Avoid carrying large or bulky loads that limit or obstruct your vision
 - Slide, push, or roll instead of carrying when appropriate
 - When there is a choice, push instead of pull
 - Carry only as much as you can safely handle
 - Try to avoid slopes, stairs, or other obstacles that make carrying materials more difficult
 - Beware of and try to avoid slippery floors (e.g., liquids, ice, oil, and fine powders)
 - Use extra caution when moving loads that may be unstable
- In general, the following steps must be practiced when planning and performing manual lifts:
 - Examine the load and the surrounding area
 - Bend knees when lifting a load
 - Look forward to keep back straight
 - Position the load close to the body
 - Maintain a firm grip on the load
 - Test the load for stability and weight prior to lifting
 - Use smooth, controlled movements
 - Keep arms in front of body
 - Turn feet in direction of movement to avoid twisting
- Avoid carrying objects more than 100 feet;

Ergonomic Work Practices

- Avoid repetitive motions, overhead reaching, and kneeling when possible;
- If prolonged awkward postures are unavoidable, use a “supported” posture to compensate; a supported posture uses part of your body to support the weight of another body segment that is in an awkward position;
- Watch your pace—attempting to do something faster can cause you to lose proper form;
- Use a table or move work to a location where you don’t have to be in a bent-over position to do your work; and
- Where awkward postures or repetitive motions are unavoidable, rotate with another worker, change tasks, stretch, and take short breaks frequently.

7.7 Field Trailer/Office Setup and Maintenance

- Determine trailer placement by considering all potential hazards that could impact “office” work. Trailers usually are placed in the support zone and out of construction zones. Think about what type of PPE will be necessary when exiting the trailer, parking needs, biological hazards or other hazards that could impact location.
- Check utility configuration prior to placement, including electrical, water, and sewer.

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- Use spotters when placing trailer.
 - Set on flat ground.
 - Be sure trailer wheels are chocked.
 - When disconnecting trailer from hitch—watch pinch points and wear leather gloves.
 - Carefully jack trailer using the appropriately rated jacks and following manufacturer’s recommendations.
 - Secure and anchor trailer to protect from wind or other severe weather.
 - Place cones in front of hitch.
 - Ensure proper stairs and secure stairs next to doors. Ensure stairs are “no slip” and that the platform or landing of the stairs is flush the door threshold.
 - Use only qualified electricians to establish electrical service.
 - Consider ergonomics when furnishing trailer with desks and chairs.
 - Place fire extinguishers near doors, and place signage.
 - Put up emergency contacts, evacuation and rally point map, and route to the hospital
 - Place right to know posters (e.g., OSHA, Workplace, Wage and Hour, Family Medical Leave).
 - Place signage on exit doors.
 - Never place porta-johns at HVAC intake (usually HVAC is located at the front of trailer).
 - Have capability to properly store food—temporary field offices can quickly develop rodent issues if food is not stored properly or the trailer isn’t cleaned regularly.

7.8 Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles, or project vehicles.
- Maintain a first aid kit and bloodborne pathogen kit in the field vehicle.
- Assess whether maintaining a fire extinguisher in the field vehicle is feasible. If fire extinguishers are readily available, for example on heavy equipment, or if the project is short duration, a fire extinguisher would not be necessary. Fire extinguishers in field vehicles need to be properly secured and inspected on a monthly basis.
- The following precautions should be implemented if work involves stopping or parking along roadways:
 - Freeways and limited access – no stopping/parking allowed
- The following applies in Canada:
 - Roads with speed limits 80 km/hr (50 mph) or higher – flashing beacon required on top of the vehicle.
 - Roads with speed limits 55 km/hr (35 mph) or higher with no/limited shoulder (not able to get fully off the road at least 12 inches from the fog line or road edge) - flashing beacon required
 - Roads with speed limits 55 km/hr (35 mph) or higher with full shoulder (are able to get fully off the road at least 12 inches from the fog line or road edge) - flashers required
 - Roads with speed limits under 55 km/hr (35 mph) - flashers required
- Familiarize yourself with rental vehicle features prior to operating the vehicle:
 - Vision Fields and Blind Spots
 - Vehicle Size
 - Mirror adjustments

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- 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. If supplies/equipment is being transported inside the vehicle, be sure to tie down or secure to prevent movement within the vehicle.
 - 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 Incident Guidance attached to the project safety plan, if a vehicle incident is experienced in a rental or fleet vehicle.

7.9 Fire Prevention

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

Follow the fire prevention and control procedures listed below.

7.9.1 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.

7.9.2 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.

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- 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.

7.10 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, motor vehicle incidents, 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 project location;

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- 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, provincial, 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.

7.11 Hazard Communication

(Reference CH2M SOPs HSE-107, Hazard Communication and HSE-403, Hazardous Material Handling; in Canada, also refer to Provincial Workplace Hazardous Materials Information System Regulation)

For work in the US, the governing regulation is OSHA's Hazard Communication regulation, 29 CFR 1910.1200. In Canada, the national hazard communication standard is the Workplace Hazardous Materials Information System (WHMIS).

The hazard communication (HazCom) coordinator is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M using the chemical inventory form included as an attachment to the project safety plan;
- Confirm that an inventory of chemicals brought on site by CH2M subcontractors is available;
- Request or confirm locations of Globally Harmonized System (GHS) compliant (i.e., consisting of 16 sections that appear in the same order and contain uniform information regarding the chemical) safety data sheets (SDSs) from the client, contractors, and subcontractors for chemicals to which CH2M employees potentially are exposed;
- For chemicals used by CH2M workers, before or as the chemicals arrive on site, obtain an SDS for each hazardous chemical and include on the chemical inventory sheet (attached to the project safety plan) and add the SDS to the SDS onsite notebook. Ensure everyone knows where SDSs are kept;
- The six required elements of the GHS label must include the product identifier, pictograms, signal word, hazard statements, precautionary statements, and the name, address, and telephone number of the chemical manufacturer, importer or other responsible party;
- The manufacturer's original label on any incoming regulated product must not be removed or defaced. The manufacturer's label and markings must be retained on the package or container until it is sufficiently cleaned of residue and purged of vapors to remove any potential hazards;
- Ensure all secondary containers are labeled in compliance with GHS labeling requirements. If GHS compliant information has not yet been provided by the manufacturer or chemical distributor, the HCC must contact the manufacturer or chemical distributor and document in the chemical inventory when the GHS labeling information will be available, until the labeling requirement is fulfilled;
- In the United States, the container label shall be in English, although labels in other languages may be kept as well. Container labels in other languages for non-speaking English speaking workers will be made available when specified by the client for their project site or facility;
- Give employees required chemical-specific HazCom training using the chemical-specific training form included as an attachment to the project safety plan and ensure that the GHS supplemental VO module has been completed; and

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- 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.

7.12 Knife Use

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

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.

Specific precautions for knife use include:

- Employees are responsible for using cutting tools in the way they are intended, maintaining them in good working order and reporting faulty or unusable items. PPE as specified in the AHA is to be used;
- Those engaging and supervising subcontractors are to ensure that the requirements of this policy are communicated;
- The most appropriate gloves shall be identified within the AHA. In general, cut resistant gloves (e.g., Kevlar) are to be worn when using a knife in an occupational setting. Other types of gloves may be required and will be identified within the AHA. An example may be leather gloves may be worn when using the acetate sleeve cutter;
- All employees that will use a cutting tool must be trained in the proper use;
- Position the item to be cut on a stable surface. Secure it to prevent slippage, wherever possible. Select a work location which does not put your body in the line of fire of a knife slippage or failure;
- When using a knife do not cut towards yourself;
- When cutting, make the force of the cut carry the blade away from any part of your body. If you have a situation where this is not possible, protect yourself with a leather apron, or other material placed between you and the blade. Consider putting the material to be cut in a vise, or other holding device;
- Many tasks using a utility knife require a knife edge but not a sharp point. For these tasks you can add protection against puncture wounds by using a rounded-tip blade;

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- In general, a pocket knife is not the preferred tool of choice as there are alternatives (e.g., retracting safety blade).
 - If you use a folding knife, it must be a locking blade type.
 - Never use a knife that will fold under pressure.
 - If you use a fixed blade knife, make sure there is a handle guard to keep your hand from slipping forward. Also, make sure the handle is dry and non-greasy/slippery to assure a better grip. If you carry a fixed blade knife, use a sheath or holder.
 - Store utility knives safely, retract the blade or sheath an open blade before storing. Never, leave a knife with the blade exposed on the floor, on a pallet, on a work surface, or in a drawer or cabinet.
 - Keep your knife sharp. A dull blade requires you to use more force to cut, and consequently increases the risk of slip or mistake.
 - Knives used on the job, but not carried with you, must be properly stored when not in use;
 - Never use a defective knife;
 - Utility knife blades are brittle and can snap easily. Don't bend them or apply side loads to them by using them to open cans or pry loose objects. Use the knife only to cut. It was not designed to work as a pry bar, screwdriver, or hole punch.

7.13 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.

7.14 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.

7.15 Personal Security

Follow the guidelines below for personal security measures. The RHSM and Firm-Wide Security Office can be contacted if additional, specific measures are needed (e.g., such as evaluating the needs for security service).

General Safety and Security Guidelines

CH2M Corporate Security Department recommends the following guidelines for workers in the United States:

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- Stay alert and be aware of your surroundings. Avoid pre-occupations with mobile devices, while in an unfamiliar area.
 - Whenever possible use the buddy system with another employee or client or subcontractor employee.
 - Trust your intuition; if a situation appears strange or wrong, it probably is.
 - Be confident in your walk or stride; do not give the appearance you are new in town.
 - Avoid carrying and displaying large sums of cash.
 - If you sense or see dangerous situations along your route, change your route and depart the area quickly. If you feel that you are being followed, go to the nearest police station or safe location and file a complaint with the police. Provide a description of the person, their vehicle, license plate number and any other useful information.
 - Only walk short distances that are safe and secure while visiting an unfamiliar city or location.
 - Take host approved transportation for long distances.
 - “Fight or Flight?” Leaving the possible or dangerous area is always better than staying to fight.
 - Always report suspicious activity to the nearest local law enforcement agency.
 - Locate emergency exits in your hotel or where you are staying to ensure you know where to go in case of a fire or a natural or man-made disaster.
 - Secure your electronic devices when left in your room or take them with you if you are not able to secure them properly.
 - If you feel your life is in danger, call 911. Be sure to speak clearly, concisely and give the dispatcher a good description of where you are physically located.

Operating or Riding in Vehicles

- When waiting for public transportation or a taxi, remain in a store or restaurant as long as possible before catching your ride and never wait by yourself in an isolated area.
- Approach your vehicle with keys firmly in your hand and ready to unlock the car.
- Quickly check your car before entering it to determine damage or presence of an intruder.
- Vulnerable times can be stopping to find your keys to enter your vehicle or stepping out of your vehicle in an isolated area. Be aware of your surroundings before you perform these activities.
- Always keep your doors locked during transit and when the vehicle is parked.
- Never leave your vehicle unlocked, even when to performing a quick task such as checking in a hotel, getting gas or going picking up food.
- If confronted by an individual inside a vehicle pointing a weapon at you, run the opposite way from where the vehicle is facing and scream as loud as you can. This evasive action will probably cause the individual to drive away.
- If an individual in a passing car points at your tires or engine to indicate a malfunction, only pull over in a well-lit and populated gas or rest stop. Never pull over in an isolated or dimly lit area. You may have a malfunction or the passing motorist may be attempting to rob you.
- Always park your vehicle in a well-lit and secure area. If your vehicle is parked in a dimly lit or isolated area in a parking garage; ask an attendant or friend to accompany you to your vehicle.

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- Secure your valuables in the trunk, or place them out of sight or cover them with a blanket or coat if there is no secure storage area in the vehicle. The would-be-perpetrator likes to see what to steal and not knowing what you have concealed will normally prevent a break in.

Riding in a Taxi

- Have your host or a designated travel agent suggest or reserve a reputable taxi service for you during your stay.
- Only use a taxi service that was vetted for safety and reliability.
- If possible, place luggage, laptop and personal belongings inside the taxi.
- When you first enter the taxi, check the driver photo identification card, normally located on the driver's visor with the driver to ensure they match.

Walking

- If you experience automotive trouble, remain inside the locked vehicle and call for assistance.
- If you can't reach assistance via a mobile phone, only walk for help in a safe area facing the traffic.
- If while walking, you are shadowed or followed by a vehicle, run back in the direction of your vehicle and enter the vehicle if possible. File a police report on the incident as soon as practicable.
- Be aware of your surroundings and those around you while walking and do not be distracted by using electronic devices.
- Regularly change your route if you are walking to and from meetings or conferences and choose only well-lit areas to walk in at night.
- If walking long distances, identify a "safe house, shop, store or restaurant" to duck into if confronted by a perpetrator.

Jogging or Running

- Always jog or run in an area that is safe, secure, and used for exercising.
- Avoid running along busy roads or highways.
- If you chose to venture out on a jog or run, check the route by vehicle prior to beginning to exercise.
- Let the host or a friend know when you leave, when you plan to return, and the route you will take during exercising.
- Take a photo identification and mobile phone with you for emergencies.
- Avoid physically over-extending yourself since reflexes and decision-making ability can be impaired.

Clothing and Jewelry

- Dress to blend in with locals, maintain a low profile and avoid drawing attention to yourself.
- Travel with inexpensive clothing and jewelry.
- Avoid wearing CH2M distinctive clothing or using CH2M logos on luggage or laptops.

Emergency Numbers and Information

- Leave your itinerary and emergency contact numbers where you can be reached with family members and only those that have a need to know.
- Pre-program emergency numbers in the mobile device you are traveling with.

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- Carry a list of current medications and specific doses in your purse or wallet.
 - Record medical emergency information on a document that can be readily available if you are unable to speak or unconscious.
 - Have a photo copy of your driver's license, passport, and credit card information separately in case your wallet or purse is stolen.

7.16 Shipping and Transportation of Hazardous Materials

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

Chemicals brought to the site might be defined as hazardous materials or dangerous goods by the U.S DOT, Canadian Transportation of Dangerous Goods (TDG) Regulations, or other local or country norms. This can include calibration gases used in personal exposure monitoring or field instruments. Hazardous wastes that may be shipped offsite are also defined as hazardous materials by U.S. DOT, Canadian TDG. Other wastes may also be considered hazardous materials. To confirm whether a material or a waste is a hazardous material under applicable regulations, check with the Waste Coordinator, the project EM, or the CH2M Dangerous Goods Shipping Coordinator (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 cannot transport hazardous wastes by public road). HazMat employees must receive CH2M online training in shipping dangerous goods. CH2M's online Dangerous Goods Shipping course can be found on the CH2M HSE 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 virtual office (under Company Resources – Online Shipping). Contact the Dangerous Goods Shipping coordinators, the Waste Coordinator or the project EM for additional information.

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

- Do not to ship calibration gas back to CH2M warehouses. See the Calibration Gas Cylinder Disposal section of this Handbook;
- 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 Transportation Security Plan (HSE-417 Appendix A).

7.17 Substance Abuse

(Reference CH2M Policy 810, Drugfree 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 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 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 Policy 810 in the United States. In addition, employees may be required to submit to drug and/or alcohol testing as required by clients. In the US, this testing is performed in accordance with Policy 810, Drug-Free Workplace. Contact the Drug-Free Workplace administrator, Mary Beth Thomas/DEN, if testing is necessary.

Employees who are enrolled in drug or alcohol testing are required to complete annual training located on the CH2M Virtual Office (VO).

In Canada, drug and/or alcohol testing is not applicable in Ontario, but employees may be required to submit to drug and/or alcohol testing as required by clients, or in the event of specific incidents/accidents. When required, employees will be contacted by Human Resources with forms and this testing is performed in accordance with CH2M Canadian Operations Alcohol and Drug Free Workplace Policy. Employees who are enrolled in drug or alcohol testing are required to complete annual training located on the CH2M Virtual Office (VO).

When drug testing is required outside of the US and Canada, follow applicable regulations or policy.

7.18 Unknown or Suspect Objects/Materials

If unknown or suspect objects/materials are encountered (i.e., exposed or partially buried drums, biological waste, cylinders, glass containers, munitions of explosive concern, unexpected stained/discolored soil) are encountered during site operations, ongoing activities shall be immediately suspended. CH2M or subcontractor personnel encountering unknown or suspect objects or materials shall:

- Secure the area and identify the location of the object/material to the extent possible, without causing bodily injury to yourself or others and without disturbing the object.
- Evacuate the work area.
- Immediately notify the PM and RHSM of the encountered condition.
- Do not further disturb or otherwise handle the suspect object or material.

The site supervisor or SC shall contact the Project Manager and the RHSM to evaluate potential hazards associated with the specific situation encountered. The project team will then address the need for the use of special procedures, engineering controls, PPE or specialized subcontract personnel to safely mitigate the situation.

7.19 Workplace Hazardous Materials Information System

(Reference CH2M SOPs HSE-107, Hazard Communication and HSE-403, Hazardous Material Handling; in Canada, also refer to Provincial Workplace Hazardous Materials Information System (WHMIS) Regulation)

- WHMIS is the governing regulation for hazard communication in Canada. For work in the US, the governing regulation is OSHA's Hazard Communication regulation, 29 CFR 1910.1200).
- By May 2017, requirements of WHMIS 2015 must be implemented.

The hazard communication (HazCom) coordinator is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M using the chemical inventory form included as an attachment to this HSP;
- Confirm that an inventory of chemicals brought on site by CH2M subcontractors is available;
- Request or confirm locations safety data sheets (SDSs) from the client, contractors, and subcontractors for chemicals to which CH2M employees potentially are exposed;
- For chemicals used by CH2M workers, before or as the chemicals arrive onsite, obtain a SDS for each hazardous chemical and include on the chemical inventory sheet (attached to this HSP) and add the SDS to the SDS attachment section of this HSP (or maintain in an accessible binder onsite). Ensure everyone knows where SDSs are kept. SDS shall be in English and French;
- Country-specific workplace-secondary container labeling systems, such as required by Canada for Workplace Hazardous Materials Identification System (WHMIS), must be used. In Canada, the label must be in English and French.
- Ensure all secondary containers are labeled in compliance with WHMIS 2015 requirements;
- Give employees required chemical-specific training using the chemical-specific training form included as an attachment to this HSP and ensure that the GHS supplemental VO module has been completed (if applicable). 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. 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 SOP to ensure all requirements are implemented. CH2M employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M employees and subcontractors who do not understand any of these provisions should contact the RHSM for clarification.

8.1 Abrasive Blasting

(Reference CH2M SOP HSE-122, *Abrasive Blasting*)

Abrasive blasting is the cleaning or preparing of a surface by forcibly propelling a stream of abrasive material against the surface using sand, glass bead, aluminum oxide, grit, garnet, steel shot, slag, walnut shells, and others. Below are the hazard controls and safe work practices to follow when overseeing or performing abrasive blasting.

- CH2M employees who work on projects with abrasive blasting operations are required to complete the CH2M 10-Hour Construction Safety Awareness training and waste management training.
- Abrasives and the surface coatings on the materials blasted are shattered and pulverized during blasting operations and the dust formed will contain particles of respirable size. The composition and toxicity of the dust from these sources shall be considered in making an evaluation of the potential health hazards. Air monitoring instruments shall be provided if the potential for a hazardous atmosphere exists.
- Personnel shall remain a safe distance from the abrasive blasting area to reduce exposure to hazardous airborne contaminants.
- Abrasive blasting equipment shall be inspected each day, before use, to ensure safe operational condition.
- Non-silica containing abrasive blasting materials must be used to the extent possible.
- Blast nozzles must be equipped with an operating valve that must be held open manually.
- Eating, drinking, and smoking shall be prohibited in areas where blasting is performed. Employees shall wash their face and hands before eating, drinking or smoking.
- Abrasive blasting debris shall be cleaned up by using dust-free methods. Wet clean-up methods and vacuum cleaners with High Efficiency Particulate Air (HEPA) filters are recommended.
- Fugitive dust must be controlled during abrasive blasting operations by using water sprays or other methods.
- Noise must be monitored and controlled as required by state, provincial, or local regulations.
- Complete the abrasive blasting self-assessment checklist when performing or when subcontractors perform this operation.

See also SOP HSE-511, *Crystalline Silica* for requirements regarding silica hazards.

8.2 Aerial Lifts

(Reference CH2M, SOP HSE-301, *Aerial Lifts*)

Below are the hazard controls and safe work practices to follow when working around or operating aerial lifts. Ensure the requirements in the referenced SOP are followed:

- Operate aerial lifts only if you are authorized and trained to do so;

- Inspect aerial lifts and test lift controls prior to use;
- Wear a full-body harness, with a lanyard attached to the boom or platform (see also SOP HSE-308, *Fall Protection*). When working within a standard guardrail system with scissors lifts, the full-body harness and lanyard are not required;
- Do not attach lanyard to any adjacent structures or equipment while working from an aerial lift;
- Stand firmly on the floor of the platform and do not sit or climb on the railings of the platform, or use planks, ladders, or other devices to increase working height;
- Remain on the platform at all times and do not leave the platform to climb to adjacent structures;
- Position aerial lifts on firm, level surfaces when possible, with the brakes set. Use wheel chocks on inclines. If outriggers are provided, position them on solid surfaces or cribbing;
- Maintain safe clearance distances between overhead power lines and any part of the aerial lift or conducting material, unless the power lines have been de-energized and grounded, or insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet (3 meters) from overhead power lines for voltages of 50 kilovolts (kV) or less, and 10 feet (3 meters) plus 0.4 inches (1.0 cm) for every 1 kV over 50 kV;
- Do not exceed the boom and basket load limits;
- Do not use aerial lifts as cranes, unless specifically designed and approved by the lift manufacturer;
- Do not work or stand below aerial lift operations;
- Do not use aerial lifts when winds exceed 30 miles per hour (48 km per hour) or per manufacturers recommendations; and
- Complete the self-assessment checklist for aerial lifts whenever aerial lifts are being used.

8.3 All-Terrain Vehicles and Utility-Type Vehicle Safety

(Reference CH2M Core Standard, *Vehicle Safety*)

An all-terrain vehicle (ATV) means any recreational vehicle with three or more tires, has handlebar steering, and a seat designed to be straddled by the operator and are not intended for use on paved roads. The only type of ATV permitted for use is the Polaris Ace model which is the only model known to have rollover protection.

Utility-type vehicle (UTV) means any recreational motor vehicle other than an ATV, motorbike, or snowmobile designed for and capable of travel over designated roads, traveling on four (4) or more tires.

Motorcycles, motorbikes, or other motorized devices with two or three wheels, ATVs or quads are not allowed to be used for company related business.

Four-wheeled, cabbed vehicles and vehicles with rollover protection structures (ROPS), with seatbelts for all passengers such, as Yamaha Mules and Polaris Rangers (and similarly designed vehicles including golf carts) are allowed for use.

Doors (plastic, metal or net) supplied by the manufacturer at the time of purchase must be utilized.

Operators shall have the proper safety training and must follow all facility, and client rules for safe operation of the vehicle.

ATVs/UTVs shall not be operated on site unless determined to be the most appropriate vehicle(s) to use and their use is pre-approved by the PM and RHSM.

Operators shall be trained and qualified before operation of the ATV or UTV onsite and will possess a valid driver's license.

ATV/UTV operators are prohibited from using any wireless device while operating ATVs/UTVs. Equipment must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.

Training shall consist of manufacturer's operating manual, hands-on training by a competent person, a demonstration of basic skills, and when required by the state or province, completion of an ATV/UTV safety course. An AHA shall also be developed for the use of ATVs/UTVs and operators shall be trained on the AHA. All individuals are required meet all training aspects before ATV/UTV use and documentation of training shall be maintained at the site.

Some states and provinces may require an ATV/UTV license or even a motorcycle endorsement on the operator's current driver's license. Be sure to contact the local division of motor vehicles (DMV) office for details. (In the United States, the following states require a specialized driver's license: Arizona, Oregon, Georgia, and Illinois. New Hampshire's and Montana's requirements vary by city. Check your state for new local requirements.)

Keep in mind that states and provinces may still:

- Impose age restrictions for operating ATVs/UTVs;
- Require an ATV/UTV safety or education course certification (even if you're older than 18);
- Require ATV/UTV insurance.

Daily inspections of vehicles for safety and maintenance are required.

Minimum PPE required for operators and passengers on ATVs/UTVs include:

- Safety glasses, goggles, or face-shield at all times when moving;
- Leather boots or shoes (if safety-toed boots are not required by the project safety plan); and
- A properly fitted DOT/ANSI/SNELL-approved helmet (check with client, local requirements, and the project safety plan for helmet requirements when operating or riding in a golf cart or UTV with roll-over protection).

Other safety requirements include:

- ATVs and UTVs shall be operated in accordance with the manufacturer's operating manual, any state, province, or client requirements, and task-specific AHA;
- Speed is not to exceed 32 km/hr (20 mph). Keep all parts of your body inside any roll over protection;
- Always use the seat belt on ATVs/UTVs;
- Make sure the engine is turned off before dismounting the vehicle;
- Avoid driving over any extremely large obstacles (i.e., wood/logs, fences, boulders, etc);
- When using trailers, watch your turning radius;
- Shut engine down prior to refueling;
- ATVs/UTVs must have fenders;
- Utilize high visibility flag and wear high visibility vest when operating adjacent to heavy equipment or haul vehicles.

8.4 Arsenic

(Reference CH2M, SOP HSE-501, *Arsenic*. In Canada, provincial occupational regulations may apply and should be implemented as required.)

Arsenic is considered a “Confirmed Human Carcinogen.” CH2M is required to control employee exposure to arsenic when exposures are at or above 5.0 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), or lower if the local regulations are more stringent, or if there is the possibility of skin or eye irritation from arsenic. The elements of the CH2M arsenic program include the following:

Exposure monitoring;

- Methods of control, including PPE and respirators;
- Medical surveillance;
- Training on hazards of arsenic and control measures (includes project-specific training and the computer-based training on CH2M’s Virtual Office, *Arsenic Exposure*); and
- Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations, notify the RHSM to ensure the above have been adequately addressed. Full implementation of SOP HSE-501, Arsenic, will be required. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Avoid skin and eye contact with liquid and particulate arsenic or arsenic trichloride;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.5 Asbestos

(Reference CH2M SOP HSE-502, Asbestos; Provincial Occupational Regulations regarding Asbestos)

Asbestos is a cancer-causing mineral that was included in many building materials. When disturbed harmful asbestos fibers can be released and inhaled and ingested by workers. Materials suspected of containing asbestos shall be treated as asbestos unless documentation and testing results indicate otherwise. Where the presence of asbestos is suspected, if at all possible, design all operations to avoid contact.

When there is a risk of disturbing asbestos and making it friable (able to release fibers when the materials are crushed, abraded or cut) the activity becomes regulated. The asbestos standard for construction regulates asbestos exposure for the following activities:

- Demolishing or salvaging structures where asbestos is present in concentrations greater than 1 percent;
- Removing or encapsulating asbestos-containing materials (1 percent or greater asbestos content);
- Constructing, altering, repairing, maintaining, or renovating asbestos-containing structures or substrates;
- Installing asbestos containing products;
- Cleaning up asbestos spills/emergencies; and
- Transporting, disposing, storing, containing and housekeeping involving asbestos or asbestos containing products on a construction site.

CH2M is required to control employee exposure to asbestos when exposures are at or above 0.1 fibers per cc (f/cc) by implementing a program that meets the requirements of the applicable regulatory agency (OSHA Asbestos standard, 29 Code of Federal Regulations (CFR) 1926.1101, Canadian Provincial OH&S Code/Regulations, etc.). The elements of the CH2M asbestos program include the following:

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- Exposure monitoring;
 - Methods of control, including PPE and respirators;
 - Medical Surveillance;
 - Training on hazards of asbestos and control measures; and
 - Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Avoid skin and eye contact asbestos;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person;
- Review the fact sheet included as an attachment to the SOP; and
- Do not disturb waste or other materials labeled “Danger - Asbestos Fibers.”

Subcontractors performing asbestos abatement activities are required to obtain state or special licenses and permits and have a written compliance/abatement plan that has been reviewed and accepted by CH2M before work begins. Subcontractors are required to provide proof that all asbestos workers medically qualified, training and a competent person has been appointed before work begins.

8.6 Barbed Wire Fences

Crossing barbed wire fences shall be avoided, in general, when performing field work. Use gates or other entryways within a reasonable walking distance whenever possible and permitted by fence owner.

In some circumstances, barbed wire fences may have to be crossed during pre-construction surveys or other similar tasks through open country. CH2M and subcontractor personnel shall follow the requirements in the safety plan which may include determining whether personnel should go over or in between the strings of barbed wire fence based on height and ability (e.g., if the fence is 3-foot high or less, most personnel may prefer to go over the fence). If going over the top string of barbed wire, use a split section of foam pipe insulation to cover the barbs while crossing over the fence. Use a buddy to hold the fence down while crossing. If personnel will be going in between two strings of barbed wire, use the buddy system to perform a step-through technique to cross through the fence. Each worker will need to take turns spreading the top and middle sections of wire, so that the second person can step through the fence. PPE shall include leather gloves and foam pipe insulation to cover the barbs.

8.7 Benzene

(Reference CH2M SOP HSE-503, Benzene. In Canada, provincial occupational regulations may apply and should be implemented as required.)

Benzene is considered a “Confirmed Human Carcinogen.” CH2M is required to control employee workplace exposure to benzene when personal exposures is at or above 0.5 parts per million (ppm) as an 8-hour time-weighted average (TWA) or above 5.0 ppm short term exposure limit (STEL), by implementing a program that meets the requirements of the local regulatory agency (OSHA Benzene standard, 29 CFR 1910.1028, Provincial OH&S Code/Regulations, etc.). [Note: Alberta, British Columbia, and Ontario state a more conservative STEL of 2.5 ppm for benzene.] The elements of the CH2M benzene program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;
- Training on hazards of benzene and control measures (includes project-specific training and the computer-based training on CH2M's Virtual Office, *Benzene*); and
- Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.8 Blasting / Explosives

(Reference CH2M SOP HSE-610, Explosives Usage and Munitions Response)

- A (safety) Opportunity Risk Evaluation (ORE) must be conducted with the Munitions Response (MR) Safety/Quality Officer prior to the Go/No Go decision making opportunity for all projects involving the use of explosives or work to be performed on a MR site.
- Only authorized, trained and qualified personnel shall handle, use and transfer explosives.
- Blasting subcontractors are responsible for providing a competent person to oversee blasting operations.
- Personnel who will be handling explosives will not wear outer or inner garments having static electricity-generating characteristics. These include clothing made of 100 percent polyester, nylon, silk, and wool, which are all highly static producing.
- Protective shoes worn by personnel performing explosives operations should be constructed of nonferrous materials (e.g., fiberglass) to prevent interference with sensitive geophysical instruments.
- Expose the minimum number of people to the minimum amount of explosives for the minimum amount of time. Project-specific explosives safety precautions shall be developed prior to field activities and must be reviewed and approved by the MR Safety/Quality Officer and the MR Operations Manager.
- Details of explosives management and safety requirements are developed and included in a site-specific Explosives Management Plan (EMP).
- Security of explosives shall conform to the requirements set forth by federal, state, provincial, and local jurisdictions. Project site and overnight explosives security will conform to any local transportation security requirements.
- In Canada, **Type-20 Manufacturer of High Explosives License/Permit** issued by the country ATF&E is required to purchase, store, and use high explosives including on-site use of binary explosives in support of MR operations, construction projects, and demolition and deactivation (D&D) projects.

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- State, Provincial and/or local explosives permits may be required for CH2M and individuals to purchase, store, and use explosives in support of MR operations, CDC operations, construction projects, and D&D projects. In addition there may be local requirements.

8.9 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 local boating safety requirements (e.g., the National Coast Guard, Canadian Coast Guard, etc.). Project boats shall be operated by experienced boat operators in possession of a current operator's license 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.

Boat Requirements

All project boats will meet or exceed US, Canada, or local 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 as 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 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 Canadian 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 Canadian 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.

8.10 Cadmium

(Reference CH2M SOP HSE-504, *Cadmium*. In Canada, provincial occupational regulations may apply and should be implemented as required.)

Cadmium is considered a "Suspected Human Carcinogen." CH2M is required to control employee workplace exposure to cadmium when personal exposure is at or above 2.5 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) by implementing a program that meets the requirements of the OSHA Cadmium standard, 29 *Code of Federal Regulations* (CFR) 1926.1127, the Provincial OH&A Code/Regulation, or other (more stringent) local regulation. The elements of the CH2M cadmium program include the following:

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- Exposure monitoring;
 - Methods of control, including PPE and respirators;
 - Medical surveillance;
 - Training on hazards of cadmium and control measures (includes project-specific training and the computer-based training on CH2M's Virtual Office, *Cadmium*); and
 - Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.11 Chainsaws

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

Below are the hazard controls and safe work practices to follow when working around or operating chainsaws. Ensure the requirements in the referenced SOP are followed.

8.11.1 Equipment

Only chainsaws equipped with a spark arrestor and fully functioning chain brake or "safety chain" shall be used. The following safety equipment shall be readily available while operating a chainsaw:

- Chainsaw operator's manual;
- Fully stocked first aid kit;
- Multipurpose fire extinguisher;
- Grounded extension cord approved for outdoor use and ground fault circuit interrupter (GFCI) for electrical-powered chainsaws;
- Approved safety gasoline container and funnel or flexible nozzle for refueling gasoline-powered chainsaws; and
- Sledge hammer and non-metallic wedges when necessary to prevent pinching of the chain.

8.11.2 PPE Requirements

The following personal protective equipment shall be worn while operating chainsaws:

- Safety glasses with side shields and face shield to prevent injury from wood chips, sawdust, or other flying objects;
- Hard hat with properly fitted suspension to prevent head injury from falling debris;
- Steel-toed safety shoes or boots to prevent foot injury from falling objects and accidental contact with the moving chain;

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- Hearing protection to prevent permanent damage to hearing. Ear muffs or plugs will have a decibel noise reduction rating (NRR) assigned to them. The higher the rating, the greater the protection offered;
 - Non-leather, fabric work gloves to prevent hand injury from abrasions, splinters and cuts;
 - Clothing that is well-fitted and free of loose edges that could become entangled in the saw; and
 - Protective chaps or leggings that cover the area from the groin to about 2 inches (5.08 cm) above the ankles should be used. These chaps are made from synthetic fabrics that are designed to prevent the running saw chain from coming in contact with your legs.

8.11.3 Safe Operation

The following safe operation guidelines shall be followed regardless of the purpose for using a chainsaw:

- Inspect the chainsaw prior to use;
- Chainsaws shall be held firmly with both hands, with thumbs and fingers encircling both chain saw handles;
- Stand slightly to the left side of the saw, out of the plane of the cutting chain and guide bar to reduce the risk of injury in the event of a kickback;
- Position saw so that it is between the waist and mid-chest level. Overreaching or cutting above the mid-chest height shall be avoided;
- Maintain a full throttle setting while cutting. Chainsaws are designed to be run at full speed;
- Always be aware of what is in the saw's downward path after the cut;
- Do not attempt to cut material that is larger than the guide bar of the saw;
- Avoid cuts that will cause the chainsaw to jam. Always cut into the compression wood first until the cut starts to close; then cut from the other side toward the compression cut;
- Use a non-metallic wedge to prevent the compression cut jamming on the blade;
- Chainsaws are designed to feed themselves into the wood and require only light pressure to cut efficiently. If extra force is required to keep cutting, the chain requires sharpening. Additional signs of a dull chain include a saw that is cutting crooked, results in fine sawdust instead of chips, or the smell of burnt wood. Do not use a dull chain;
- Bystanders and helpers shall be kept at a safe distance from operation;
- Do not operate a chainsaw when fatigued; take frequent breaks;
- Work slowly; don't rush; and
- A fire extinguisher shall be present at all times when operating the chainsaw in forest or brushy areas.

8.11.4 Refueling the Engine

The fuel for gasoline-powered chainsaws shall be mixed in accordance with the manufacturer's recommendations as outlined in the chainsaw operator's manual. Fuel shall be stored and transported in an approved safety container. The following precautions should also be followed:

- The engine shall be shut off and allowed to cool before refueling; never refuel a hot engine;
- A fire extinguisher shall be present during fueling and refueling;
- Smoking around fueling or refueling operations shall be prohibited; and
- A funnel or a flexible nozzle shall be used to avoid spilling fuel on the engine.

8.12 Chemical Injections

When the remedial action objectives for a project include subsurface injection of chemicals, the procedures and handling practices identified below must be implemented.

Pre-Injection

Review the Safety Data Sheets (SDSs) for the materials which are expected to be utilized in the chemical injection processes for this contract task order and:

- Document training in accordance with the Hazard Communication section of this Handbook.
- Ensure that appropriate spill response materials are present (e.g., absorbent media for oil, neutralizing agents for potassium permanganate, secondary containment for larger chemical tanks).

Evaluate potential for “daylighting” of chemical injection in the work area:

- Evaluation should identify known or potential pathways such as existing monitoring wells screened at the same depth interval as the planned injection, wells that were not properly abandoned, and utility corridors.
- Identify potential surface release areas such as nearby sensitive areas (e.g., wetlands) storm drains, ditches, or streams, and ensure that mitigation measures are in place (e.g., temporarily blocking storm sewer drains).
- Contact the project Environmental Manager for assistance in identifying release scenarios and mitigation measures.

Injection Operations

- Operate and maintain pressure vessels, pumps and hosing in accordance with the manufacturer’s recommendations.
- Do not exceed the rated pressure of the vessels and associated piping or hoses of the system.
- The system must be provided with a pressure relief valve/controller that safely reduces the system pressure to within the system rated pressure.
- The pressure relief valve must be rated at no more than 110 percent the rated pressure of the system and must be tested at regular intervals.
- Each vessel must be equipped with a functioning pressure gauge to monitor pressure.
- For PPE and air monitoring requirements, refer to the PPE section and Site Monitoring section of the project safety plan. PPE shall be used to minimize potential exposure to identified site contaminants of concern and injection solutions during site injection operations. In addition, good personal hygiene practices and procedures must be practiced.
- Use face shields in combination with safety glasses or goggles when the potential for exposure to chemical splashes may exist.
- If repairs to injection delivery system components are necessary after the subsurface injection operations have been initiated, the injection lines must be relieved of pressure and drained before conducting repair work. See also the Lockout/Tagout section of this Handbook.
- Drums/containers of injection material shall be moved using a drum “dolly” or other appropriate material handling equipment where the weight of the drum can be properly managed and secured during the movement.
- Empty containers may require special preparation/rinsing prior to disposal. Verify requirements with the project EM.

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- Only qualified personnel, by prior training or experience, may operate the injection system delivery components/array(s).
 - Appropriate spill response materials for all chemicals must be present at the job site. Only qualified (by training and previous experience) who have proper PPE and equipment available shall provide spill response operations.
 - Station a portable eye wash in the immediate work area where chemical injections are occurring, along with wash facilities for hygienic practices and PPE decontamination.
 - If PPE becomes saturated and may potentially impact work clothing, dermal surfaces, or mucous membranes, change PPE immediately.
 - Verify the competency and integrity of the chemical injection hoses/piping and connection points
 - Confirm hose/piping rated for 100 psi.
 - Verify the any cam-lock fitting on the injection hose/piping, well head, or direct push technology (DPT) rods are structurally sound and free of defects. Where hoses are used, ensure fittings have been secured to the hose surface via mechanical banding equipment to prevent whipping.
 - When injecting under pressure, stand at a sufficient distance (i.e., ~ 20 feet) from the injection well head/point. Keep unessential project personnel away from the injection system, array, and well head(s) during injection operations.
 - Remove/stow all unnecessary equipment and material in the area.
 - The injection system/array must be monitored/attended at all times during the injection process and when not in use, components must be properly secured, de-energized, or stowed. If the system will operate without an attendant, plans for operating unattended must be in place and approved by the PM and RHSM/EM.
 - All pressured lines and fittings should be ‘tethered’ or otherwise secured to minimize whipping or ‘launching’ of lines in the event of an equipment failure. Any “quick connect” type fittings (compressed air or fluid) should be secured with appropriate pins, clips to prevent accidental disengagement of the fitting during operation.
 - Inspect all equipment, hoses, pressure lines, and fittings daily and prior to pressurizing.

Chemical Storage

- Some injection chemicals, such as strong oxidizers, may have stringent storage requirements per local or National Fire Codes. Verify that appropriate storage provisions are in place prior to starting work.
- NOTE: Counties and cities may have requirements specific to storing these chemicals. Also, storage and use of certain chemicals such as potassium permanganate and hydrogen peroxide may be subject to the new Chemical Facility Anti-Terrorism Standards of the Department of Homeland Security – the applicability depends on the chemical, quantity/concentration, and type of facility. Please contact the project Environmental Manager to determine whether chemicals are subject to these standards.
- Chemicals must be stored in a designated, secured area with spill prevention capabilities. Review SDS or other information to determine potential incompatible materials. Incompatible materials shall not be stored together. Ensure all containers are labeled.

Substrates That Create Reducing Conditions to Facilitate Bioremediation

Materials such as Emulsified vegetable oil (EVO) or emulsified oil substrate (EOS), lactate, and cheese whey are commonly used as the electron donors or “fuel” during enhanced reductive dechlorination (ERD) treatment. ERD can be an effective method for degrading various chlorinated solvents dissolved in groundwater.

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Addition of these “electron donors” can also cause changes that need to be recognized and monitored, such as production of gases such as methane and hydrogen sulfide, and increases in carcinogenic byproducts, such as vinyl chloride, in groundwater or in the vadose zone. These gases or byproducts are not yet formed during the injection work, but are observed weeks following the injections as the biological process take place. These hazards must be considered during subsequent groundwater sampling activities. The air monitoring protocol and action levels, as well as required PPE, are discussed in later sections of this HSP.

Although EVO is food-grade material, SDSs for the material must be kept onsite, as well as added to the chemical inventory, and specific training on hazards conducted and documented in the Attachments in this HSP.

The Clean Water Act requires a Spill Prevention, Control, and Countermeasures (SPCC) Plan for storage of more than 1320 gallons of oil (including EVO and EOS) in ≥ 55 gallon aboveground containers. Additionally, spill kits/materials capable of stopping the spread of a leak/spill must be available and accessible. Involve your Environmental Manager for assistance to determine whether a plan is required, to prepare an SPCC Plan, or to plan for spill control if EVO or other oils will be used around a body of water.

The following hazards must be acknowledged and addressed in the injection AHA or AHA/EIA:

- Slips/falls resulting from spilled EVO/EOS
- Slips/trips/falls from hoses transporting EVO/EOS and water
- Pressure in the injection lines (<20 psi)
- Potential for oil to spray on face/body if there’s a breach or leak (refer to bullets above for mitigation measures)
- Hazards associated with the mixing and injection process such as electrical hazards associated with the pump, hand contact hazards during the mixing process, spills, etc.
- Other hazards applicable to the injection process.

Potassium Permanganate

- This in situ treatment technology uses potassium permanganate (KMnO₄) to destroy [insert COCs, i.e., DNAPL] through an oxidative reaction. The KMnO₄ reacts with the carbon-carbon double bonds found in chloroethenes to produce primarily carbon dioxide, chloride ions, and manganese dioxide as byproducts.
- Potassium permanganate (KMnO₄) is considered to be an irritant to the respiratory system affecting the nose, throat, and the lungs. Engineering controls should be employed to minimize dust generation during use (pouring). The best protection is to enclose the operation or to provide local exhaust ventilation at the site of dust generation. KMnO₄ also is a skin irritant and can severely burn the eyes and skin. Caution should be used to prevent the generation of dust which can contact the eyes or skin. It should be mixed with water before use. Aqueous solutions of KMnO₄ are much less dangerous, especially when diluted.
- Solid KMnO₄ is a very strong oxidizer. Keep in a tightly closed, labeled container, in a cool, dry, ventilated area. Protect against physical damage and moisture. Isolate from any source of heat or ignition. Avoid storage on wood floors. Separate from incompatibles, combustibles, organic or other readily oxidizable materials. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.
- Potassium permanganate stains the hand and clothing and should be handled with care. It causes corrosive burns on the skin, and swallowing it may lead to gastroenteritis.
- When handling, wear chemical splash-type goggles, impervious clothing, such as Polycoated-tyvek, rubber or nitrile gloves and rubber or neoprene gloves and shoe covers. Should clothing become contaminated, it should be immediately decontaminated or removed to prevent injury.

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- Respiratory protection should be worn during pouring if dust cannot be controlled; follow the action levels in the Site Monitoring section of this HSP. Strict adherence to dust control measures and monitoring must be performed during the execution of this task.

Hydrogen Peroxide

- Hydrogen peroxide is an oxidizer and will release oxygen when decomposed adding to combustion. It can be corrosive to eyes, nose, throat, lungs and gastrointestinal tract.
- When handling hydrogen peroxide, wear chemical splash-type goggles and full-face shield, impervious clothing, such as Polycoated-Tyvek, rubber or nitrile gloves and rubber or neoprene gloves and shoe covers (avoid cotton, wool and leather).
- Avoid excessive heat and contamination (meaning other material getting in the container). Contamination may cause decomposition and generation of oxygen gas which could result in high pressures and possible container rupture. Hydrogen peroxide should be stored only in vented containers and transferred only in a prescribed manner (refer to the SDS). Never return unused hydrogen peroxide to original container, empty drums should be triple rinsed with water before discarding. Utensils used for handling hydrogen peroxide should only be made of glass, stainless steel, aluminum or plastic.
- Store drums in cool areas away from direct sunlight and incompatible materials such as reducing agents, wood, paper and other combustibles, iron and other heavy metals, copper alloys and caustic. Provide mechanical general and/or local exhaust ventilation to prevent release of vapor or mist into the work environment.

Sodium Permanganate

- Sodium Permanganate (NaMnO₄) is considered to be an irritant to the respiratory system affecting the nose, throat, and the lungs. Since solution is in a liquid form, all spraying, misting, and splashing should be minimized. If used, this liquid form should alleviate the potential for dust exposure which can occur during the mixing of the potassium permanganate described above.
- Engineering controls should be implemented to prevent or minimize the potential for spraying, misting, or splashing. In addition to wearing appropriate PPE (see below), an emergency eye wash/shower facilities shall be provided in the immediate area.
- Should clothing become contaminated, it should be immediately decontaminated or removed to prevent injury. While handling, the following PPE should be worn: Face shield & chemical goggles, coveralls, rubber protective gloves (shoulder length), and a rubber apron.

Hydrogen Release Compound (HRC)

- HRC is a controlled release, electron donor material, that when hydrated is specifically designed to produce a controlled release of lactic acid. The lactic acid is critical for the production of hydrogen to fuel anaerobic biodegradation processes in soil and groundwater.
- Refer to the SDS for HRC for specific handling and storage protocol.
- HRC is considered to be a skin irritant. Should clothing become contaminated, it should be immediately decontaminated or removed to prevent injury.
- HRC is a skin irritant and can burn the eyes and skin. Caution should be used to prevent the generation of misting, spraying, or splashing. While handling, the following PPE should be worn: Face shield & safety glasses, rubber protective gloves (shoulder length) along with a rubber apron.
- Spills of HRC should be cleaned up immediately to prevent slips and falls. Adequate spill containment and clean-up material must be provided in areas of chemical use. Dry absorbent material must be maintained on hand and ready to be immediately employed should a spill occur.

8.13 Compressed Gas Cylinders

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

8.13.1 General

Below are the hazard controls and safe work practices to follow when working around or using compressed gas cylinders. Ensure the requirements in the referenced SOP are followed.

- Cylinders and pressure-controlling apparatus shall be inspected for defects and leakage prior to use. Damaged or defective items shall not be used. If a cylinder is found to be defective, the gas distributor shall be notified and subsequent instructions followed. If a leak should develop at a fuse plug or other safety device, the cylinder shall be removed from the work area.
- Cylinders shall be labeled with the identity of the contents. Cylinders not labeled shall be sent back to the cylinder distributor. The color of the cylinder shall not be used exclusively to identify cylinder contents.
- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinders must be secured in an upright position at all times.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.
- Eye protection (safety glasses or goggles) shall be worn when using cylinders.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders inside buildings shall be stored in dry, well-ventilated locations at least 20 feet (6.1 meters) from highly combustible materials. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage areas shall be located where cylinders will not be knocked over or damaged.
- Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials by a minimum of 20 feet (6.1 meters) or by a noncombustible barrier at least 5 feet (1.5 meters) high, having a fire resistance rating of at least 0.5 hour.
- Signs indicating no smoking shall be provided for storage areas containing flammable gas cylinders.
- Complete the self-assessment checklist for compressed gas cylinders are being used.

8.13.2 Calibration Gas Cylinder Disposal

Calibration gas for field instruments is usually shipped in non-refillable DOT-39 specification cylinders. They can be identified by a code stamped into the cylinder that begins with "DOT-39, NRC" followed by a series of other numbers and letters. These cylinders cannot be refilled and are intended to be disposed of by the end user once the contents are consumed. Because of the high cost of shipping partially full cylinders to a CH2M warehouse, equipment rental company, or the manufacturer, most calibration gas cylinders should be disposed of locally using this procedure.

Applicability

This procedure applies only to non-refillable DOT-39 specification cylinders containing calibration gas that is classified by DOT as a Division 2.2 nonflammable gas. The cylinder will display the green nonflammable gas label. Calibration gas usually contains parts per million (ppm)-range concentrations of compounds such as isobutylene, hexane, or methane. This procedure does not apply to Division 2.1 flammable gasses, Division 2.3 poison gasses,

corrosive gasses, or oxidizing gasses. It also does not apply to gasses contained in larger refillable DOT-specification cylinders.

Disposal Procedure

1. Review the cylinder labeling and material safety data sheet (SDS) to verify that the material in question is calibration gas containing ppm-range concentrations of materials such as isobutylene, hexane, or methane, and that the gas is classified as a Division 2.2 nonflammable gas. If the material is a flammable gas (Division 2.1), poison gas (Division 2.3) corrosive gas, oxidizing gas, or contains toxic air contaminants such as trichloroethylene, DO NOT FOLLOW THIS PROCEDURE. Contact a dangerous goods advisor or the project EM for assistance.
2. Attach the appropriate regulator or valve to the cylinder, open the valve, and allow the gas to vent slowly to the atmosphere in an unconfined, well ventilated area outdoors.
3. If a regulator is not available, depress the valve with a non-sparking tool (e.g., pencil, stick). Be sure that the cylinder is pointed away from you at all times. The valve operates the same way as the valve on a car or bicycle tire.
4. Wear leather work gloves and keep your hands away from the flow of gas.
5. Leave the valve open until all gas is discharged from the cylinder.
6. If the cylinder has a permanently attached valve, leave it open. If a removable regulator or valve was used, remove it from the cylinder.
7. Mark the cylinder as "EMPTY" or "MT."
8. Recycle the empty cylinder as scrap metal or dispose as solid waste after verifying that the solid waste collection company will accept this material in the trash.
9. If required to puncture the empty cylinder before disposal or recycling, do not attempt to do so using hand tools such as a hammer and nail or punch. Contact a dangerous goods advisor, the project EM, or health and safety manager for assistance.

8.14 Concrete Work and Masonry Construction Activities (Including well pad construction)

(Reference CH2M SOP HSE-302, *Concrete and Masonry*)

Below are the hazard controls and safe work practices to follow when working around or performing concrete and masonry activities. Ensure the requirements in the referenced SOP are followed.

- Wear PPE to avoid contact with concrete including gloves, mud boots, hard hat, safety glasses, long sleeved shirt and long pants.
- Consult the glove supplier or the cement manufacturer's SDS for help in choosing the proper gloves. Butyl or nitrile gloves (rather than cotton or leather gloves) are frequently recommended for caustic materials such as Portland cement.
- Use only well-fitting gloves. Loose-fitting gloves let cement in. Often the use of gloves and clothing makes exposure worse when cement gets inside or soaks through the garment. Use glove liners for added comfort.
- Wash your hands before putting on gloves. Wash your hands every time that you remove your gloves.
- Dry your hands with a clean cloth or paper towel before putting on gloves.
- Protect your arms and hands by wearing a long sleeve shirt with the sleeves duct-taped to your gloves to prevent wet cement from getting inside the gloves.

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- Follow proper procedures for removing gloves, whether reusing or disposing them.
 - Clean reusable gloves after use. Before removing gloves, clean the outside by rinsing or wiping off any wet cement. Follow the manufacturer's instructions for glove cleaning. Place clean and dry gloves in a plastic storage bag and store them in a cool, dry place away from tools.
 - Throw out grossly contaminated or worn-out gloves.
 - Keep the inside of gloves clean and dry.
 - Wear waterproof boots when necessary to prevent wet cement from coming into contact with your skin. It is as important to protect your legs, ankles, and feet from skin contact with wet cement as it is to protect your hands.
 - Boots need to be high enough to prevent wet cement from getting inside. Tuck pants inside and wrap duct tape around the top of the boots to prevent wet cement from entering.
 - Change protective boots if they become ineffective or contaminated on the inside with wet cement while in use.
 - Change out of any work clothes that become contaminated with wet cement and keep contaminated work clothes separate from your street clothes.
 - When kneeling on wet cement use waterproof kneepads or dry kneeboards to prevent the knees from coming into contact with the cement.
 - Wear proper eye protection when working with Portland cement.
 - Perform hazard communication training for concrete. Read SDSs heed the manufacturers' recommendations for safety precautions.
 - Protruding reinforcing steel (rebar), onto which personnel could fall, must be guarded to eliminate the hazard of impalement
 - During post-tensioning, only those personnel essential to the operation are permitted behind the tensioning jacks.
 - Personnel shall not ride concrete buckets nor position themselves in areas where buckets are lifted overhead.
 - Personnel shall maintain a safe distance from formwork and shoring being removed from concrete structures.
 - Personnel shall maintain a safe distance from precast and lift-slab concrete being lifted into position until physically secured.
 - Personnel shall not enter limited access zones during masonry wall construction.
 - When CH2M is in control of concrete and masonry operations, a lift slab competent person will oversee all the concrete and masonry operations.
 - See also SOP HSE-511, Crystalline Silica.
 - Complete the self-assessment checklist for concrete and masonry activities whenever those activities are being performed.

8.15 Concrete Core Drilling

(Reference CH2M SOP HSE-204, *Drilling*)

Below are the hazard controls and safe work practices to follow when working around or performing concrete core drilling.

- Operators must read and understand the Operators Manual(s) for the equipment that will be used.
- Follow all manufacturers' operating instructions and comply with all warning labels on the equipment.
- Inspect equipment to ensure it is in proper operating condition prior to use. Equipment damage or missing parts must be corrected prior to operation.
- Follow all requirements for use of PPE. Minimum PPE includes hearing protection, safety glasses with side shields, safety toed boots. A face shield over safety glasses or liquid splash goggles may be required for wet coring.
- Inspect areas to be cored to ensure there are no obstructions, for example utilities on the opposite side of a wall to be cored through. Follow utility locate procedures for when coring slab on grade.
- Provide dust control (wet coring or local exhaust for dry coring) to avoid potential silica exposure.
- Make sure that all electrical wiring is grounded.
- The power supply line (electric cord, pneumatic or hydraulic line) must be protected from damage and routed to prevent it becoming a tripping hazard.
- When hydraulic coring equipment is used, all workers must be aware of hydraulic lines running to the coring equipment. Preparations must be made for containment/clean up in the event of a ruptured hydraulic line.
- All workers must keep their hands and body away from the cutting saw/cable.
- The power supply must be disconnected when changing bits or conducting other maintenance on the equipment.
- Slippery conditions may exist in wet coring operations. Water needs to be controlled during cutting and proper safety toed footwear used to minimize slip potential.
- The dust created by the concrete coring needs to be controlled using the application of water or local exhaust ventilation (i.e., removing dust at the source) to reduce the amount of airborne dust generated. Contact the RHSM to determine if air monitoring/respiratory protection will be necessary. See also SOP HSE-511, *Crystalline Silica*.
- Use the Drilling Self-Assessment checklist to evaluate coring operations.

8.16 Concrete Saw Cutting

- Ensure operators are trained and familiar with the equipment are operating the saw. Operators must read and understand the Operators Manual(s) for the equipment that will be used.
- Inspect equipment to ensure it is in proper operating condition prior to use. Equipment damage or missing parts must be corrected prior to operation.
- Cutting blades shall be the correct size, installed properly, guarded at all times, and speed should not exceed the manufacturer's suggested operating speed.
- Workers shall use the correct blade for the job and inspect it for defects before each use.

- Saws shall be maintained and kept clean from dust build-up. Workers shall not push against the saw during operation to avoid the blade jumping out of the cutting path and loss of operator control.
- Inspect areas to be sawed to ensure there are no obstructions, for example rocks or other debris. Follow utility locate procedures prior to cutting.
- Personal protective equipment (PPE) saw use shall include hard hats, safety-toed boots, safety glasses and face shields, hearing protection, and leather gloves.
- The dust created by the concrete saw needs to be controlled using the application of water or local exhaust ventilation (i.e., removes dust at the source) to reduce the amount of airborne dust generated. Contact the RHSM to determine if air monitoring/respiratory protection will be necessary. See also SOP HSE-511, *Crystalline Silica*.
- If equipped, the power supply line (electric cord, pneumatic or hydraulic line) must be protected from damage and routed to prevent it becoming a tripping hazard. The power supply must be disconnected when changing blades or conducting other maintenance on the equipment.
- Ensure all utilities have been marked and located in accordance with the underground utilities section of this Handbook.
- Slippery conditions may exist in wet cutting operations. Water needs to be controlled during cutting and proper safety toed footwear used to minimize slip potential.

8.17 Confined Space Entry Activities

(Reference CH2M, SOP HSE-203, Permit Required Confined Space Entry)

OSHA and CH2M define a confined space as a space that has all of the following characteristics:

- Large enough to allow personnel to enter the space with their entire body;
- Limited openings for entry and exit; and
- Not designed for continuous human occupancy;

Examples of possible confined spaces include underground vaults, pipelines, ducts, tunnels, storage tanks, sewers, process vessels, and pits. Entry into a confined space is defined as breaking the plane of a confined space with any part of the body.

A Permit-required Confined Space (PRCS) is defined as a confined space that has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere
- Contains a material that has the potential for engulfing an entrant
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section, or
- Contains any other recognized serious safety or health hazard

In Canada, some individual Provinces have different definitions of confined spaces; refer to the specific Canadian Provincial code.

The following requirements apply when entering a permit-required confined space (PRCS), an Alternate Procedure Confined Space, or a PRCS reclassified as a non-permit confined space (NCS). Ensure the requirements in the referenced SOP are followed.

- Entrants, Attendants, and the Entry Supervisor shall have successfully completed Confined Space Entry training.

- The appropriate confined space entry permit shall be completed as outlined in CH2M SOP HSE-203, *Confined Space Entry*.
- The completed permit or certificate shall be posted for review near the space entrance point.
- The Entry Supervisor shall conduct a pre-entry briefing with all Authorized Entrants and Attendants prior to entry in accordance with SOP HSE-203.
- Entrants and Attendants shall verify that the Entry Supervisor has authorized entry and that all requirements of the permit or certificate have been satisfied prior to each entry.
- Atmospheric monitoring for oxygen, combustible gases, and potential toxic air contaminants shall be conducted at the frequency provided on the permit or certificate. Entry shall not be permitted if an atmospheric hazard is detected above acceptable safe levels. Atmospheric monitoring shall be performed in accordance with the Site Monitoring Section of the project safety plan and SOP HSE-203.
- Entrants shall evacuate the space upon orders of the Attendant or Entry Supervisor, when an alarm is sounded, or when a prohibited condition or dangerous situation is recognized.
- Entrants and Attendants shall inform the Entry Supervisor of any hazards confronted or created in the space, or any problems encountered during entry. The Entry Supervisor shall inform the owner of such issues.
- The Entry Supervisor shall provide a copy of the canceled permit or certificate to the SC for review and maintain it in the project file.
- Complete the self-assessment checklist for confined space entry whenever entries are being performed.

8.18 Cranes

(Reference CH2M SOP HSE-303, *Cranes*)

Below are the hazard controls and safe work practices to follow when working around or operating cranes. Ensure the requirements in the referenced SOP are followed.

- Crane operators are prohibited from using any wireless device while operating a crane. Equipment must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- Cranes shall be operated by a certified crane operator. After November 10, 2014, only operators possessing a certificate from a nationally accredited testing organization, an audited employer training program, or U.S. military, or state- or provincial-issuing agency will be authorized to operate cranes.
- The crane's operations manual and load chart specifically designed for the crane shall be in the crane at all times.
- The crane must have a current annual inspection to include load test certification (within the last 12 months) that meets all state and provincial and federal safety standards. Documentation of this inspection must be available for review.
- A competent person will inspect the crane daily to ensure it is in safe operating condition. The daily crane inspection log provided within the crane manufacturer's operations manual shall be used. See also the requirements for monthly inspections, among others, in SOP HSE-303.
- All rigging equipment must be inspected by a competent person prior to use for signs of excessive wear; equipment found to be damaged will be tagged and removed from service.

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- A qualified and competent Assembly/Disassembly (A/D) Director shall be assigned when cranes must be assembled onsite. The A/D Director is responsible for ensuring the crane is assembled and disassembled according to manufacturer requirements; performing training for the A/D crew; and ensuring sufficient ground conditions exist for crane placement; among other responsibilities (see SOP HSE-303).
 - The assembly/disassembly process must comply with requirements in HSE-303, including having an AHA for the task.
 - A critical lift plan shall be prepared when the lift is estimated to be greater than 75 percent of the crane capacity or when two cranes will be used to make a lift.
 - A pre-lift meeting will be conducted to include all parties involved in that day's crane operation.
 - Only one qualified person shall be designated to signal the crane operator. This person shall be thoroughly familiar with the ANSI standard method of hand signals and an illustration of these signals shall be posted at the job site.
 - No personnel shall be permitted under the load at any time.
 - Tag lines shall be attached to every load being made by the crane.
 - The swing radius of the rear rotating superstructure (counterweight) of the crane shall be barricaded and no entrance allowed.
 - Suspended loads shall not pass over workers or occupied buildings at any time.
 - Complete the self-assessment checklist for crane-suspended personnel platforms whenever they are being used.
 - CH2M employees exposed to hazards posed by crane operations, must be trained in hazards awareness and control procedures. See requirements for training in HSE-303.

Power Line Safety

It must be determined whether equipment operations including assembly/disassembly, positioning, and crane operation (including traveling with a load) will occur in proximity to power lines within 20 feet (6.1 meters) for line voltage up to 350 kilo volts (kV), and within 50 feet (15.2 meters) for line voltage between 350 kV to 1000 kV. For power lines over 1000 kV, the distance must be determined by the utility/operator or qualified registered professional engineer in electrical power transmission and distribution.

If equipment operations are within proximity of aforementioned distances to power lines, one of the following options must be implemented to prevent encroachment and electrocution:

- Option 1: Deenergize and ground the power. Confirm from the utility/operator that the power line has been deenergized and visibly grounded at the worksite
- Option 2: If the voltage is not determined, ensure that no part of the equipment, load line, or load (including rigging and lifting accessories), gets closer than 20 feet (6.1m) by:
 - Conduct a planning meeting with the operator and other workers in the area to review the actions that will be taken to prevent encroachment and electrocution. Training requirements for working around energized power lines are described in Section 6.0, Training.
 - Use non-conductive tag lines.
 - Erect and maintain an elevated warning line, barricade or line of signs in view of the operator, either with flags or other high-visibility markings at 20 feet (1.6m) from the power line. A spotter must be used when the operator does not have clear line of sight to the elevated warning line.

- To prevent encroachment, the operator can use a proximity alarm, or position a dedicated spotter with visual aids to demarcate the encroachment and constant communication access to the operator.

If the line voltage can be determined, and if any part of the equipment, line load or load (including rigging and lifting accessories) would encroach within that specified distance listed in Table 1, then the requirements listed in Option 2 must be implemented.

TABLE 1
Minimum Clearance Distances

Voltage (nominal, kV, alternating current)	Minimum Clearance – Feet (meters)
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1000	45
Over 1000	Established by the utility owner/operator or by a qualified registered professional engineer in electrical power transmission and distribution

For equipment traveling within 20 feet (6.1m), under or near power lines without a load, the clearance distances described in Table 2 must be maintained and the following actions implemented.

- A dedicated spotter is assigned during equipment travel, positioned to effectively gauge the clearance distance, and is in continuous communication with the operator.
- During equipment travel, the boom/mast and support system are sufficiently lowered to ensure clearance distances are maintained, along with taking into consideration of the effects of speed and terrain.

TABLE 2
Minimum Clearance Distances While Traveling With No Load

Voltage (nominal, kV, alternating current)	Minimum Clearance – Feet (meters)
Up to 0.75	4
Over 0.75 to 50	6
Over 50 to 345	10
Over 345 to 750	16
Over 750 to 1000	20
Over 1000	Established by the utility owner/operator or by a qualified registered professional engineer in electrical power transmission and distribution

8.19 Crystalline Silica

(Reference CH2M SOP HSE-511, Crystalline Silica)

Crystalline silica can be a hazard during concrete cutting, jackhammering, well completion, building demolition or using impact or rotary drills on concrete surfaces.

CH2M and its subcontractors shall control employee exposure to crystalline silica when exposures are at or above the ACGIH TLV and the OSHA action level of 0.025 mg/m³ by submitting for review and approval a crystalline silica exposure monitoring plan. The elements of an exposure monitoring plan include, but are not limited to the following:

- A bulk sample representative of the material to be demolished must be sent with the air monitoring sample media for analysis;
- Initial monitoring and personal air sampling must be conducted to determine the potential worker exposure to respirable crystalline silica;
- Real-time particulate monitors with a 10 micron respirable size fraction attachment may be used as part of the initial and ongoing monitoring plan to evaluate the potential worker exposure. This must include an action level established by their corporate or site health and safety professional and include actions required (e.g., implement engineering, administrative controls, respiratory protection);

Other exposure control measures include:

- Follow the engineering controls and PPE requirements for tasks called out under 29 CFR 1926.1153, Table 1 (e.g., use of jackhammers, walk behind or hand-held saws, hand-held and rig-mounted core saws or drills, among others);
- Workers shall use power tools with dust suppression controls such as a water spray or local exhaust ventilation connected to a HEPA vacuum system when cutting concrete;
- When using handheld and stand-mounted drills (including impact and rotary hammer drills) (e.g., for soil vapor probe installation):
 - Use a drill equipped with commercially available shroud or cowling with dust collection system
 - Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions
 - The dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism
 - Use a HEPA-filtered vacuum when cleaning holes
- Maintaining surfaces as clean as practicable to minimize accumulation of crystalline silica containing particulate material;
- Apply dust control products or water on dry, dusty roads or piles of materials;
- Utilize heavy equipment with pressurized cabs and HEPA filter systems;
- Clean surfaces with a HEPA-filter vacuum or equivalent method;
- Implement dust suppression during demolition;
- An area on the worksite must be designated to be free of crystalline silica for workers to consume food or beverages;

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- Restricting access to the work area where crystalline silica exposure may exist to only those authorized to perform work or enter the area;
 - Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in these areas; and
 - Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

8.20 Demolition

(Reference CH2M SOP HSE-305, *Demolition*)

This section is applicable to all forms of demolition. Demolition is defined as the removal or dismantling of structures or equipment by disassembly.

An engineering survey shall be completed prior to start of demolition operations. The survey shall determine the condition of the structure framing, floors, and walls; the presence of asbestos, polychlorinated biphenyls (PCBs), lead paint, or other regulated hazardous substances; the presence of hazardous materials in tanks, pipes, and equipment; and the possibility of unplanned collapse of any portion of the structure. Any adjacent structure where personnel may be exposed shall also be similarly evaluated. The survey shall be conducted by a competent person and a written record of the survey findings shall be maintained at the project site.

The demolition contractor working on this project will provide CH2M with a demolition safety plan prior to the start of work. CH2M will use this plan to verify that the subcontractor is implementing the necessary safety precautions during this activity. In addition, the following safety precautions shall be implemented by CH2M personnel. Below are the hazard controls and safe work practices to follow when working around or performing demolition. Ensure the requirements in the referenced SOP are followed.

- Appropriate warning and instructional safety signs shall be conspicuously posted where necessary.
- Fugitive dust must be controlled during demolition by using water spray or other methods.
- Remain a safe distance from the demolition zone to reduce exposure to fragmentation of glass, steel, masonry, and other debris during demolition operations.
- Do not enter the demolition zone unless completely necessary, and only after the competent person has assessed the condition of the structure and has authorized entry.
- Follow all requirements established by the competent person. The competent person shall inform personnel of the areas that are safe to enter and the areas where entry is prohibited. When possible, the competent person should escort CH2M personnel while in the demolition zone.
- All demolition activities that may affect the integrity of the structure or safety of personnel must cease until personnel have exited the demolition zone.
- During the course of demolition, work areas, passageways, stairs, ladders, and exits shall be kept free of demolition debris.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel
- Proper control measures shall be in place before welding or cutting on surfaces covered by coatings containing flammable or hazardous materials such as lead, cadmium, zinc, etc. Highly flammable or toxic coatings may require stripping of the coating a sufficient distance from the area to be heated. Welding and cutting shall be performed in accordance with the applicable governing provisions (e.g., in the US: OSHA 1926, Subpart J, "Welding and Cutting"; in Canada: provincial code, etc.). Follow "Welding and Cutting" SOP HSE-314.

The following lead-exposure-control procedures will be implemented during demolition operations involving potential exposure to lead:

- Site personnel will be provided lead-awareness training;
- Site personnel will be provided with hand-washing facilities and will wash their hands daily;
- An excavator equipped with hydraulic shears will be used only to cut painted wooden, concrete, and metal structures;
- Neither hand-held band/chop saws nor torch cutting equipment will be used on painted surfaces without proper PPE and engineering controls in place or removal of paint prior to cutting;
- During all demolition operations to control potential exposures to LBP, wet methods using water mist will be used;
- A direct-reading dust monitor will be used to monitor demolition operations that pose a potential lead-exposure hazard (that is, those with an action level requiring that additional dust control measures be employed and/or that respiratory protection be used.);
- Personal air samples will be collected and analyzed for lead to confirm that no personnel are exposed to levels above the lead action level of 30 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$); and
- The selection of respiratory protection and other exposure controls will be based on the most recent exposure monitoring results obtained from the lead-exposure-competent person.
- For more information see CH2M SOP HSE-508, Lead.

8.21 Diving

(Reference CH2M's Commercial Diving Manual)

Diving operations must be conducted in accordance with the CH2M Commercial Diving Safe Practices Manual. Requirements in the manual include:

- Dive team members must have the experience and/or training in the use of tools, equipment and systems relevant to assigned tasks; techniques of the assigned diving mode; diving operations; and emergency procedures;
- Dive team members must be trained in cardiopulmonary resuscitation and standard first aid;
- Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology; and
- A "designated person-in-charge" must be at the dive location and in charge of all aspects of the diving operation affecting the safety and health of dive team members. The designated person-in-charge shall have experience and training in the conduct of the assigned diving operation.

8.22 Drilling Safety

(Reference CH2M SOP HSE-204, *Drilling*)

Below are the hazard controls and safe work practices to follow when working around or performing drilling. Ensure the requirements in the referenced SOP are followed.

- When considering drilling at sites with nearby monitoring wells, particularly in cases where drilling methods utilize pressurized fluids (air or water), consider the potential risk of hydraulic communication between the drilling location and the adjacent wells and/or other subsurface conduits.
- The drill rig is not to be operated in inclement weather.

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- The driller is to verify that the rig is properly leveled and stabilized before raising the mast.
 - Personnel should be cleared from the sides and rear of the rig before the mast is raised.
 - The driller is not to drive the rig with the mast in the raised position.
 - The driller must check for overhead power lines before raising the mast. Maintain a minimum distance of 10 feet (3 meters) between mast and overhead lines (<50 kV) and an additional 0.4 inches for every 1 kV over 50kV. Verify the voltage of nearby overhead power lines to determine the minimum distance.
 - If the project site is suspected of munitions or explosives of concern (MEC) contamination, requirements of the *Explosives Usage and Munitions Response (MR) SOP HSE-610* shall be followed. MECs include material potentially presenting an explosive hazard (MPPEH), discarded military munitions, materials that present a potential explosive hazard, chemical warfare materials, munitions constituents, and contaminated soil or groundwater. "Down-hole" avoidance support may be required to prevent accidental contact with MPPEH. Safety requirements will be based on the risk assessment identified within the MR (safety) ORE (Opportunity Risk Evaluation).
 - All drilling sites must be evaluated for potential contamination by consulting with the client, reviewing historic data related to properties' past owners and uses, prior investigation reports or through vendor services.
 - If unexpected contamination is discovered during drilling operations, all activities must immediately stop and the CH2M Safety Coordinator or Project Manager shall be immediately notified. Work shall not recommence until authorized by the CH2M Project Manager.
 - If contamination is suspected or confirmed at the drilling site, the following must be implemented:
 - The standard hazardous materials/hazardous waste clause is included in our contract with the client and in our subcontract agreements
 - The drilling subcontract work plans address appropriate disclosure of potential contamination, any required training (e.g., HAZWOPER) and the requirement to plan for unexpected contamination. The subcontractor work plan and submittals are reviewed for appropriate licenses, certifications, permits, training, sampling and analytical, waste characterization, and waste management, including accumulation, transport and disposal.
 - Personnel should stand clear before rig startup.
 - The driller is to verify that the rig is in neutral when the operator is not at the controls.
 - Become familiar with the hazards associated with the drilling method used (cable tool, air rotary, hollow-stem auger, etc.).
 - Do not wear loose-fitting clothing, watches, etc., that could get caught in moving parts.
 - Do not smoke or permit other spark-producing equipment around the drill rig.
 - The drill rig must be equipped with a kill wire or switch, and all personnel are to be informed of its location.
 - Be aware and stand clear of heavy objects that are hoisted overhead. Ensure any components subject to load bearing are rated and not shop-made.
 - The driller is to verify that the rig is properly maintained in accordance with the drilling company's maintenance program.
 - The driller is to verify that all machine guards are in place while the rig is in operation.
 - The driller is responsible for housekeeping (maintaining a clean work area).
 - The drill rig should be equipped with at least one fire extinguisher.

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- If the drill rig comes into contact with electrical wires and becomes electrically energized, do not touch any part of the rig or any person in contact with the rig, and stay as far away as possible. Notify emergency personnel immediately.
 - Use the drilling self-assessment checklist to evaluate drilling operations.

8.22.1 Air Rotary Drilling

- When a hydraulic communication hazard may exist, do not perform work at an adjacent structure or conduit when drilling, and be mindful of potential line-of-fire hazards. Evaluate the possibility of:
 - Increasing the distance between the proposed drilling site and the existing structure(s);
 - Abandon the adjacent structure(s)/conduit(s);
 - Consider use of an alternative drilling technology that minimizes propagation of pressures in the borehole to the adjacent formation (e.g., casing methods, continuous override methods, rotonomic); and
 - Ensure that hydraulic communication risks are addressed in your AHA or AHA/EIA.
- If drilling near a previously installed well, remove or loosen the well cap of that well to relieve pressure that may build during drilling.
- Stay clear of nearby wells that aren't protected by a secured steel casing/monument as a steel casing should provide protection from the inner well in the event of a pressure buildup.
- When opening a well in the vicinity of where air rotary drilling is being performed, or when opening a newly installed well via air rotary methods, remove the cap slowly to relieve pressure, keeping your head away from the line of fire in case the cap does pop off.

8.22.2 Cold Weather Drilling

- When possible, secure a tarp or plastic sheeting on the ground of the drilling work area overnight to reduce buildup of ice/snow.
- Place non-slip pads near work area and clean off regularly.
- Keep the drilling area clear of soil or cuttings at the surface, especially if soil is very wet, to prevent freezing and slipping/tripping hazards.
- Work at a slower pace to avoid slips
- Evaluate alternate methods for extreme conditions with PM/HSM.

8.23 Drum and Portable Tank Handling

Below are the hazard controls and safe work practices to follow when overseeing the movement of drums or when handling drums:

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries;
- Ensure drum or tank bungs and lids are secured and are labeled prior to moving;
- Ensure that drums and tanks remain covered except when removing or adding material or waste. Covers and/or lids will be properly secured at the end of each workday;
- Provide equipment to keep the operator removed from the drums to lessen the likelihood of injury. Such equipment might include: a drum grappler attached to a hydraulic excavator; a small front-end loader, which can be either loaded manually or equipped with a bucket sling; a rough terrain forklift; Roller conveyor equipped with solid rollers; drum carts designed specifically for drum handling;

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- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface;
 - Ensure there are appropriately designed Plexiglas cab shields on loaders, backhoes, etc., when handling drums containing potentially explosive materials;
 - Equipment cabs should be supplied with fire extinguishers, and should be air-conditioned to increase operator efficiency;
 - Supply operators with appropriate respiratory protective equipment when needed;
 - Ensure that drums are secure and are not in the operator's view of the roadway;
 - Prior to handling, all personnel should be warned about hazards of handling;
 - Before moving anything, determine the most appropriate sequence in which the various drums, portable tanks, and other containers should be moved (e.g., small containers may have to be removed first to permit heavy equipment to enter and move the drums);
 - Overpack drums and an adequate volume of absorbent should be kept near areas where minor spills may occur;
 - Use containers or overpacks that are compatible with the waste or materials;
 - Drums containing liquids or hazardous waste will be provided with secondary containment and may not be located near a storm water inlet or conveyance;
 - Allow enough aisle space between drum pallets and between drums and other equipment that the drums can be easily accessed (at least 2 to 3 feet) by fire control equipment and similar equipment.; and
 - Make sure that a spill kit is available in drum or tank storage areas (or where liquids are transferred from one vessel to another).

8.24 Drum Sampling Safety

Personnel are permitted to handle and/or sample drums containing certain types of waste (drilling waste, investigation-derived waste, and waste from known sources) only. Handling or sampling drums with unknown contents requires a plan revision or amendment approved by the RHSM. The following control measures will be taken when sampling drums:

- Minimize transportation of drums;
- Sample only labeled drums or drums from a known waste stream;
- Do not sample bulging or swollen drums. Contact the RHSM;
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open;
- Use the proper tools to open and seal drums;
- Reseal bung holes or plugs whenever possible;
- Avoid mixing incompatible drum contents;
- Sample drums without leaning over the drum opening;
- Transfer/sample the content of drums using a method that minimizes contact with material;
- Use the PPE and perform air monitoring as specified in the PPE and Site Monitoring sections of the project safety plan;

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- Take precautions to prevent contaminated media from contacting the floor or ground, such as having plastic under the sampling area, having a spill kit accessible during sampling activities; and
 - If transferring/sampling drums containing flammable or combustible liquids, drums and liquid transfer equipment should be grounded and bonded to reduce the potential of a static discharge.

8.25 Earthmoving/Heavy Equipment

(Reference CH2M, SOP HSE-306, *Earthmoving Equipment*)

Below are the hazard controls and safe work practices to follow when working around or operating heavy equipment. Ensure the requirements in the referenced SOP are followed.

- CH2M authorizes only those employees qualified by training or previous experience to operate material handling equipment.
- CH2M employees must be evaluated prior to operating earthmoving equipment by a CH2M earthmoving equipment operator evaluation designated person. This evaluation will be documented according to SOP HSE-306, Earthmoving Equipment.
- Heavy equipment operators are prohibited from using any wireless device while operating equipment. Equipment must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- Equipment must be checked at the beginning of each shift to ensure the equipment is in safe operating condition and free of apparent damage. The check should include: service brakes, parking brakes, emergency brakes, tires, horn, back-up alarm, steering mechanism, coupling devices, seat belts and operating controls. All defects shall be corrected before the equipment is placed in service. Documentation of this inspection must be maintained onsite at all times (use the Earthmoving Equipment Inspection form if operated by CH2M).
- Equipment must be on a stable foundation such as solid ground or cribbing; outriggers are to be fully extended.
- Equipment must not be used to lift personnel; loads must not be lifted over the heads of personnel.
- Equipment, or parts thereof, which are suspended must be substantially blocked or cribbed to prevent shifting before personnel are permitted to work under or between them. All controls shall be in a neutral position, with the motors stopped and brakes set.
- Equipment which is operating in reverse must have a reverse signal alarm distinguishable from the surrounding noise or a signal person when the operators view is obstructed.
- When equipment is used near energized power lines, the closest part of the equipment must be at least 10 feet (3 meters) from the power lines less than 50 kilovolts (kV). Provide an additional 4 feet (1.2 meters) for every 10 kV over 50 kV. A person must be designated to observe clearances and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. All overhead power lines must be considered to be an energized until the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded.
- Underground utility lines must be located before excavation begins; refer to the Utilities (underground) section.
- Operators loading and unloading from vehicles are responsible for seeing that vehicle drivers are in the vehicle cab or in a safe area.

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- The parking brake shall be set whenever equipment is parked; wheels must be chocked when parked on inclines.
 - When not in operation, the blade or bucket must be blocked or grounded; the master clutch must be disengaged when the operator leaves the cab. When equipment is unattended, power must be shut off, brakes set, blades or buckets landed and shift lever in neutral.

8.26 Elemental Sulphur

- Do not enter regulated work area unless training, medical monitoring and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum or apply cosmetics in regulated areas.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- Exposure to elemental sulphur dust may irritate eyes, skin and respiratory tract.
- Avoid breathing dust and keep clothing from dust as possible.
- If dusty conditions, wear dust mask, safety goggles and Tyvek.

8.27 Energized Electrical Work

(Reference CH2M SOP HSE-221, *Energized Electrical*)

All electrical systems shall be considered energized unless lockout/tagout procedures are implemented and zero energy verified in accordance with the Lockout/Tagout section of this Handbook.

Energized electrical work is defined as work performed on or near energized electrical systems or equipment with exposed components operating at 50 volts AC (or 100 volts DC) or greater. Working near energized live parts is any activity inside a Limited Approach Boundary.

Evaluate the use remote testing device for troubleshooting (e.g., Fluke 233 Remote Display Multimeter or equivalent). This type of testing device eliminates the exposure to unprotected energized electrical parts.

Electrical wiring and equipment shall be de-energized prior to conducting work unless it can be demonstrated that de-energizing introduces additional or increased hazards or is unfeasible due to equipment design or operational limitations. When energized electrical work is the only means that work can be performed (e.g., for voltage testing or troubleshooting), all requirements of SOP HSE-221 must be implemented including the following:

- Only qualified personnel are permitted to work on unprotected energized electrical systems. To be a CH2M qualified person, an employee must meet all of the following bulleted requirements:
 - The employee must be assigned one of the two worker categories and up-to-date on the requirements:
 - Energized Electrical Trained Worker Limited (EETW-L) which is restricted to working on electrical systems 480 VAC and below or working in the Limited Approach Boundary of systems that have a designated Arc Flash PPE Category of ≤ 2 , which **does not** require First Aid/CPR or AED training or the buddy system.
 - Energized Electrical Trained Worker (EETW) allows individuals to work on equipment rated at Arc Flash PPE category 2, which requires the individual to complete First Aid/CPR or AED, and implement the buddy system.
 - Possess credentials, electrical educations, training and task specific knowledge, experience and capability (i.e., a qualified person may be qualified for one type of system or task, but not another).

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- Attachment 4 of the Energized Electrical SOP, "Energized Electrical Qualified Person Assessment" must be completed annually by the RHSM or applicable operations lead/supervisor which requires a skill demonstration performed by the qualified person while wearing the necessary PPE and using the required tools. This form must be submitted to the SPA and maintained with the project files.
 - Employees shall complete the CH2M energized electrical refresher safety training every 3 years.
 - First Aid/CPR and AED training (EETW only), release of victim, completed annually (Release of victim refresher available on the VO). For annual the First Aid, CPR and AED requirement, an employee may retake the course through a certified provider (including local organizations), conduct a drill where CPR and AED skills are demonstrated, or complete the American Red Cross CPR/AED Refresher course.
- If CH2M personnel are only overseeing a qualified subcontractor performing energized electrical work and not entering the Limited Approach Boundary or tasked to perform troubleshooting near unprotected energized parts, then the '2015 NFPA 70E Awareness for Oversight of Work' VO training is required (i.e., the above training requirements would not apply).
 - The client sector HSE Lead must approve any energized electrical work that is above an Arc Flash PPE Category 2 or an incident energy greater than 8 calories/cm².
 - An Electrical Hazard Analysis must be performed to identify energized electrical safe work practices before any person approaches exposed live parts within the Limited Approach Boundary (as determined by the shock hazard analysis), by performing both shock hazard analysis and flash hazard analysis, which comprise the electrical analysis.
 - The Energized Electrical Work Permit must be completed prior to working on unprotected energized electrical systems.
 - Provisions for first responder equipment, such as a first aid kit, AED, communication devices, and non-conductive release equipment (when disconnect means is not in the immediate vicinity of the work) shall be made available. If an AED is available at the host employer's facility, the location of the AED must be determined and personnel trained in its use.
 - CH2M employees designated as qualified persons working on live parts of energized electrical systems 480 volts and above shall implement the buddy system. This means that two EEQPs must be engaged in this work. Working on live parts of energized electrical systems 480 volts and above means actual contact with live parts or working within the Prohibited Approach Boundary, which is one inch (2.54 cm) for 480 volt systems.
 - The buddy system requires the presence of an additional EEQP who shall stand by and render assistance, or summon help for the first person, in the event the first person is inadvertently shocked while performing the work. The second person shall not be assigned to additional distracting duties or tasks while the energized electrical work is being performed and shall know the location of the isolation device(s) for the equipment being worked on.
 - Workers designated as qualified persons shall wear the required electric shock and arc-flash PPE, as specified by the qualified person responsible for the energized electrical operations.
 - Safety signs, safety symbols or incident prevention tags, meeting applicable American National Standards Institute (ANSI) Standards, shall be used where necessary to warn employees about electrical hazards.
 - Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas containing live parts. Conductive barricades shall not be used where it may cause an electrical hazard. Barricades shall be placed no closer than the Limited Approach Boundary.

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- If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect unqualified employees. The primary duty and responsibility of an attendant providing manual signaling and alerting shall be to keep unqualified employees outside a work area where the unqualified employee might be exposed to electrical hazards. An attendant shall remain in the area as long as there is a potential for employees to be exposed to the electrical hazards.
 - Employees shall not perform tasks near exposed energized parts where lack of illumination or an obstruction precludes observation of the work. Employees shall not reach blindly into areas that may contain energized parts.
 - Work shall be performed in accordance with National Fire Protection Association (NFPA) 70E requirements (2015 edition).
 - Follow all control measures and procedures identified on the Energized Electrical Work Permit and the AHA. Complete the self-assessment checklist for energized electrical work.

8.28 Electrofishing Safety

Below are the hazard controls and safe work practices to be followed when overseeing or performing electrofishing.

- At least one member of the crew must have current first aid and CPR cards.
- Make sure every member of your crew knows where the nearest hospital is and how to get there or where to go to get help.
- All members of the crew shall have completed an electrofishing safety course.
- Before loading up equipment and heading into the field, make sure every member of the crew know the evacuation routes in case of an accident.
- Check the equipment for damaged or missing parts and for proper operation. Never use an electrofisher that is in poor condition or not working correctly as it can present a severe shock hazard.
- Check the cathodes cable for wear and burrs that may cause injury or tear holes in protective clothing. Check the insulation for damage. Replace the cathode as necessary.
- Check the anode pole for cracks in the fiberglass and handle assembly. Replace as necessary.
- Check the curl cord for cracks and abrasion. Do not use a cracked pole or a pole with a damaged curl cord.
- Check your boots and high voltage gloves for holes. Boots and gloves must be water tight without any holes. Repair as necessary.
- If you are using chest waders you should use a wading belt. A wading belt around your chest will trap air in your waders if you step or fall into a hole.
- Check all batteries for damage. Never use a damaged battery as the gelled electrolyte in these batteries is a strong acid and can cause severe chemical burns and damage clothing and the electrofisher.
- Use only dip nets with non-conductive handles. Never use an anode as a net, as it is extremely dangerous to other members of the crew and can cause severe injury to any fish caught with it.
- Never electrofish alone.
- Never electrofish if you are tired.
- Use only dip nets with insulated handles.

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- Wear lineman's gloves, rated 5,000V minimum.
 - Never try to reach into deeper pools with the electrodes. If you can't safely wade in an area it cannot be electrofished with a backpack electrofisher.
 - Only one person on a crew can order the power for the electrofisher to be turned on, and that person is the crew leader. The crew leader is responsible for the safety of everyone on the crew.
 - Any member of the crew can call for or turn off the power to the electrofisher.
 - If an accident occurs, stop electrofishing and turn off the power to the unit. The person wearing the backpack unit should leave the water and take the unit to shore. The remaining members of the crew should help or attend to the accident victim. Get help for the injured person if necessary. Evaluate what happened and make the necessary procedural or equipment changes before proceeding.
 - Never electrofish with spectators on shore. Electric fields can travel large distances through buried pipes, metal culverts, and metal sheet piling. If spectators show up during electrofishing, stop the operation and go explain what you are doing. Explain the risks to them being there and ask them to please leave for their own safety. If they refuse to leave, stop electrofishing, load your equipment and leave the area.

8.28.1 Safe Fishing

Electrofishing equipment uses voltages and currents that can be lethal to humans. The operators must always keep in mind that the chance of receiving an electrical shock is multiplied in or near water. Using an electrofisher is like using a firearm: if used properly and with good judgment it is perfectly safe; lose respect for it and you can lose your life.

Electrical equipment used in a moist field environment is always subject to deterioration that could lead to dangerous electrical shock. Field equipment is also subjected to vibration and impact during transporting and while in operation. Often equipment shared by different crews does not receive proper maintenance or a complete checkout. Follow the safety guidelines, and use good common sense to handle unforeseen circumstances.

All personnel involved in electrofishing should be taught the fundamentals of electricity, and have an understanding of the safety requirements.

8.28.2 Electrical Shock

It is the current that passes through the human body that does the damage. The voltage is relevant, because it is the force that "pushes" the current through the body. Experiments show that 20 to 500 HZ AC current is more dangerous than DC, or higher frequencies of AC.

The voltage used by electrofishing gear cause death by one of the following three means:

Ventricular Fibrillation – is uncoordinated contraction of the muscles of the heart. The heart quivers rather than beats. Electrical current through the chest can cause this condition,. Once a person goes into ventricular fibrillation, the only way to stop the quivering is to use a defibrillator that applies a pulse shock to the chest to restore heart rhythm. Cardiopulmonary resuscitation may help to keep a victim alive until he can be defibrillated.

Respiratory Arrest – The respiratory center is at the base of the skull. Thus, shock to the head can cause the breathing to stop. Artificial respiratory by the mouth-to-mouth method should be used in this case.

Asphyxia – is caused by contraction of the chest muscles. When current is above a certain level, a person cannot let go of an electrically hot wire. Currents above this level may not cause ventricular fibrillation, but may be enough to cause contraction of the chest muscles. If the current is not stopped, or the victim is not removed from

the point of electrical contact, asphyxia will result. Artificial respiration or cardiopulmonary resuscitation may be necessary.

8.28.3 Preventing Electrical Shock

Electricity needs to have a complete electrical circuit in order for current to flow. The only way that you can get shocked is if you become the electrical conductor to complete the circuit. The current flows from the cathode to the anode through the water. The water is the electrical conductor. If you touched both the anode and the cathode you would become an electrical conductor and complete the circuit path and get a severe electrical shock. If you were to touch only one of the electrodes, you would not complete the electrical circuit and not get shocked.

WARNING: Touching any electrode is not recommended. Unless all conductive objects you come into contact with are connected to the same electrode, you will be shocked to find a current path that is not obvious, (e.g., the water or the boat).

Preventing electrical shock means preventing electrical current from entering and flowing through parts of the body. The skin is a partial but variable barrier, because it offers resistance to the passage of electrical current. Tough skin has more resistance than tender skin, and dry skin more than wet skin. But tough dry skin alone does not offer enough protection for electrofishing. Rubber lineman's gloves, rated 5,000V minimum should always be worn.

Even while wearing rubber gloves and waders, never touch an electrode while the circuit is energized. Do not work on electrical system while the generator is running. Do not enter the water while the current is on during boom shocking operations.

A severe electrical shock from electrofishing gear may result in the need for artificial respiration; therefore it is imperative that no one ever works alone.

8.28.4 Backpack Safety

- Before each operation, check that the frame emergency release is in working order and check that the tilt switch shuts off power if the unit is tipped more than 55 degrees forward.
- Wear hip boots or chest-high waders, with non-skid soles.
- Wear polarized sunglasses to help you detect sub-surface hazards and obstacles. Beware of turbid water that can hide unseen subsurface obstacles and sudden drop-offs.
- Shut off your electrofisher before entering or leaving a stream.
- Do not operate an anode pole when carrying a backpack unit weighing more than 20 pounds (9 kg) when in hazardous conditions.
- If you get water in your boots, waders, or gloves, stop work immediately and get dry clothing.
- Operate slowly and carefully. Footing in most streams is poor, and most falls often occur when operators are in a hurry.

8.29 Excavation Activities

(Reference CH2M SOP HSE-307, Excavation and Trenching Safety)

The requirements in this section shall be followed whenever excavation is being performed. Refer to the Earthmoving Equipment section and SOP for additional requirements applicable to operating/oversight of earthmoving equipment. Below are the hazard controls and safe work practices to follow when working around or performing excavation. Ensure the requirements in the referenced SOP are followed.

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- If the project site is suspected of munitions or explosives of concern (MEC) contamination, requirements of the *Explosives Usage and Munitions Response (MR)* SOP HSE-610 shall be followed. MECs include material potentially presenting an explosive hazard (MPPEH), discarded military munitions, materials that present a potential explosive hazard, chemical warfare materials, munitions constituents, and contaminated soil or groundwater. “Down-hole” avoidance support may be required to prevent accidental contact with MPPEH. Safety requirements will be based on the risk assessment identified within the MR (safety) ORE (Opportunity Risk Evaluation).
 - Do not enter the excavations unless completely necessary, and only after the excavation competent person has completed their daily inspection and has authorized entry. An inspection shall be conducted by the competent person prior to the start of work, as needed throughout the shift, after every rainstorm, and after any hazard increasing occurrence. Documentation of the inspection must be maintained onsite at all times.
 - Follow all excavation entry requirements established by the excavation competent person and any excavation permit being used.
 - Sloping, benching, shoring, shielding, or other protective systems are required to protect personnel from cave-ins except when the excavation is made entirely in stable rock or is less than 5 feet deep (1.5 meters) and there is no indication of possible cave-in, as determined by the excavation competent person. Protective systems for excavations deeper than 20 feet (6.1 meters) must be designed or approved by a registered professional engineer.
 - Trenches greater than 4 feet (1.2 meters) deep shall be provided with a ladder, stairway, or ramp positioned so that the maximum lateral travel distance is no more than 25 feet (7.6 meters).
 - The atmosphere of excavations greater than 4 feet (1.2 meters) deep shall be tested prior to entry when a hazardous atmosphere exists or could reasonably be expected to exist, such as excavating landfills, hazardous waste dumps; or areas containing sewer or gas utility systems, petroleum distillates, or areas where hazardous substances are stored nearby.
 - Spoil piles, material, and equipment must be kept at least 2 feet (61 centimeters) from the edge of the excavation, or a retaining device must be used to prevent the material from falling into the excavation.
 - Excavations shall not be entered when:
 - Protective systems are damaged or unstable;
 - Objects or structures above the work location may become unstable and fall into the excavation;
 - The potential for a hazardous atmosphere exists, unless the air has been tested and found to be at safe levels; or
 - Accumulated water exists in the excavation, unless precautions have been taken to prevent excavation cave-in.
 - The excavation self-assessment checklist shall be used to evaluate excavations prior to entry.

Excavation Operations

Refer to the Excavation Entry section when entering excavations controlled by other parties. When CH2M performs the excavating, a CH2M excavation competent person will oversee all excavation operations and entry into excavations. The competent person shall:

- Complete the CH2M Excavation Permit to ensure HSE requirements have been satisfied during excavation activities;

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- Complete the CH2M Daily Excavation Inspection Checklist to ensure HSE requirements have been satisfied, document that an inspection has been conducted, and to authorize entry into the excavation. A new Checklist shall be completed each day, authorizing excavation entry. Inspections should be continued as needed throughout the work shift, and after any event that could increase the potential for cave-in (e.g., rainfall); and
 - Conduct daily safety briefings prior to excavation entry.

8.30 Fall Protection Activities

(Reference CH2M, SOP HSE-308, *Fall Protection*)

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are exposed to unprotected heights. Ensure the requirements in the referenced SOP are followed.

- Fall protection systems must be used to eliminate fall hazards when performing construction activities at a height of 6 feet (1.8 meters) or greater and when performing general industry activities at a height of 4 feet (1.2 meters) or greater.
- CH2M staff exposed to fall hazards must complete initial fall protection training by completing either the CH2M 10-Hour Construction Safety Awareness training course or the Fall Protection computer-based training module. Staff must also receive project-specific fall protection training using the fall protection evaluation form attached to the project safety plan. Staff shall not use fall protection systems for which they have not been trained.
- The SC or designee must complete the Project Fall Protection Evaluation Form and provide project-specific fall protection training to all CH2M staff exposed to fall hazards.
- The company responsible for the fall protection system shall provide a fall protection competent person to inspect and oversee the use of fall protection system. CH2M staff shall be aware of and follow all requirements established by the fall protection competent person for the use and limitation of the fall protection system.
- When CH2M designs or installs fall protection systems, staff shall be qualified as fall protection competent persons or work directly under the supervision of a CH2M fall protection competent person.
- When horizontal lifelines are used, the company responsible for the lifeline system shall provide a fall protection qualified person to oversee the design, installation, and use of the horizontal lifeline.
- Inspect personal fall arrest system components prior to each use. Do not use damaged fall protection system components at any time, or for any reason. Fall protection equipment and components shall be used only to protect against falls, not to hoist materials. Personal fall arrest systems that have been subjected to impact loading shall not be used. SC shall periodically inspect CH2M fall protection equipment using the Fall Protection Inspection Log form.
- Personal fall arrest systems shall be configured so that individuals can neither free-fall more than 6 feet (1.8 meters) or contact any lower level.
- Only attach personal fall arrest systems to anchorage points capable of supporting at least 5,000 pounds (2,268 kg). Do not attach personal fall arrest systems to guardrail systems or hoists.
- Rescue support shall be provided when personnel are not capable of rescuing themselves in the event of a fall. The emergency rescue requirements will be included in the Activity Hazard Analysis (AHA) for associated task(s) requiring the fall arrest system.

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- Remain within the guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted. Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders to increase working height on top of platforms protected by guardrails.
 - Only one person shall be simultaneously attached to a vertical lifeline and shall also be attached to a separate independent lifeline.

8.31 Flight Line Safety

Always assume that the airfield is active. An active airfield means there is the possibility, even if an area is “closed”, that aircraft or other vehicles will need access on or through a work area. There is always the potential for an incursion. If in an area of the airfield where radio contact with the control tower is required, the potential for miscommunication exists. Any mistake in communication has the potential to cause a problem with Air Operations. When maneuvering on the airfield, there are fuel trucks, helicopter rotors, jet blast, etc., all of which are potential hazards for workers. Pilots of aircraft do not expect workers to be on the airfield. If equipment is not properly marked, it may go unnoticed by pilots and present the potential for an incursion.

An aircraft always has the right of way. When working in a confined area that is “closed” to traffic, outline the work area with traffic cones or barricades that will provide a warning to other airfield traffic. This will also serve to keep vehicles from running through wet paint. Have one person designated as the point of contact who will be responsible for monitoring the radio and communicating with the control tower. That person shall be properly trained in the use of the radio, and check in daily with Air Operations to confirm work areas. Properly train workers to be aware of airfield operations going on around them, to give way to all moving aircraft, to allow great distances from aircraft, parked or running, when maneuvering on airfield.

It is inherent upon the contractor to be visible to everyone operating on the airfield. Orange and white checkered flags, flashing amber beacons, cones and/or barricades should be in good condition and clearly visible.

Speed limits on airfield area are enforced. Speed limits on an airfield are very low relative to speeds on the roads. Speeding on the airfield can lead to a possible incursion. Restricted areas, particularly on a military installation, must be strictly enforced. They are usually outlined with a red line and often have certain “Entry Control Points” painted along the red line where entry into the area is permitted. Entry into the restricted area without permission may subject the workers to arrest.

There are safety areas around runways on the airfield. All equipment and materials must be stored behind these areas. If a crew working on the runway is instructed to clear the runway, all workers and equipment must be moved beyond the safety area until given clearance by the control tower to return to the runway.

8.32 Forklift Operations

(Reference CH2M, SOP HSE-309, *Forklifts*)

Below are the hazard controls and safe work practices to follow when working around or operating forklifts. Ensure the requirements in the referenced SOP are followed.

- Forklift operators are prohibited from using any wireless device while operating forklifts. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- A rated lifting capacity must be posted in a location readily visible to the operator.
- A forklift truck must not be used to elevate employees unless a platform with guardrails, a back guard, and a kill switch is provided on the vehicle. When guardrails are not possible, fall arrest protection is required.
- The subcontractor operating the forklift must post and enforce a set of operating rules for forklift trucks.
- Only certified forklift operators shall operate forklifts.

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- Stunt driving and horseplay are prohibited.
 - Employees must not ride on the forks.
 - Employees must never be permitted under the forks (unless forks are blocked).
 - The driver must inspect the forklift once a shift and document this inspection.
 - The operator must look in the direction of travel and must not move the vehicle until all persons are clear of the vehicle.
 - Forks must be carried as low as possible.
 - The operator must lower the forks, shut off the engine, and set the brakes (or block the wheels) before leaving the forklift operator's position unless maintenance or safety inspections require the forklift to be running.
 - Trucks must be blocked and have brakes set when forklifts are driven onto their beds.
 - Extreme care must be taken when tilting elevated loads.
 - Every forklift must have operable brakes capable of safely stopping it when fully loaded.
 - Forklifts must have parking brakes and an operable horn.
 - When the operator is exposed to possible falling objects, industrial trucks must be equipped with overhead protection (canopy).
 - If using certified CH2M forklift operators—forklifts must be inspected and documented daily using the forklift inspection form.

8.33 Groundwater Sampling/Water Level Measurements

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are performing groundwater sampling and/or water level measurements.

- Full coolers are heavy. Plan in advance to have two people available at the end of the sampling effort to load full coolers into vehicles. If two people won't be available use several smaller coolers instead of fewer large ones.
- Wear the appropriate PPE when sampling, including safety glasses, nitrile gloves, and steel toe boots (see PPE section of the project safety plan).
- Monitor headspace of wells prior to sampling to minimize any vapor inhalation (refer to the "Site Monitoring" section of the project safety plan).
- Use caution when opening well lids. Wells may contain poisonous spiders and hornet or wasp nests.
- Use the appropriate lifting procedures (see CH2M SOP HSE-112) when unloading equipment and sampling at each well.
- Avoid sharp edges on well casings.
- If dermal contact occurs with groundwater or the acid used in sample preservation, immediately wash all affected skin thoroughly with soap and water.
- Avoid eating and drinking on site and during sampling.
- Use ear plugs during sampling if sampling involves a generator.
- Containerize all purge water and transport to the appropriate storage area.

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- Use two people to transport full coolers/containers whenever possible. If two people are not available use a dolly to move coolers. If the coolers weigh more than 40 pounds Attachment 1 of the HSE-112, *Manual Lifting*, shall be completed by the SC. If the coolers weigh more than 50 pounds they should never be lifted by one person.

8.34 Hand and Power Tools

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

Hands are one of the most complex parts of the body. Every employee uses their hands to help them make a living. There are more on-the-job injuries to hands than any other body part.

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.

General

- Always select the right tool for the job;
- Keep cutting tools sharp—less force will be needed for the cut. Do not use pocket knives—only safety cutting tools and if using these be sure to comply with the “Knife Use” section of this Handbook;
- Carry and store tools correctly and never put sharp or pointed tools in your pocket or belt;
- Tools shall be inspected prior to use and damaged tools will be tagged and removed from service;
- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials; and
- Tools used in an explosive environment must be rated for work in that environment (that is, intrinsically safe, spark-proof, etc.).
- Employees shall be trained on the “line of fire” hazards associated with operating power tools, how to look after their hands and body, and avoid pinch points or crush points. This may be accomplished by completing the Hand Safety training on the VO and reviewing the task-specific hazards and control measures in the Activity Hazard Analysis (AHA).

Hand and Power Tools

- Hand and power tools will be used for their intended use and operated in accordance with manufacturer’s instructions and design limitations;
- Screwdrivers are one of the most used and abused tools, never:
 - Hammer with a screwdriver
 - Use as a pry bar
 - Use with a broken handle
 - Use with worn out tips
- Maintain all hand and power tools in a safe condition;
- When possible, use power tools over hand tools. Powered tools tend to require less exertion and reduce repetitive motion. Be sure that the weight of a powered tool (and cording) does not create additional force issues.
- Whenever possible, select tools that use a full-hand power grip rather than a precision finger grip. The greater the efforts to maintain control of a hand tool, the higher the potential for injury. A compressible gripping surface rather than hard plastic should be used.

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- Avoid repetitive trigger-finger actions. Select tools with large switches that can be operated with all four fingers.
 - When possible, use tools with extension handles that let you stand up while performing a floor-level task (extension handles must be manufacturer-approved)
 - To lessen vibration:
 - Pad tool handles with a soft compressible surface
 - Use vibration damping (gel filled) gloves
 - Select tools (hammers and chippers) with built in damping systems (springs/hydraulics)
 - Maintain straight wrists. Avoid bending or rotating the wrists; a variety of bent-handle tools are commercially available.
 - Avoid static muscle loading. Reduce both the weight and size of the tool. Do not raise or extend elbows when working with heavy tools.
 - 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;
 - If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer's specifications; and

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; and
- 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.

8.35 Haul Trucks

Below are the hazard controls and safe work practices to follow when working around or operating haul trucks:

- Haul truck operators are prohibited from using any wireless device while operating trucks on site. Trucks must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- Haul truck operators should be familiar with their equipment and inspect all equipment before use;

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- Haul truck operators should ensure all persons are clear before operating truck or equipment. Before moving operators should sound horn or alarm, all equipment should be equipped with a working back up alarm;
 - Haulage trucks or equipment with restricted visibility should be equipped with devices that eliminate blind spots;
 - Employees should stay off haul roads. When approaching a haul area, employees should make eye contact and communicate their intentions directly with the equipment operator;
 - If possible minimize steep grades on haul roads;
 - Where grades are steep provide signage indicating the actual grade as well as measures for a runaway truck;
 - Trucks are to be operated within the manufacturer's recommendations (for example- retarder charts indicate the combination of loads, grades and speeds that should not be exceeded if the truck's retarder is to work properly – to ensure the truck does not descend grade at speeds greater than listed);
 - Haul roads should be well lit, sufficiently wide (at least 50 percent of the width of the equipment on both sides of road) and equipped with reflectors to indicate access points;
 - Haul roads should have adequate right-of-way signs indicating haul directions;
 - Haul trucks will follow designated haul roads; and
 - Haul trucks will comply with posted speed limits.

8.36 Hoists

(Reference CH2M SOP HSE-315, *Hoists*)

- Below are the hazard controls and safe work practices to follow when working around or operating hoists. Ensure the requirements in the referenced SOP are followed.
- Manufacturer's specifications and limitations applicable to the operation of material hoists shall be followed. Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a professional engineer competent in the field.
- Rated load capacities, recommended operating speeds, and special hazard warnings or instructions shall be posted on hoists.
- Hoisting ropes shall be installed in accordance with the wire rope manufacturer's recommendations.
- The installation of live booms on hoists is prohibited.
- Operating rules shall be established and posted at the operator's station of on hoists.
- No person shall be allowed to ride on material hoists except for the purposes of inspection and maintenance.
- All entrances of the hoistways shall be protected by substantial gates or bars, which guard the full width of the landing entrance.
- Overhead protective coverings of 2-inch planking, ¾-inch plywood, or other solid material of equivalent strength, shall be provided on the top of every material host cage or platform.
- All hoistway entrance bars and gates shall be painted with diagonal contrasting colors, such as black and yellow.

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- A qualified hoist operator will operate, inspect, maintain and oversee all hoist operations. The SC or designee shall verify hoist operator qualifications (e.g., operator to provide for the type of hoist being operated—years of experience, training, background).
 - CH2M employees who are required to operate hoists shall read the hoist manufacturer’s operations and maintenance manual, be evaluated and approved as qualified hoist operators. The CH2M may require operators to complete separate hoist operations training, provided by commercial training specialists.

8.37 Hydrogen Sulfide

Hydrogen sulfide (H₂S) is a colorless, toxic, and flammable gas responsible for the odor of rotten eggs. It often results from the bacterial break down of organic matter in the absence of oxygen, such as in sewers. It also occurs in gases, natural gas and in well waters. H₂S may be produced during the biological process when biological substrates are used to expedite the remediation process.

Chemical Properties

Hydrogen sulfide is heavier than air and may travel along the ground. It collects in low-lying and enclosed, poorly-ventilated areas such as basements, manholes, sewer lines, and underground telephone vaults. For work within confined spaces, use appropriate procedures for identifying hazards, monitoring and entering confined spaces (see Confined Space Entry section of this Handbook or the project safety plan). Additionally, H₂S is a highly flammable gas and gas/air mixtures can be explosive. It may travel to sources of ignition and flash back. If ignited, the gas burns to produce toxic vapors and gases, such as sulfur dioxide.

Routes of Exposure and Exposure Limit

The primary route of exposure to H₂S is inhalation, and the gas is rapidly absorbed by the lungs. Absorption through the skin is minimal. People can smell the “rotten egg” odor of H₂S at low concentrations in air. However, with continuous low-level exposure, or at high concentrations, a person loses his/her ability to smell the gas even though it is still present; this is called olfactory fatigue. This can happen very rapidly and at high concentrations, the ability to smell the gas can be lost instantaneously. Therefore, DO NOT rely on your sense of smell to indicate the continuing presence of H₂S or to warn of hazardous concentrations.

About half of the population can smell H₂S at concentrations as low as 0.5 parts per billion (ppb) in air, and more than 90 percent can smell it at levels of 50 ppb. At higher concentrations H₂S rapidly deadens the sense of smell. For most people, this occurs at approximately 150 ppm.

The American Conference of Governmental Industrial Hygienists (ACGIH) 8-hr time-weighted average (TWA) exposure limit for H₂S is 1 ppm; the 15-minute short term exposure limit (STEL) is 5 ppm.

The Immediately Dangerous to Life or Health (IDLH) in air is 100 ppm. Exposure to 500 ppm can be fatal in a few breaths. Exposure to 1000 ppm is fatal.

Effects on the Body

Hydrogen sulfide is both an irritant and a chemical asphyxiant with effects on both oxygen utilization and the central nervous system. Its health effects can vary depending on the level and duration of exposure. Low concentrations irritate the eyes, nose, throat and respiratory system (e.g., burning/tearing of eyes, cough, shortness of breath). Asthmatics may experience breathing difficulties. The effects can be delayed for several hours, or sometimes several days, when working in low-level concentrations. Repeated or prolonged exposures may cause eye inflammation, headache, fatigue, irritability, insomnia, digestive disturbances and weight loss.

Moderate concentrations can cause more severe eye and respiratory irritation (including coughing, difficulty breathing, and accumulation of fluid in the lungs), headache, dizziness, nausea, vomiting, staggering and excitability.

High concentrations can cause shock, convulsions, inability to breathe, extremely rapid unconsciousness, coma and death.

H₂S as a Project Hazard

Elevated levels of H₂S have not been reported during normal drilling activities, but experience has shown that high levels of H₂S may be present in the well space and in the breathing zone following the injection of emulsified oil, once the biological process has had time to progress. Engineering controls shall be considered to bring the concentrations of H₂S down to an acceptable level in the breathing zone, followed by administrative controls, and respiratory protection.

All employees will receive orientation on the emergency contingency plan for the specific actions to follow when there is an H₂S release from equipment, fire involving H₂S, or medical emergency involving exposure to H₂S.

Air Monitoring

Follow the air monitoring action levels in the project safety plan. If elevated levels of H₂S are encountered, first implement engineering controls to reduce exposures to allowable levels. If that is not possible, then an upgrade in PPE may be required; refer to the PPE section of the project safety plan.

8.38 Ionizing Radiation

In addition to the general requirements below, refer to Section 2.4 “Radiological Hazards and Control” for project-specific information.

- CH2M Policy approval may be required for activities involving radiation; check with the project EM in the project planning stages.
- CH2M employees working onsite must complete the CH2M online Ionizing Radiation Training module available through the Virtual Office.
- Do not enter restricted work areas unless training, medical monitoring, personal monitoring equipment, and PPE requirements established by the radiation protection competent person have been met.
- Know your quarterly dose margin and do not exceed your personal limits.
- Assure personal monitoring devices are worn properly. Always calibrate pocket dosimeters prior to entering and exiting restricted areas.
- Plan activities to minimize exposure (ALARA) and waste generation.
- Limit the amount of potential waste (e.g., packaging, boxes, paperwork, etc.) brought into restricted areas.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in restricted areas.
- Promptly report any condition which may lead to or cause a violation of radiation protection standards.
- Assure radioactive sources, containers, and the area are properly labeled and posted.
- Protective clothing and other exposure controls shall be based on the most recent survey results obtained from the radiation protection competent person.
- Know the emergency evacuation warning signals and be prepared to respond.
- Do not leave radioactive source materials and equipment unattended.

8.39 Lead

(Reference CH2M SOP HSE-508, *Lead*. In Canada, provincial occupational regulations may apply and should be implemented as required.)

CH2M is required to control employee exposure to lead when exposures are at or above 30 µg/m³ by implementing a program that meets the requirements of the OSHA Lead standard, 29 CFR 1910.1025 and 29 CFR 1926.62, or lower if the local regulations are more stringent. The elements of the CH2M lead program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;
- Training on hazards of lead and control measures (includes project-specific training and the computer-based training on CH2M's Virtual Office, *Lead Exposure Training*); and
- Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.40 Lockout/Tagout Activities

(Reference CH2M SOP HSE-310, *Lockout and Tagout*)

Lockout/tagout (LO/TO) shall be performed whenever service or maintenance is necessary on equipment that could cause injury to personnel from the unexpected equipment energizing or start-up or unexpected release of stored energy. Energy sources requiring lockout/tagout may include electrical, pneumatic, kinetic, and potential.

If work on energized electrical systems is necessary—contact the RHSM. Specific training and procedures are required to be followed before any work on energized electrical systems can be performed and are NOT covered in this section. Energized electrical work is defined as work performed **on or near** energized electrical systems or equipment with exposed components operating at 50 volts or greater. Working near energized live parts is any activity inside a Limited Approach Boundary (anywhere from 3.5 feet to 24 feet [1 meter 7.3 meters] depending on voltage). Examples of energized electrical work include using a voltmeter to troubleshoot electrical systems and changing out controllers.

When lockout/tagout is necessary to perform maintenance/repair of a system, all the requirements of SOP HSE-310, Lockout and Tagout, shall be met including the following bulleted items:

- When CH2M controls the work, CH2M must verify that subcontractors affected by the unexpected operation of equipment develop a written lockout/tagout program, provide training on lockout/tagout procedures and coordinate its program with other affected subcontractors. This may include compliance with the owner or facility lockout/tagout program.

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- When CH2M personnel are affected by the unexpected operation of equipment they must complete the electrical safety awareness module on the VO. Authorized personnel shall inform the affected personnel of the LO/TO. Affected personnel shall not tamper with LO/TO devices.
 - Standard lockout/tagout procedures include the following six steps: 1) notify all personnel in the affected area of the lockout/tagout, 2) shut down the equipment using normal operating controls, 3) isolate all energy sources, 4) apply individual lock and tag to each energy isolating device, 5) relieve or restrain all potentially hazardous stored or residual energy, and 6) verify that isolation and deenergization of the equipment has been accomplished. Once verified that the equipment is at the zero energy state, work may begin.
 - All safe guards must be put back in place, all affected personnel notified that lockout has been removed and controls positioned in the safe mode prior to lockout removal. Only the individual who applied the lock and tag may remove them.
 - CH2M authorized employees shall complete the LO/TO training module on the VO and either the electrical safety training module on the VO or 10-hour construction training. The authorized employee must also be trained and qualified on the system they are working on (e.g., qualified electrician for working on electrical components of a system).
 - When equipment-specific LO/TO procedures are not available or when existing procedures are determined to be insufficient, CH2M authorized employees shall also complete the Equipment-Specific LO/TO Procedure Development Form, provided as an attachment to the SOP, to create an equipment-specific lockout/tagout procedure. Each lockout/tagout event shall be recorded on the Logout/Tagout Log (Attachment 4 of SOP HSE-310) to manage work and identify every point where locks and tags are applied.

8.41 Avoidance of Munitions and Explosives of Concern (MEC) and/or Materials Potentially Presenting an Explosive Hazard (MPPEH)

(Reference CH2M, SOP HSE-610, Explosives Usage and Munitions Response)

If work will be conducted on a government/military facility or ex-government/military facility; area currently or previously used as a range; or if military munitions, MEC, or material potentially presenting an explosive hazard (MPPEH) are associated with the scope of work or location immediately contact the CH2M Central Point of Contact for Explosives Usage and Munitions Response. The following will be required prior to any field work:

- Setting up a conference call with all required personnel to conduct a basic safety risk assessment over the phone.
- Providing written directions detailing job-specific requirements and what actions to take to ensure safety during the work.
- “3R Training” will be required for all affected project personnel. This training teaches personnel to Recognize, Retreat, and Report.

8.42 Marijuana Cultivation Sites

Marijuana grow sites are illegal on public lands, but are becoming more common. These sites may be encountered when working in undeveloped or “back country” areas. These sites pose risks to workers, the public, and the environment and are most often associated with organized crime. The potential for violent confrontations is high.

Most marijuana grow sites have someone always watching the site. Even unattended sites pose a significant risk. Recognize the signs of marijuana cultivation sites, and if you think you are near one, be quiet and leave the area immediately.

How to recognize a cultivation site:

- Sometimes marijuana smells like a skunk on hot days.
- Hoses or drip lines (made of black or white PVC piping or rubber hose) located in unusual or unexpected places.
- Discarded containers of herbicides, pesticides or other chemicals. A variety of chemicals for pest and animal control, including chemicals that may be so hazardous they are illegal in the United States are sometimes encountered.
- A well-used trail where there shouldn't be one.
- People standing along roads without vehicles present, or in areas where loitering appears unusual.
- Grow sites are usually found in isolated locations, in rough steep terrain. Look for signs of cultivation, cleared vegetation, soil disturbance.
- Food cached near trailheads or alongside roads.
- Sights or sounds of human activity in remote forest areas.
- Camps containing cooking and sleeping areas with food, fertilizer, weapons, garbage, rat poison, and/or dead animals.
- Small propane bottles, used to avoid the detection of wood smoke.
- Individuals armed with rifles outside of hunting season.
- Paper cups, chicken wire or plastic sheets used for starting and protecting plants.

As soon as you become aware that you have come upon a cultivation site, leave the way you came in immediately and make as little noise as possible. Never engage the growers as these are extremely dangerous people. If you can identify a landmark or it is helpful for authorities, but put your own safety first. The growers may be present and may or may not know that you have found their grow site. Get to a safe place and report as much detail about the location and incident as you can recall to authorities. Ensure you contact the RHSM and Project Manager as soon as possible.

Other precautions to take include:

- Check with local law enforcement officers to see whether they know of any dangers or concerns in the area where you will be working.
- Establish and follow check-in and checkout procedures every day.
- Make sure your supervisor and the dispatch office know where you will be working.
- If necessary, agree on a phrase that you would use to let your co-workers (SC, RHSM, or PM) know you are in danger and need law enforcement assistance immediately at your last known location.
- Make sure you have a working communication device.
- Use the buddy system. Work in pairs.
- Park your vehicle so it's pointing in the direction of escape.

8.43 Methane (as a Product of Injection Activities)

Methane is a colorless, odorless gas with a wide distribution in nature. Methane is created when organic matter decomposes (rots) without any oxygen present ("anaerobic" decomposition) and is common in landfills, marshes, septic systems and sewers.

Methane may be produced as a by-product of the biological process when biological additives are used in a remediation process (such as when emulsified oil is injected to enhance dechlorination of contaminated groundwater).

Experience has shown that methane may be present in the well space following the injection of emulsified oil, once the biological process has had time to progress. This needs to be considered when returning to collect ground water samples. Although methane degrades Engineering controls shall be considered to bring the concentrations of methane down to an acceptable level in the breathing zone.

Methane is a “simple asphyxiant,” which means that it can displace available oxygen. Methane is combustible and mixtures of methane with air are explosive within the range 5-15 percent by volume of methane (the lower and upper explosive limits). At room temperature, methane is lighter than air, so in an outdoor environment, it tends to dissipate.

Methane is not toxic when inhaled, but it can produce suffocation by reducing the concentration of oxygen inhaled. When exposed to concentrations high enough to displace oxygen, you may experience dizziness, deeper breathing, possible nausea and eventual unconsciousness.

The primary danger is from fire and explosion, so ensure that you work in a well-ventilated area, and that there is no source of ignition present. Use spark-proof tools and intrinsically safe equipment, if necessary. If working in a confined space, make sure that appropriate controls are in place and follow an approved permit-required confined space entry plan.

8.44 Methane (as Landfill Gas or Shale Formations)

Landfill gas is normally made up of 50 percent methane and 50 percent carbon dioxide

Shale formations can produce methane that has the potential to be released during drilling or groundwater sampling.

Other constituents have been found in the landfill gas. These may include hydrogen sulfide, tetrachloroethene, ethyl benzene, toluene, and xylenes. Refer to the project health and safety plan for additional information on these constituents when this hazard is part of your work.

- Continuous monitoring is required when performing intrusive activities (e.g., excavation, drilling) in a methane area. This includes refuse and any cover material.
- Monitoring will be conducted with oxygen/combustible gas meters.
- All instruments will be calibrated according to manufacturer’s specifications. Instruments will be calibrated at the frequency specified by the manufacturer.
- Ventilation is the primary control to reduce the fire potential from methane. The action required for ventilation include:
 - Natural Ventilation – If the wind speed across the bore hole or sampling apparatus is over 5 mph (8 kph) then natural ventilation is sufficient. Equipment and personnel must be located upwind of the potential methane source to prevent any ignition source from contacting methane in air.
 - Forced Ventilation – If the wind speed across the bore hole or sampling apparatus is less than 5 mph (8 kph) then forced ventilation is required. Large air movers are preferable but standard ventilation fans may be used if the air flow is directed to the bore hole or the location in the sampling apparatus where the methane first encounters open air.

8.45 Methylene Chloride

(Reference CH2M SOP HSE-509, *Methylene Chloride*. In Canada, provincial occupational regulations may apply and should be implemented as required.)

Methylene chloride has a faint, sweet odor which is not noticeable at dangerous concentrations. Methylene chloride is shipped as liquefied compressed gas and will cause frostbite on contact.

CH2M is required to control employee workplace exposure to methylene chloride when personal exposures are at or above 12.5 parts per million (ppm) as an 8-hour time-weighted average (TWA) or above 125 ppm short-term exposure limit (STEL) by implementing a program that meets the requirements of SOP HSE-509, the OSHA Methylene Chloride standard, 29 *Code of Federal Regulations* (CFR) 1910.1052, or local regulation if more stringent. The elements of the CH2M methylene chloride program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;
- Training on hazards of methylene chloride and control measures (includes project-specific training and the computer-based training on CH2M's Virtual Office, *Methylene Chloride*) and;
- Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person;
- Appropriate air-supplied respirators must be used when methylene chloride exposures exceed PEL or STEL;
- Air supplied to respirators must meet Grade D breathing air requirements; and
- Review the fact sheet included as an attachment to the SOP.

8.46 Naturally Occurring Radiation Materials (NORM)

Naturally Occurring Radiation Materials (NORM) is found in the earth's crust, soil, plants and many living organisms. The geologic formations that contain oil and gas deposits also contain NORM, commonly consisting of the elements of uranium, radium, thorium and their associated decay products. If present, these radio nuclides dissolve in water and can be bound into the scale deposited in production equipment handling produced water. Radon gas follows the propane/ethane streams of produced (natural) gas and the radon gas byproducts (radon daughters) can be deposited on the inside surfaces of gas handling equipment. Land can be contaminated with NORM from descaling operations, contaminated sludges, and/or residual from produced water.

Equipment that can contain NORM-contaminated scale includes equipment associated with the separators (separate gas from the oil and water) and heater treaters (divide the oil and water phases) such as flowlines, pumps, valves, and piping (especially transition pieces such as elbows and reducer) and filters.

Gas processing equipment can also be contaminated with NORM (radon daughters). This contamination, unlike scales, can be in the form of an invisible film inside gas equipment and can only be detected by internal surveying with appropriate instrumentation.

Natural gas liquid equipment can also be contaminated by radon in the gas. Sludges accumulated in this equipment may contain the heavy metal radon daughters that have attached to dust and other particles that become part of the sludge.

While NORM has generally been associated with exploration and production activities, there is some industry experience to indicate that some refinery process equipment can also be contaminated with NORM, including natural gas stream equipment, crude tank bottoms, desalters, overhead atmospheric pipestill equipment, and exchanger deposits/sludge.

Hazards of NORM

NORM generally does not present an external radiation (Gamma) hazard to employees working around closed process equipment. This is particularly the case with NORM associated with scale inside equipment handling production water due to attenuation by the scale and steel pipe wall. Recent field experience, however, indicates that some in-service gas processing equipment, particularly valves, elbows, or transition piping pieces, may have fairly high external Gamma radiation levels. If gas-processing equipment is out of service for more than 4 hours, external Gamma measurements will not detect internal accumulation of the radon daughters.

Work procedures are recommended when maintaining NORM contaminated equipment such as pipelines, filters, pumps, lines, sludge or wellhead equipment. The exposure risk is highest when grinding, cutting, polishing, or performing other work that may generate dust. These dusts present inhalation hazards that result in internal exposures to radioactive material.

- Radium, radon, and their decay products are radioactive elements of concern in petroleum production and gas processing. Exposure may occur when contaminated dusts and sludge are inhaled or ingested (internal exposure) or when radiation from surrounding equipment strikes the body (external exposure).
- Radium is found in most oil and gas fields in the world in varying concentrations. There is potential to find radium in significant amounts in almost all types of equipment. Radon is found in most natural gas deposits in the world.
- Radon itself does not present a health hazard because it is not easily absorbed into the body and is quickly cleared when absorbed.
- Radon's radioactive breakdown products, called radon "daughters," may be hazardous. Radon naturally breaks down into radioactive metals before becoming non-radioactive lead.
- Radon daughters may be inhaled or ingested when attached to scale or dust generated during equipment inspection and repair. Radon daughter overexposure has been associated with an increased risk of lung cancer.

NORM Hazard Control Measures

- For operations where NORM is a potential hazard, a qualified individual (s) will be assigned for implementing radiological protection of employees, members of the public, and the environment.
- Surveys and monitoring must be conducted to evaluate the potential radiological hazards. The surveys must include measurements for radiation levels based on the concentrations or quantities of radioactive material, along with any other measurements or evaluations necessary to characterize the potential radiological hazards that could be present.
- Equipment contaminated with NORM must be labeled.
- Gas processing equipment should be opened to allow gas to escape, and allowed to stand idle for at least 4 hours prior to any entry.
- Water washing of any equipment prior to entry is recommended when practical.

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- Personal protective equipment (PPE) must be selected based on the hazards (both radiological and non-radiological) work activities to be conducted, and the contamination levels in the work area,
 - Level D PPE must be worn to minimize skin contact with NORM such as gloves and appropriate body protection. Disposable clothing such as TYVEK is preferred since NORM contaminated clothing should be laundered.
 - Level C PPE using full-face air-purifying respirator with high efficiency particulate air (HEPA filters) must be worn if dust exposure is expected.
 - Do not sand, grind, cut, or weld on surfaces contaminated with NORM without appropriate cleaning. Equipment should be resurveyed after cleaning prior to these activities.
 - NORM-contaminated equipment or material should not be shipped offsite for repair or disposal without first contacting the designated NORM coordinator (may be the RHSM and/or REM)

8.47 Mower, Brush Hog and Weed Trimmer Safety

Below are hazard controls and safe work practices to follow when personnel or subcontractors are working near or using mowers, brush hogs and weed trimmers. The brush hog is a dangerous machine that will throw rocks and debris long distances at speeds that can and have caused significant injury. It can also become entangled in rope, wire or other objects that can endanger workers in the vicinity.

Ensure that the following requirements are followed

Mower/Brush Hog

- Meet with the brush hog or mower crew during the safety tailgate meeting and immediately prior to operations to ensure all personnel understand the signal that indicates when the operator will operate the brush hog.
- Conduct a sweep of the area where the brush hog or mower is scheduled to cut vegetation and 100-foot buffer prior to mower, brush hog, masticator and trimmer operations for loose debris, rocks, logs, foreign objects, wire, rope, fencing, etc. that could present a safety hazard.
- Restrict other workers and oversight activities to 300 feet outside the staked limits of the work area while brush clearing equipment is operating.
- Workers should position themselves 180 degrees towards the rear of the mower, always maintaining >300 feet from the edge the area being cleared by the mower.
- Minimum PPE Requirements – leather boots with safety toes, safety glasses, leather gloves, hard hat, long pants, and high visibility vest.
- The equipment operator must read the owner’s manual prior to operating the equipment.
- Make all necessary adjustment prior to turning on the equipment.
- Practice operation in an open area.
- Make sure all protective guards are in place. Never remove guards.
- Determine that steering is responsive before beginning a job.
- Test the brakes.
- Clean the steps and operating platform to prevent slipping.
- Ensure that tires are properly inflated.
- Only the operator should be riding on the equipment, no passengers are allowed.
- When leaving the seat, the operator should disengage the Power Take Off (PTO), engage the brake, stop the engine, and wait for all parts to stop before dismounting.

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- The operator should not adjust any mechanism of the equipment while the mower is running, making sure all parts have stopped moving prior to making any adjustments.
 - When driving between mowing jobs, crossing a road, path or sidewalk, or when not using the mower, the operator should disengage the PTO to stop the mower blade.
 - Operators should not mow in conditions where traction or stability is questionable. If uncertain, test drive a section with the PTO off.
 - Never refuel equipment while the engine is running or extremely hot. A fire or explosion could result.
 - Maintain a fire extinguisher nearby.
 - When mowing on uneven ground follow these rules:
 - Reduce the travel speed so that you can see and react to hazards in your path. Overturns are four times more likely to occur when the speed is doubled.
 - Be on the alert for holes and ditches covered by grass or debris. A wheel may drop and cause an overturn.
 - Drive up and down a hill, not across.
 - Do not stop when going uphill or downhill. If the mower stops going uphill, turn off the PTO and back down slowly.
 - Do not try to stabilize the mower by putting your foot on the ground.

Weed Trimmer

- Wear snug, tight-fitting equipment while operating the weed trimmer or tri-blade. Retain long hair or any other loose items or clothing.
- Inspect guard/shield and ensure it is securely in place.
- Do not change string with equipment running. Turn off equipment before removing any jams.
- When cutting, keep spinning string low and maintain control.
- Never operate the weed trimmer one handed; hold with both hands with thumbs opposed to direction of other fingers, using a firm grip to prevent losing grip if the tool kicks back or bucks.
- Start cutting in a position so that it is off to the side of your body, so that if the tool bucks it doesn't come back up into your body.
- Inspect brush/weeds for any objects that could become a harmful projectile.
- Clear area of people and vehicles; minimum of 100 feet safe zone.

8.48 Off-Road Driving Safety

- Whenever possible, use only paved roads when there is a choice between un-improved roads and paved roads.
- On a project by project basis, conduct an assessment based on the degree of hazard, driving route, and location, determine whether an In Vehicle Monitoring System (IVMS) is required when driving alone in remote areas (Refer to Working Alone Core Standard). Also consider what will be used for communication when in remote areas (e.g., satellite phone, InReach device).
- When four-wheel drive (off-road) roads are used, personnel shall be experienced in off-road driving.
- Plan access routes prior to setting out. Obtain the most current maps if traveling on federal lands.
- Prepare an emergency kit with extra clothes, food, water, batteries, flashlight, and other items that may be needed if you become stranded.

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- Roads can become slick with mud, may be along cliff sides with no protection, have soft shoulders/erosion, may be narrow, have blind curves, have damage or obstructions in the road. Do not attempt to drive routes you are not comfortable with. Have potential alternate routes identified wherever possible so if a road becomes more dangerous than when you used it before, you can take another road.
 - Carry a compass and/or GPS when traveling to remote areas on rural roads.
 - Before going off-road, inspect the vehicle. Make sure the tires (including the spare) are in good condition and inflated properly. Look under the vehicle for any leaks or mechanical problems. Make sure all fluids are topped off. Check the condition of your steering and brakes.
 - Fill fuel tank before leaving populated areas. Fuel stations may be unavailable for long distances. Carry extra fuel in an approved gas can if you will be a long way from populated areas.
 - Know how the 4x4 system works and how to use the controls before they are needed. Practice using the low ratio gearbox. If the vehicle is equipped with manual locking hubs, test them to ensure they are working properly.
 - Know where the spare tire and jack are located and how to use them.
 - Know and understand the vehicle's dimensions - height, width, length, approach angle, departure angle and ramp angle. Also know where the lowest point of clearance is - usually the differential casing.
 - Keep track of preventative maintenance schedule and keep vehicle up-to-date if being used long-term.
 - Pay attention to how the vehicle is loaded. Loads should be distributed evenly within the vehicle if possible. Loads behind the rear axle will sag the rear of the vehicle, limiting your departure angle and clearance. Excessive loads will change the center-of-gravity, thus making the vehicle less stable.
 - Be time-conscious. What may look like a short trip on the map may take many hours in 4-wheel drive; allow enough time for safe travel.
 - Drive within your ability. If you are not comfortable, do not proceed.
 - Avoid surprises by surveying the road ahead before it is driven, when needed. Get a good idea where to place the tires and have a plan of approach. Follow through beyond the obstacle.
 - Driving diagonally can lead to a rollover. Always drive straight down hills or steep terrain.
 - Avoid driving over obstacles that may cause the vehicle to become stuck. Cross ditches or logs at an angle so that one wheel at a time goes over the obstacle; the other three help the one wheel to climb over. Dropping the tire into a ditch or crack in a rock can put you and your truck in a vulnerable position.
 - When driving on narrow roads and there is no shoulder available for either vehicle to pull over safely, stop. One vehicle should back up until a safe spot is reached. By custom the vehicle closest to the safe shoulder will reverse or, on a steep hill, the vehicle traveling downhill.
 - Do not expect logging trucks, cars with trailers, or other large vehicles to make room for you. Pull over early when you see them coming.
 - Slow down when traversing blind curves, washboard roads, or roads with loose surfaces. Make turns and brake gently to avoid sliding or loss of control.

8.49 PCB/Ballast Handling

Fluorescent lighting used in many older buildings use ballast resistors that contain polychlorinated biphenyl (PCB) oil. PCB is colorless to light-colored, viscous liquid with a mild, hydrocarbon odor.

PCB has been found to cause, irritation eyes; chloracne; liver damage; reproductive effects; and has shown to cause cancer in lab animals.

When work requires the handling or removal of fluorescent ballast resistors, extra care and attention needs to be taken. While ballasts are usually well sealed, it is not uncommon to find a ballast resistor that has leaked. Below are the hazard controls and safe work practices to be followed when PCBs are present.

- A survey must be made to determine whether ballast resistors contain PCB fill.
- Leaking resistors must be identified and handled with appropriated PPE.
- Exposure Routes are inhalation, skin absorption, ingestion, skin and/or eye contact
- Prevent skin contact by using chemical resistant gloves, wear eye protection, and thoroughly wash hands before eating or smoking.
- Ensure eyewash is available.
- In the event of exposure, follow the following First Aid procedures:
Eyes: Irrigate immediately
Skin: Soap wash immediately
Ingestion: Seek medical attention immediately
- Dispose of PCB ballast resistors in accordance with Federal, State and Local environmental regulations.

8.50 Portable Generator Hazards

(Reference CH2M 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.
- Generators rated greater than 5 kilowatts that are not vehicle- mounted need to be grounded in accordance with regulatory and manufacturer requirements. Always refer to the manufacturer grounding requirements for any generator used on site.
- 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.

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- 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.

8.51 Powder-Actuated Tools

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

Below are the hazard controls and safe work practices to follow when working around or using powder-actuated tools. Ensure the requirements in the referenced SOP are followed.

- Only trained personnel are permitted to operate powder-actuated tools. CH2M employees using powder-actuated tools must be trained in the operation of the particular tool in use. Training and certification are provided by the tool manufacturer.
- Inspect and test powder-actuated tools each day before they are loaded per manufacturer's instruction. Remove from service any tool that is not in proper working order.
- Wear appropriate personal protective equipment (eye, face, and hearing protection) when using powder-actuated tools.
- Never point powder-actuated tools at other workers, whether empty or loaded. Tools shall not be loaded until just before use. Never leave loaded tools unattended.
- Do not drive fasteners into very hard or brittle materials such as, cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, or hollow tile.
- Avoid driving fasteners into easily penetrable materials unless backing is provided. Pins or fasteners can otherwise become flying missiles when they pass right through such materials.
- Use powder-actuated tools with the manufacturer's specified guard, shield, or other attachment.
- Do not use powder-actuated tools in explosive or flammable atmospheres.

8.52 Pressure Line/Vessel Systems

- Operate and maintain pressure vessels, pumps and hosing in accordance with the manufacturer's recommendations.
- Do not exceed the rated pressure of the vessels and hosing of the system.
- The system must be provided with a pressure relief valve/controller that safely reduces the system pressure to within the system rated pressure.
- The pressure relief valve must be rated at no more than 110 percent the rated pressure of the system and must be tested at regular intervals.
- Each vessel must be equipped with a functioning pressure gauge to monitor pressure.

8.53 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.
- The operator must maintain good footing.
- 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.

8.54 Process Safety Management

(Reference CH2M SOP HSE-213, *Process Safety Management*)

- All CH2M projects require a systematic evaluation of processes to prevent, or minimize the consequences of, catastrophic releases of toxic, reactive, flammable, or explosive chemicals at or above the specified threshold quantities. In the US, these are listed in Appendix A, List of Highly Hazardous Chemicals, Toxics, and Reactives in OSHA Standard 29 CFR 1910.119, Process Safety Management.
- A Process Hazard Analysis (PHA) is required of all processes covered by PSM.
- Operating procedures shall be developed and implemented that provide clear operating instructions consistent with the process safety information.
- Contractors, whether considered to be CH2M or a subcontractor of CH2M, performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process shall be informed by the client of the known potential fire, explosion, and toxic release hazards related to the contractor work and the provisions of the emergency action plan.
- CH2M projects shall develop and implement the written procedure requirements to maintain the mechanical integrity of pressure vessels, storage tanks, piping systems, relief and vent systems, emergency shutdown systems, and controls and pumps process systems.
- A hot work permit shall be completed for any CH2M work involving welding, cutting, brazing, or similar flame- or spark-producing operations conducted near a covered process.
- Written procedures shall be developed, updated, and implemented to manage changes in chemicals, technology, equipment, and facilities.

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- An incident report form (IRF) shall be completed within 24 hours of a PSM-related incident. Incidents involving a release of highly hazardous chemicals shall be reported following the Serious Incident Reporting section of SOP HSE-111.
 - An investigation shall be initiated as soon as possible, but no later than 48 hours following an incident that resulted in, or could reasonably have resulted in, a catastrophic release of a highly hazardous chemical.
 - An emergency action plan shall be developed and implemented for the entire plant, including procedures for handling small releases.
 - A facility or process audit shall be performed every three years to certify compliance with the PSM standard.
 - All information regarding compliance with PSM requirements shall be made available to affected personnel without regard to possible trade secret status.
 - CH2M employees shall be trained before operating a newly assigned process or when involved in maintaining equipment. Refresher training shall be provided at least every three years and more often if necessary to assure the employee understands and adheres to the current operating procedures of the process.

8.55 Radar Hazards

Airports and all branches of the military use radar of significant power for buildings, towers, aircraft, ships, armor vehicles, and installations in general. Radar devices may emit harmful microwave radiation emissions. Microwave radiation is absorbed by the body and dissipated in the tissue as heat.

The penetration ability of the radiation depends on the wavelength. Microwave wavelengths of 25-200 centimeters have the ability to reach the internal organs with potentially damaging effects. Wavelengths less than 25 centimeters are absorbed and dissipated by the skin and the human body is thought to be transparent to microwave wavelengths greater than 200 centimeters. The health effects of microwave radiation include deep burns and thermal damage to any organ or organ system with low blood flow, most notably the lenses of the eyes. If adequate time has elapsed between exposures, the repair mechanisms of the lens seem to limit damage. Microwave radiation cannot be seen and its effects cannot be felt until serious damage has already occurred.

The OSHA exposure limit is 10 milliwatts per square centimeter (10 mW/cm²) averaged over any 6-minute period.

Warning signs must be posted in areas where potentially damaging microwave radiation exists.

The prevention method for microwave radiation exposure is to not be in the path of radar or other microwave emitting devices by either ensuring that the device is not operating or ensuring that there is sufficient shielding between you and the microwave source.

8.56 Rail Road Safety

Careful observation of railroad safety requirements is essential and in the US is governed by the Federal Railroad Administration (FRA). For railroads involving Union Pacific Railroads (UPRR), refer to the "Minimum Safety Requirements for Engineering Department Contractors," of the HSE SharePoint site which addresses training, minimum PPE, and safety requirements.

Permission to enter railroad property must be obtained from the local railroad. Working alone is not anticipated for this work. Contact the RHSM if working alone in the vicinity of railroads becomes necessary. Additional hazard controls will be evaluated by the RHSM and incorporated into the project safety plan.

If required by the client or railroad, all employees must participate in and comply with any job briefings conducted by the railroad's employee in charge (EIC). During these briefings, the railroad's EIC will specify safe work procedures, the potential hazards of the job, and emergency response procedures.

The following PPE must be worn when working around trains and rail-yards.

- Reflective/high-visibility safety vests (orange or green-yellow);
- ANSI Z87.1-approved safety glasses shall be worn to protect from flying debris;
- ANSI-approved hard hat;
- Safety-toed boots (ANSI, CSA, or country/region equivalent);
- Hearing protection is required when employees are within 100 feet of locomotive or roadway/work equipment; 15 feet of power operated tools 150 feet of jet blowers or pile drivers 150 feet of retarders in use (when within 10 feet, employees must wear dual ear protection – plugs and muffs); and
- Any other PPE as required by the PPE section of the project safety plan.

Other general safety requirements include:

- Any work conducted within 25 feet of active tracks must first be approved by the client and any EIC requirements addressed (preferably in an AHA). Training (i.e., On-track Railroad Safety Training) is required in the US Federal Railroad Administration in these instances and may be required in other countries/localities. Coordinate this training with the RHSM or Safety Program Assistant (SPA).
- Attend client's safety training courses, as required, and carry or maintain proof of training as required by the client;
- Always pay attention to moving trains – never assume they are looking out for you;
- Work as far from traveled way as possible to avoid creating confusion for trains;
- Use the "buddy system" when work does not face the direction in which trains are coming from;
- The railroad must be promptly notified of any reportable injury;
- The railroad must be promptly notified of any damage to railroad property;
- All waste must be properly disposed of. No fires are permitted;
- All contractor's vehicles stop at all railroad crossings to ascertain the way is clear;
- Always be on alert for moving equipment in either direction on the tracks. Do not stop or walk on the top of rail, frog, switches, guard rails, or other track components;
- When walking around a standing rail car, stay at least 20 feet behind it. Do not walk between rail cars unless there is a 50 feet clearance between cars. Do not sit on, lie under, or cross between cars; and
- No tools or materials are to be left close to the track when trains are passing.

8.57 Rigging

(Reference CH2M SOP HSE-316, *Rigging*)

Below are the hazard controls and safe work practices to follow when personnel are overseeing or performing rigging. Ensure the requirements in the referenced SOP are followed.

8.57.1 General

- All rigging equipment shall be used only for its intended purpose, inspected by a competent person prior to use, and shall not be loaded in excess of its capacity rating. Defective rigging shall be removed from service.

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- When CH2M is in control of rigging operations, CH2M shall provide a rigging competent person that will inspect, maintain oversee all rigging operations. The competent person shall use the appropriate rigging inspection log form to inspect wire rope, synthetic slings and/or shackles.
 - Tag lines shall be attached to every load being lifted by a crane.
 - Rigging equipment shall be protected from flame cutting and electric welding operations, and or contact avoided with solvents and chemicals.
 - Rigging equipment, when not in use, shall be stored in an area free from damage caused by environmental elements, hazardous substances, and other factors that may compromise equipment integrity and performance.
 - No modification or addition, which that could affect the capacity and or safe operation of the equipment, shall be made without the manufacturer's written approval.
 - Rigging equipment shall not be shortened with knots, bolts or other makeshift devices.
 - The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. All hooks for which applicable manufacturer's recommendations are available shall be tested to twice the intended safe working load before they are initially put into their initial use. Vendors or suppliers will provide documentation of proof testing documentation.
 - Special hoisting devices, slings, chokers, hooks, clamps, or other lifting accessories shall be marked to indicate the safe working loads and shall be proof -tested prior to initial use to 125 percent of their rated load. Vendors or suppliers will provide documentation of proof testing documentation.

8.57.2 Equipment

- Protruding end strands of wire rope shall be covered or blunted.
- Wire rope shall not be used, if in any length of eight diameters, the number of total number of visible broken wires exceeds 10 percent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion, or defect.
- When inspecting the end fittings of wire rope slings, if more than one wire in a lay is broken in the fitting, do not use the sling.
- Synthetic web slings shall be immediately removed from service if any of the following conditions are present:
 - acid or caustic burns; melting or charring of any part of the sling
 - surface; snags, punctures, tears or cuts; broken or worn stitches; distortion of fittings;
 - discoloration of or rotting; red warning line showing.
- Never use makeshift hooks, links or other fasteners. Job or shop hooks and links, or makeshift fasteners, formed from bolts, rods, etc., or other such attachments, shall not be used.
- Alloy steel chains shall have permanently affixed identification stating size, grade, rated capacity and reach.
- Shackles and hooks shall be constructed of forged alloy steel with the identifiable load rating on the shackle or hook.

8.57.3 Rigging Use

- Rigging shall not be pulled from under a load when the load is resting on the rigging.
- Place sling(s) in center bowl of hook.

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- When attaching slings to the load hoist hook, corners and sharp edges should be “packed” to prevent cutting or damaging the rope or slings.
 - Never use nylon, polyester, or polypropylene web slings, or web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of acids, caustics or phenolics are present.
 - Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range from minus 20° F to plus 180° F without decreasing the working load limit. For operations outside this temperature range, and for wet frozen slings, the sling manufacturer’s recommendations shall be followed.
 - When used for eye splices, the U-bolt shall be installed so that the “U” section is in contact with the dead end of the rope.

8.58 Scaffolds

(Reference CH2M SOP HSE-311, *Scaffolds*)

Below are the hazard controls and safe work practices to follow when personnel or subcontractor personnel are using scaffolds. Ensure the requirements in the referenced SOP are followed.

8.58.1 Working from Scaffolds

- All scaffolds must be designed by a qualified person and installed under the supervision of a competent person.
- Do not access scaffolds until the competent person has completed the work shift inspection and has authorized access.
- Follow all requirements established by the competent person or as identified on the scaffold tag.
- Do not access scaffolds until authorized by the competent person.
- Do not access scaffolds that are damaged or unstable at any time and for any reason.
- Only access scaffolds by means of a ladder, stair tower, ladder stand, ramp, integral prefabricated scaffold access, or other equivalent safe means of access. Scaffold cross-bracing shall not be used to access scaffold platforms.
- Remain within the scaffold guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted.
- Use personal fall arrest systems when required by the competent person and when working from suspension scaffolds or boatswains’ chairs.
- Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders on top of scaffold platforms to increase working height unless the platform covers the entire floor area of the room.
- Do not work on scaffolds covered with snow, ice, or other slippery material or work on scaffolds during storms or high winds unless personal fall arrest systems or wind screens are provided and the competent person determines it is safe to remain on the scaffold.
- Do not overload scaffold planks over their rated weight bearing capacity. When feasible, place loads directly over the scaffolds vertical weight bearing structures.

8.58.2 Supported Scaffolds

This section covers the erection, use, and dismantling of supported scaffolds. Supported scaffolds consist of one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support. Supported scaffolds include frame, fabricated frame, tube and coupler, pole, bricklayer’s, and step

platform. The common requirements for all supported scaffolds are addressed here; the competent person shall ensure scaffold type specific requirements are included as applicable.

- CH2M staff erecting, dismantling, or working on scaffolds must complete the CH2M 10-Hour Construction Safety Awareness training course. Staff must also and receive project-specific scaffold training from a qualified person. Staff shall not use scaffold systems for which they have not been trained.
- A CH2M scaffold competent person shall be assigned to direct and oversee the erection, dismantling, and use of scaffolds. Additionally, they must inspect scaffolds each day prior to use.
- Scaffolds shall be designed by a qualified person and shall be constructed and loaded in accordance with that design.
- Stationary scaffolds over 125 feet (38.1 meters) in height and rolling scaffolds over 60 feet (18.3 meters) in height must be designed by a professional engineer.
- A tag and permit system shall be used to inform personnel of the construction status of the scaffold. At a minimum, the system used shall inform users when a scaffold is complete and safe to be used and when a scaffold is under construction and is not ready to be used. When additional precautions are required to use the scaffold safely, for example, the use of fall protection systems, the system shall identify the precautions to be taken. The tag or permit shall be placed at each means of access to the scaffold. The competent shall be responsible for the tag and permit system.
- A daily safety briefing shall be conducted with all scaffold personnel to discuss the work planned for the day and the HSE requirements to be followed.
- Scaffolds and scaffold components must be capable of supporting, without failure, their own weight and at least 4 times their maximum intended load.
- The site must be inspected to determine ground conditions, strength of supporting structure, and for proximity of electric power lines, overhead obstructions, wind conditions, the need for overhead protection or weather protection coverings.
- Supported scaffolds must be set on base plates, mudsills, or other adequate firm foundation.
- Frame spacing and mudsill size can only be determined after the total loads to be imposed on the scaffold and the strength of the supporting soil or structure are calculated and considered. This analysis must be done by a qualified person.
- Base plates or screwjacks with base plates must be in firm contact with both the sills and the legs of the scaffolding. Compensate for uneven ground with screwjacks with base plates. DO NOT USE unstable objects such as blocks, loose bricks, etc.
- Scaffolds and scaffold components must be inspected for visible defects before each shift by a competent person, and after each occurrence that could affect a scaffold's integrity (such as being struck by a crane).
- Maintain scaffolding and materials (e.g., paint roller extensions, building material) at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus 0.4 inch (1.0 cm) for every 1 kV over 50 kV.
- All portable electric equipment must be protected by ground-fault circuit interrupters (GFCIs) or an assured equipment grounding conductor program.

8.58.3 Suspended Scaffolding

Suspension scaffolds consist of one or more platforms suspended by ropes or other non-rigid means from an overhead structure(s). The common requirements for suspended scaffolds are addressed here; the competent person shall ensure scaffold type specific requirements are included as applicable.

- CH2M staff erecting, dismantling, or working on scaffolds must complete the CH2M 10-Hour Construction Safety Awareness training course. Staff must also and receive project-specific scaffold training from a qualified person. Staff shall not use scaffold systems for which they have not been trained.
- A CH2M scaffold competent person shall be assigned to direct and oversee the erection, dismantling, and use of scaffolds. Additionally, they must inspect scaffolds each day prior to use.
- Scaffolds shall be designed by a qualified person and shall be constructed and loaded in accordance with that design.
- A tag and permit system shall be used to inform personnel of the construction status of the scaffold. At a minimum, the system used shall inform users when a scaffold is complete and safe to be used and when a scaffold is under construction and is not ready to be used. When additional precautions are required to use the scaffold safely, for example, the use of fall protection systems, the system shall identify the precautions to be taken. The tag or permit shall be placed at each means of access to the scaffold. The competent shall be responsible for the tag and permit system.
- A daily safety briefing shall be conducted with all scaffold personnel to discuss the work planned for the day and the HSE requirements to be followed.
- Scaffolds and scaffold components must be capable of supporting, without failure, their own weight and at least 4 times their maximum intended load.
- The site must be inspected to determine the strength of supporting structure, and for proximity of electric power lines, overhead obstructions, wind conditions, the need for overhead protection or weather protection coverings.
- Scaffolds and scaffold components must be inspected for visible defects before each shift by a competent person, and after each occurrence that could affect a scaffold's integrity (such as being struck by a crane).
- Maintain scaffolding and materials (e.g., paint roller extensions, building material) at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus 0.4 inch (1.0 cm) for every 1 kV over 50 kV.
- All portable electric equipment must be protected by ground-fault circuit interrupters (GFCIs) or an assured equipment grounding conductor program.

8.58.4 Fall Protection on Suspended Scaffolds

- Each employee on a multi-point or two-point adjustable suspension scaffold must be protected by both a guardrail system and a personal fall arrest system.
- Personal fall-arrest systems used on scaffolds shall be attached by lanyard to a vertical lifeline, horizontal lifeline, or scaffold structural member.
- Guardrail systems must be installed along all open sides and ends of platforms, and must be in place before the scaffold is released for use by employees other than erection/dismantling crews.

8.59 Spotters during Vehicle Backing Operations and Heavy Equipment Tasks

Spotters should be used for these tasks as indicated below.

- Evaluate vehicle operations prior to performing the task to assess the following:
 - Can the distance of reversing the vehicle be eliminated or minimized?
 - Are there any hazards along the route that would interfere with the safe completion of the job including any points along the path of travel where the spotter may be placed in a dangerous position or line of fire?
 - Can the route be modified to make the task safer?

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- Can the route be cleared of workers (pedestrians) within 8 feet (2.5m) of the moving vehicle? If not, do not proceed. Contact HSM and PM.
 - In addition to verbal communications, the driver/operator and spotter must agree to communicate via one of the following: hand signals, two-way radio, lights, handheld air horn or other (specify in daily safety briefings, PTSP, etc.).
 - Only one spotter should be used at a time.
 - Spotters responsibilities are:
 - Position to enable the driver to maintain visual contact with me
 - Never cross the path of travel of a **moving** vehicle
 - Maintain a minimum 8 feet (2.5 m) distance from **moving** vehicle
 - Wear a high visibility vest
 - Wear the PPE requirements for the area
 - Communicate to the driver to **STOP** immediately if any unexpected hazards are observed
 - Never ride on the vehicle while it is moving
 - Keep the route free of people that don't need to be there
 - Driver responsibilities include:
 - STOP immediately if visual contact with the spotter is lost
 - STOP immediately if instructed by the spotter
 - STOP immediately if anyone comes within 8 feet (2.5 m) of the vehicle
 - Operate the vehicle so speed does not exceed the walking pace of the spotter
 - Communicate the blind spots of the vehicle to the spotter
 - Turn radio and any other distractions off in the cab of vehicle
 - Make sure window(s) are open to receive spotter communications
 - Make sure windows and mirrors are clear to ensure good visibility

8.60 Stairways and Ladders

(Reference CH2M SOP HSE-214, *Stairways and Ladders*)

Below are the hazard controls and safe work practices to follow when using stairways and ladders. Ensure the requirements in the referenced SOP are followed.

- Stairway or ladder is generally required when a break in elevation of 19 inches (48.3 cm) or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Always obey and pay attention to warning labels or stickers on the specific ladder being used.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Ladder safety training on safe use (take the Stairways and Ladders safety training module located on the VO).
- Only one person at a time shall climb on or work from an individual ladder.

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- User must face the ladder when climbing; keep belt buckle between side rails.
 - Ladders shall not be moved, shifted, or extended while in use.
 - User must use both hands to climb; use rope to raise and lower equipment and materials.
 - Straight and extension ladders must be tied off to prevent displacement.
 - Ladders that may be displaced by work activities or traffic must be secured or barricaded.
 - Personnel climbing ladders shall face the ladder and maintain 3 points of contact with the ladder.
 - Portable ladders must extend at least 3 feet (91.5 cm) above landing surface.
 - Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder.
 - Stepladders are to be used in the fully opened and locked position.
 - Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder.
 - Fixed ladders \geq 24 feet (7.3 meters) in height must be provided with fall protection devices.
 - Fall protection should be considered when working from extension, straight, or fixed ladders greater than six feet (1.8 meters) from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

8.61 Steel Erection

(Reference CH2M SOP HSE-312, *Steel Erection*)

Below are the hazard controls and safe work practices to follow when working around or performing steel erection activities. Ensure the requirements in the referenced SOP are followed.

- Protruding reinforcing steel (rebar), onto which personnel could fall, must be guarded to eliminate the hazard of impalement.
- Structural steel loads shall not be released from the hoisting line until the members are secured with at least two bolts, or the equivalent at each connection and drawn up wrench tight.
- Tag lines shall be used for controlling loads.
- Containers shall be provided for storing or carrying rivets, bolts, and drift pins, and secured against accidental displacement when aloft.
- Air line hose sections shall be secured together, except when quick disconnect couplers are used to join sections.
- Impact wrenches used for bolting shall be provided with a locking device for retaining the socket.
- Turnbuckles shall be secured to prevent unwinding while under stress.
- Plumbing-up guys shall be removed only under the supervision of a competent person.
- Metal decking of sufficient strength shall be laid tight and secured to prevent movement.
- Provisions shall be made to secure temporary flooring against displacement. Planks shall overlap the bearing on each end by a minimum of 12 inches (30.5 cm). Wire mesh, exterior plywood, or equivalent, shall be used around columns where planks do not fit tightly.
- All unused openings in floors, temporary or permanent, shall be completely planked over or guarded.

8.62 Slips, Trips and Falls

General

- Institute and maintain good housekeeping practices.
- Designate foot traffic paths in and out of sites, when necessary, to ensure paths are kept free from slip, trip, and fall hazards or to deter personnel from taking “shortcuts” where slip, trip, hazards may be.
- Mitigate icy conditions by keeping foot traffic paths clear of ice and snow.
- Watch footing as you walk to avoid trip hazards, animal holes, or other obstacles, especially in tall grassy areas.

Muddy Conditions

- Muddy conditions present a slipping hazard. Use mats or other similar surface to work from if footing cannot be stabilized.
- Take shortened steps across muddy areas.
- Use a walking staff or other similar means to assist with balance.

Steep Slopes/Uneven Ground/Rock and Vertical Slopes

- Be aware that escarpments can slough. Avoid these areas.
- Exercise caution in relying on rocks and trees/tree stumps to support yourself – many times they are loose.
- Whenever possible, switchback your way up/down steep areas, and maintain a slow pace with firm footing.
- Employees walking in ditches, swales and other drainage structures adjacent to roads or across undeveloped land must use caution to prevent slips and falls which can result in twisted or sprained ankles, knees, and backs.
- Whenever possible observe the conditions from a flat surface and do not enter a steep ditch or side of a steep road bed.
- If steep terrain must be negotiated coordinate with RHSM to evaluate the need for ladders or ropes to provide stability.

Snow and Ice on Walking/Working Surfaces

Housekeeping and Preparedness

- Evaluate whether the work can be postponed until site conditions improve for both our work and our subcontractors.
- Remove snow from walkways regularly and use ice-melt or sand, when necessary.
- Notify those responsible for clearing walkways and work areas when we observe a potentially hazardous location. At our project sites, be sure someone is responsible for maintaining walkways.
- Don’t assume that the walk path is not slippery if it has been plowed and sanded already.
- Mark potential hazards (e.g., holes, rebar, plastic, etc.) prior to snowfall. Designate walkways that avoid such hazards.
- Avoid any ice or snow-covered location where a hazard may exist; use a vehicle rather than walking, when possible.
- If you cannot avoid the area, wear shoes or boots that provide traction on snow and ice or use YakTrax™, ice cleats, or similar product (see links below). *Note* - Additional hazards could be introduced if these

types of footwear are worn inside, on stairs, etc. Be sure appropriate donning and doffing areas are established.

- Inspect your footwear before wearing it.
- Ensure that your safety plan or Activity Hazard Analysis is up to date and adequately addresses hazards of winter work environments.

How to Walk in Icy Conditions

- Give yourself sufficient time and plan your route.
- Keep your eyes on where you are stepping and GO S-L-O-W-L-Y!! This will help your reaction time to changes in traction.
- Be aware of hazards you might have missed such as black ice and ice covered by snow.
- Keep both hands free for balance --NOT in your pockets.
- When handrails are available – USE THEM!
- Wear gloves to keep hands warm and readily available to hold snow-covered handrails.
- Take short steps or shuffle for stability, bend slightly, and walk flat-footed. Keep your center of gravity directly over your feet as much as possible. Keep your eyes on where you are going. Remember the “Walk like a penguin” method.
- Don’t carry too much or block your line of vision.
- Be prepared to fall!

How to Fall

Have you ever practiced falling? In the event that you slip and fall while walking in the office, to your car, or on a project site try and remember the following:

- Do not try to break your fall by sticking out your arm, elbow or wrist due to potential for fractures or ligament damage.
- Try instead to create a large surface area by either outstretching your arm and landing on your side or tucking your arm and curling to a ball and landing on your back.

Getting in and out of Vehicles on Icy or Snowy Surfaces

Use special care when entering and exiting vehicles:

- Use the vehicle for support
- Step out planting foot firmly on the ground
- Have hands free for support

8.63 Stream Crossing

Traversing streams present significant hazards, including drowning, hypothermia, and abrasions. When crossing streams, be sure to implement the bulleted items below.

- When walking in streams, first plan the route. Look ahead for exits should there be any difficulty during the crossing, and “read” the water for spots to avoid such as drop offs, sunken logs, and tricky currents.
- Do seek out the safest route – narrow, low flow, shallow. Evaluate deeper and faster moving sections with caution. Backtracking is often dangerous or impossible once committed.
- If streams to be crossed are deeper than “knee deep”, find an alternate crossing location that is less deep.
- Streams should be crossed while facing upstream, stepping side to side, and using a sturdy walking stick. When possible, wade a stream diagonally, moving downstream. Move slowly, keeping the foot on the upstream side in the lead and pointed forward. Your rear, or anchor, foot should point downstream and be

at right angles to the lead foot. Move the lead foot forward about half a step, feeling for a solid hold. Next, move the anchor foot forward the same distance – shuffle across so that your anchor foot never passes the lead. This way both feet are always in position to lend support. If you must turn around, do so toward the upstream direction.

- Don't attempt to cross above rocky rapids or a cascade. Step on submersed rocks with great care.
- If you are working in streams, algae covered rocks should be assumed slippery until tested. Always be alert for unstable and extremely slippery rocks.
- Rocks with green moss or attached plants offer better traction or even better, look for gravel and sand pockets among the stream boulders, which are much more stable, and use a wading staff (if not carrying one, find a suitable one nearby) to steady your balance while crossing. Use a solid wading staff instead of the collapsible type.
- Be cautious of areas where there are submerged or partially submerged trees/tree branches – these can create entanglement hazards during a crossing or a “swim”.
- If streams are crossed that are deeper than “crotch deep”, personnel must use either ropes and/or wear chest waders.
- Choose the right waders (with RHSM/SC involvement).
- Footwear with felt-bottom soles are ideal for rocky bottom streams. The rough texture cuts through algae growing on the rocks and grips well. For very slippery conditions, consider studded felt soles or a slipover, studded sandal. However, felt soles do not provide good traction on muddy, slippery banks. Cleated soles work well for mud or sand bottom streams (a hard molded tread pattern similar to a hiking boot).
- Wear a wading belt with chest waiters to keep your waders from billowing out like a parachute; the currents will carry you and move you in ways you don't want to move.
- Never wade alone.
- If the wader fills with water, don't panic. Waders full of water weigh less in water than on land and the water inside doesn't add any weight as long as you are in the water. Also a common fear is that air trapped in the waders will raise the feet higher than the head and force the face underwater is unfounded. Waders do streamline your legs and kicking is useless. Follow these steps if the waders fill with water:
 - Don't try to take them off in the water
 - In calm water, wade or swim to shore
 - In fast-moving water, ride the current:
 - Pull your feet up in front of you, bend your knees
 - Point your feet downstream (so the feet, not the head will bounce off the rocks)
 - Sculling with your hands will help direct to the nearest shallow area
 - When you reach calm water, go ashore and empty your waders
 - Don't waste energy in the vertical position going for the bottom. This position is virtually impossible to maintain and leads quickly to exhaustion (the major cause of drowning).
 - Concentrate on getting out of the water and not saving the equipment.
- The higher the elevation you are at, the steeper the stream gradient is. This means the stream can rise quicker and return to lower flow more quickly.

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- Always wait out a swollen stream if at all possible.
 - If you do slip into the water and are being swept downstream, don't panic. Cold water will be a shock for 2-3 seconds. Pull your knees up, face your feet downstream and lean back, using your hands as best you can to navigate and get to the bank. Keep your head up; you don't want your head underwater banging into rocks. If you stay calm, you can reach water where you can stand up or swim to the bank.
 - When walking along stream banks and not entering streams, wear work boots.

8.64 Traffic Control

(Reference CH2M SOP HSE-216, *Traffic Control*)

The following precautions must be taken when working around traffic, and in or near an area where traffic controls have been established by a subcontractor. Ensure the requirements in the referenced SOP are followed.

- CH2MHILL employees must never perform traffic control activities for 3rd party subcontractors.
- Exercise caution when exiting traveled way or parking along street – avoid sudden stops, use flashers, etc.
- Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier.
- All staff working adjacent to traveled way or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic related hazards and required controls – sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of shoulder (i.e., breakdown lane), etc.
- Always remain aware of an escape route (e.g., behind an established barrier, parked vehicle, guardrail, etc).
- Always pay attention to moving traffic – never assume drivers are looking out for you.
- Work as far from traveled way as possible to avoid creating confusion for drivers.
- When workers must face away from traffic, a “buddy system” should be used, where one worker is looking towards traffic.
- When working on highway projects, obtain a copy of the contractor's traffic control plan.
- Work area should be protected by a physical barrier – such as a K-rail or Jersey barrier.
- Review traffic control devices to ensure that they are adequate to protect your work area. Traffic control devices should: 1) convey a clear meaning, 2) command respect of road users, and 3) give adequate time for proper traffic response. The adequacy of these devices are dependent on limited sight distance, proximity to ramps or intersections, restrictive width, duration of job, and traffic volume, speed, and proximity.
- Either a barrier or shadow vehicle should be positioned a considerable distance ahead of the work area. The vehicle should be equipped with a flashing arrow sign and truck-mounted crash cushion (TMCC). All vehicles within 40 feet (12.2 meters) of traffic should have an orange flashing hazard light atop the vehicle.
- Except on highways, flaggers should be used when 1) two-way traffic is reduced to using one common lane, 2) driver visibility is impaired or limited, 3) project vehicles enter or exit traffic in an unexpected manner, or 4) the use of a flagger enhances established traffic warning systems.
- Lookouts should be used when physical barriers are not available or practical. The lookout continually watches approaching traffic for signs of erratic driver behavior and warns workers.

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- Vehicles should be parked at least 40 feet (12.2 meters) away from the work zone and traffic. Minimize the amount of time that you will have your back to oncoming traffic.
 - Traffic control training module on the VO shall be completed when CH2M workers who work in and around roadways and who exposed to public vehicular traffic.

8.65 Utilities (underground)

An assessment for underground utilities must be conducted where there is a potential to contact underground utilities or similar subsurface obstructions during intrusive activities. Intrusive activities include excavation, trenching, drilling, hand augering, soil sampling, or similar activities.

The assessment must be conducted before any intrusive subsurface activity and must include at least the following elements:

- A background and records assessment of known utilities or other subsurface obstructions.
- Contacting and using the designated local utility locating service.
- Conducting an independent field survey to identify, locate, and mark potential underground utilities or subsurface obstructions. *Note: This is independent of, and in addition to, any utility survey conducted by the designated local utility locating service above.*
- A visual survey of the area to validate the chosen location.
- When required by the project-specific safety plan, using the Utility Verification Checklist.

When any of these steps identifies an underground utility within 5 feet (1.5 meters) of intrusive work, then non-aggressive means must be used to physically locate the utility before a drill rig, backhoe, excavator or other aggressive method is used.

Aggressive methods are never allowed within 2 feet of an identified high risk utility (see paragraph below).

Any deviation from these requirements must be approved by the Responsible HS Manager and the Project Manager.

Background and Records Assessment of Known Utilities

Identify any client- or location-specific permit and/or procedural requirements (e.g., dig permit or intrusive work permit) for subsurface activities. For military installations, contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.

Obtain available utility diagrams and/or as-built drawings for the facility.

Review locations of possible subsurface utilities including sanitary and storm sewers, electrical lines, water supply lines, natural gas lines, fuel tanks and lines, communication lines, lighting protection systems, etc. Note: Use caution in relying on as-built drawings as they are rarely 100 percent accurate.

Request that a facility contact with knowledge of utility locations review and approve proposed locations of intrusive work.

Designated Local Utility Locating Service

Contact your designated local utility locating service (e.g., Dig-Safe, Blue Stake, One Call) to identify and mark the location of utilities. In the US, call 811 in the go to www.call811.com to identify the appropriate local service group. Contacting the local utility locating service is a legal requirement in most jurisdictions. (Some US states, [e.g., Washington] require that the entity performing the intrusive work be the responsible for contacting the local service.) Where subcontractors are responsible for the intrusive work, CH2M personnel shall verify the subcontractor has contacted the designated local utility locating service.

Independent Field Survey (Utility Locate)

The organization conducting the intrusive work (CH2M or subcontractor) shall arrange for an independent field survey to identify, locate, and mark any potential subsurface utilities in the work area. This survey is in addition to any utility survey conducted by the designated local utility locating service.

The independent field survey provider shall determine the most appropriate instrumentation/technique or combinations of instrumentation/techniques to identify subsurface utilities based on their experience and expertise, types of utilities anticipated to be present, and specific site conditions.

A CH2M or subcontractor representative must be present during the independent field survey to observe the utility locate and verify that the work area and utilities have been properly identified and marked. If there is any question that the survey was not performed adequately or the individual was not qualified, then arrangements must be made to obtain a qualified utility locate service to re-survey the area. Obtain documentation of the survey and clearances in writing and signed by the party conducting the clearance. Maintain all documentation in the project file.

If the site owner (military installation or client) can provide the independent field survey, CH2M or the subcontractor shall ensure that the survey includes:

- Physically walking the area to verify the work location and identify, locate, and mark underground utility locations:
- Having qualified staff available and instrumentation to conduct the locate;
- Agreeing to document the survey and clearances in writing.
- Should any of the above criteria not be met, CH2M or subcontractor must arrange for an alternate independent utility locate service to perform the survey.
- The markings from utility surveys must be protected and preserved until the markings are no longer required. If the utility location markings are destroyed or removed before intrusive work commences or is completed, the PM, SC, or designee must notify the independent utility locate service or the designated local utility locating service to resurvey and remark the area.

Visual Assessment before and during Intrusive Activities

Perform a "360 degree" assessment. Walk the area and inspect for utility-related items such as valve caps, previous linear cuts, patchwork in pavement, hydrants, manholes, utility vaults, drains, and vent risers in and around the dig area.

The visual survey shall include all surface landmarks, including manholes, previous liner cuts, patchwork in pavement, pad-mounted transformers, utility poles with risers, storm sewer drains, utility vaults, and fire hydrants.

If any unanticipated items are found, conduct further research before initiating intrusive activities and implement any actions needed to avoid striking the utility or obstruction.

Completion of the Utility Verification Checklist

When required by the safety plan, the utility verification checklist shall be completed by the SC and submitted to the PM and HSM for review and signature. Follow the instructions on the form and keep it accessible in the field during intrusive operations. Evaluate intrusive activities for changed conditions and contact the PM and HSM to ensure hazards are addressed and whether a new checklist needs to be completed.

Subsurface Activities within 5 feet of an Underground Utility or if there is Uncertainty

When aggressive intrusive activities will be conducted within 5 feet (1.5 meters) of an underground utility or when there is uncertainty about utility locations, locations must be physically verified by non-aggressive means such as air or water knifing, hand digging, or human powered hand augering. Non-conductive tools must be used if

electrical hazards may be present. If intrusive activities are within 5 feet (1.5 meters) and parallel to a marked existing utility, the utility location must be exposed and verified by non-aggressive methods every 100 feet (30.5 meters). Check to see if the utility can be isolated during intrusive work.

Intrusive Activities within 2 feet of an Underground Utility

Use non-aggressive methods (hand digging, vacuum excavation, etc.) to perform intrusive activities within 2 feet of a high risk utility (i.e., a utility that cannot be de-energized or would cause significant impacts to repair/replace). Hazardous utilities shall be de-energized whenever possible.

Spotter

A spotter shall be used to monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon, presence of pea gravel or sand in soils, presence of concrete or other debris in soils, refusal of auger or excavating equipment). If any suspicious conditions are encountered stop work immediately and contact the PM or RHSM to evaluate the situation. The spotter must have a method to alert an operator to stop the intrusive activity (e.g., air horn, hand signals).

8.66 Utilities (overhead)

Proximity to Power Lines

It must be determined whether equipment operations including, positioning, and traveling will occur in proximity to power lines within 20 feet (6.1 meters) for line voltage up to 350 kilo volts (kV), and within 50 feet (15.2 meters) for line voltage between 350 kV to 1000 kV. For power lines over 1000 kV, the distance must be determined by the utility/operator or qualified registered professional engineer in electrical power transmission and distribution.

Operations adjacent to overhead power lines are PROHIBITED unless one of the following conditions is satisfied:

- Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.
- The minimum clearance from energized overhead lines is as shown in the tables below, or the equipment will be repositioned and blocked to ensure that no part, including cables, can come within the minimum clearances shown in the table. [NOTE: Outside of the US, check with local and provincial code for more stringent requirements. The more stringent requirement will be followed.]
- The power line(s) has been isolated through the use of insulating blankets which have been properly placed by the utility. If insulating blankets are used, the utility will determine the minimum safe operating distance; get this determination in writing with the utility representative's signature.
- All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the PM prior to the start of work.

MINIMUM DISTANCES FROM POWERLINES - US

Powerlines Nominal System Kv	Minimum Required Distance, Feet (Meters)
0-50	10 (3.0)
50-200	15 (4.6)
201-350	20 (6.1)
351-500	25 (7.6)
501-750	35 (10.7)
751-1000	45 (13.7)

Over 1000

Established by utility owner/operator or by a professional engineer in electrical power transmission/distribution

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

MINIMUM DISTANCES FROM POWERLINES – ALBERTA

Operating voltage between conductors of overhead powerline	Safe limit of approach distance for persons and equipment
0-750 volts (insulated or polyethylene covered conductors – entire length)	300 millimetres
0-750 volts (bare, uninsulated)	1.0 metre
Above 750 volts (insulated conductors – entire length, rated and tested)	1.0 metre
750 volts to 40 kilovolts	3.0 metres
69 kilovolts, 72 kilovolts	3.5 metres
138 kilovolts, 144 kilovolts	4.0 metres
230 kilovolts, 260 kilovolts	5.0 metres
500 kilovolts	7.0 metres

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

MINIMUM DISTANCES FROM POWERLINES – British Columbia, Manitoba, NWT, Ontario, Saskatchewan, and Yukon

Voltage of live Powerlines	Minimum Required Distance, Metres (Feet)
750 to 75,000 volts	3 (10)
75,000 to 250,000 volts	4.5 (15)
250,000 to 550,000 volts	6 (20)

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

8.67 Vacuum Trucks

When CH2M personnel are exposed to vacuum truck operations, the following safe work practices/hazard controls shall be implemented.

- A pre-operational check should be performed on the vacuum truck before use. Operators must be familiar with the operator's manual.
- Operators of vacuum trucks should be trained and familiar with the equipment. At least one person should be operating the boom and one person signaling and assisting the boom operator.
- Before use the hoses and lines should be checked for fraying and connections checked for leakage. Proper selection of hose diameter and type of hose (smooth bore hose vs. corrugated hose) is vital before the job is performed.
- The amount of force produced by a vacuum truck can kill hose operators. If an eight-inch hose gets stuck to your body at 27 inches Hg, it can be fatal. All trucks should be equipped with an emergency release the hose operator or assistant can initiate if a worker gets sucked into a hose. A remote release, manual release near the truck and an inline "T" should be present on the truck. The inline "T" should be installed

between the very last section of hose and the working section of hose. The cord that releases the in-line relief should be tethered to the hose handler's belt or a watch buddy should be nearby holding the cord and ready to relieve in the event of an emergency. Operators should never attempt to vacuum hose with any part of their body to check for suction.

- Tanks on vacuum trucks are a confined space. Before the tank is opened and anyone enters a confined space assessment should be performed.
- The truck should always be grounded before use. The static electricity produced when sucking materials into the system can produce a spark and ignite anything in the tank or hose. Use of a grounding wire will prevent static electric explosions. Vacuum trucks should not be used to pump mixtures with a flash point less than 140 degrees or less - this is an accepted industry standard - refer to the operators manual for more information.
- When positioning truck to work, be extra cautions of personnel and other equipment located next to truck.
- Wet and dry material should not be mixed in the tank.
- When swinging the boom, change directions slowly.
- Do not load dump body beyond rated capacity. Be aware of possible load surge when turning or braking.

8.68 Vinyl Chloride

(Reference CH2M, SOP HSE-512, *Vinyl Chloride*)

Vinyl Chloride is considered a "Confirmed Human Carcinogen." Vinyl Chloride has a mild, sweet, chloroform-like odor.

CH2M is required to control employee workplace exposure to vinyl chloride when personal exposures are at or above 1.0 ppm as an 8-hour time-weighted average (TWA) or above 5.0 ppm short term exposure limit (STEL), by implementing a program that meets the requirements of the governing regulatory agency (e.g., in the US: Occupational Safety and Health Administration (OSHA) Vinyl Chloride standard, 29 CFR 1910.1017; in Canada: Provincial OH&S Code/Regulation, etc.). The elements of the CH2M vinyl chloride program include the following:

- Exposure monitoring
- Methods of control, including personal protective equipment (PPE) and respirators
- Medical surveillance
- Training on hazards of vinyl chloride and control measures (includes project-specific training and the computer-based training on CH2M's Virtual Office, *Vinyl Chloride*)
- Record keeping requirements

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- Review the fact sheet included as an attachment to the SOP.

8.69 Welding and Cutting

(Reference CH2M, SOP-314, *Welding and Cutting*)

Below are the hazard controls and safe work practices to follow when working around or performing welding and cutting. Ensure the requirements in the referenced SOP are followed.

- Workers designated to operate welding and cutting equipment shall have been properly instructed and qualified to operate such equipment.
- Before welding or cutting is permitted, the area shall be inspected by the individual responsible for authorizing the welding or cutting operation. The authorization, preferably in the form of a written permit, shall detail precautions to be taken before work is to begin.
- Suitable fire extinguishing equipment shall be immediately available in the work area.
- Flame-resistant blankets shall be used to control sparks produced by welding and cutting operations from traveling to lower levels or adjacent surfaces.
- If the valve on a fuel-gas cylinder is found to leak around the valve stem, the valve shall be closed and the gland nut tightened. If this does not stop the leak, the cylinder is to be tagged and removed from service.
- Nothing should be placed on top of a cylinder or manifold that will damage it or interfere with the quick closing of the valve.
- Flow gages and regulators shall be inspected prior to use and removed from cylinders when not in use.
- Hoses, leads, and cables shall be not be routed through doorways and walkways unless covered, elevated, or protected from damage. Where hoses, leads, and cables pass through wall openings, adequate protection shall be provided to prevent damage.
- Flash arresters shall be installed at the torch handle.
- Arc welding electrodes shall not be struck against compressed gas cylinders to strike an arc.
- All arc welding or cutting operations shall be shielded by noncombustible or flame resistant screens to protect employees or other persons in the vicinity from the direct rays of the arc.
- Proper ventilation shall be provided so as to maintain the level of contaminants in the breathing zone of welders below applicable permissible exposure limits.
- When the potential for an explosive atmosphere exists in the immediate area of welding or cutting operations, air monitoring instruments shall be used to verify that no explosive atmosphere is present before or during welding or cutting operations.
- An assigned Fire Watch shall be maintained at least a half an hour after the welding or cutting operation was completed. The fire watch must be identifiable with a distinguishable hard hat and/or vest.
- Minimum personal protective equipment includes the following:
 - Safety-toed shoes or boots, hard hats, and safety glasses
 - Body protection (such as gloves, coveralls, or Tyvek) when chemical hazards exist
 - Hearing protection when working in close proximity to loud equipment and machinery
 - Protective clothing and gloves to prevent burns
 - Suitable eye protective equipment for the type of welding or cutting performed
 - Opaque screens to block arc flash from arc welding and cutting operations

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- Mechanical ventilation systems for welding and cutting operations conducted in enclosed or confined spaces
 - Air monitoring or sampling equipment to evaluate airborne concentrations of welding and cutting contaminants
 - Respiratory protection when airborne concentrations of contaminants exceed regulatory limits

8.69.1 Compressed Gas Cylinders

- Cylinders being transported, moved, or stored shall have valve protection caps installed. When transported by motor vehicle, hoisted, or carried, cylinders shall be in the vertical position.
- Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials by a minimum of 20 feet (6.1 meters) or by a noncombustible barrier at least 5 feet (1.5 meters) high having a fire resistant rating of at least one half hour.
- Inside of buildings, cylinders shall be stored in well-ventilated, dry locations at least 20 feet (6.1 meters) from highly combustible materials. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage areas shall be located where cylinders will not be knocked over or damaged.
- During use, cylinders shall be kept far enough away from the actual welding and cutting operations to prevent sparks, hot slag, or flames from reaching them. When impractical, fire resistant shields shall be provided.
- Cylinders containing oxygen or fuel-gas shall not be taken into confined spaces.
- If cylinders are frozen, warm (not boiling) water shall be used to thaw them.

8.69.2 Welding and Cutting Equipment

- Fuel-gas and oxygen hoses shall be easily distinguishable from each other and shall not be interchangeable between fuel-gas and oxygen.
- Hoses shall be inspected at the beginning of each shift. Defective hoses shall be removed from service.
- Hose couplings shall be designed to be disconnected with a rotary motion, not by straight pull.
- Torches shall be inspected at the beginning of each shift for leaking valves, connections, and couplings. Defective torches shall be removed from service.
- Torches shall be ignited with friction lighters, not open flames or hot work.

8.69.3 Arc Welding and Cutting

- Only manual electrode holders that are designed for arc welding or cutting and are capable of safely handling the maximum rated current shall be used.
- Only cable that is free from repair or splices for a minimum distance of 10 feet (3 meters) from the cable's attachment to the electrode holder shall be used.
- Any current-carrying part that arc welders or cutters grip in their hand, as well as the outer surfaces of the jaws of the holder, shall be fully insulated against the maximum voltage encountered to ground.
- The frames of arc welding or cutting machines shall be grounded. Grounding circuits, other than by means of the structure, shall be checked to ensure that the circuit between the ground and the grounded power conductor has resistance low enough to permit sufficient current flow to cause the fuse or circuit breaker to interrupt the current.

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- When electrode holders are left unattended, the electrode shall be removed and the holder placed where it cannot harm employees.
 - Hot electrode holders shall not be dipped in water to cool them.
 - When welding or cutting is stopped for any appreciable length of time, or before the welding or cutting machine is moved, the power shall be shut off.
 - Before starting welding or cutting operations, all connections to the machine shall be checked.

8.69.4 Toxic Fumes and Gases

- General mechanical or local exhaust ventilation shall be provided when welding or cutting in a confined space.
- Contaminated air exhausted from the work area shall be discharged into the open air or otherwise clear of the intake air.
- Other employees exposed to the same atmosphere as the welder or cutter shall be protected in the same manner as the welder or cutter.
- In enclosed spaces, all surfaces covered with toxic preservative coatings shall be stripped to a distance of at least four inches from the area to be heated, or the worker shall be protected with an air-line respirator.
- Welding or cutting in an enclosed space shall be performed with local exhaust ventilation or air-line respirators when the following metal bases, fillers, or coatings are involved: lead, cadmium, mercury, zinc, stainless steel, or beryllium.
- Employees welding or cutting in the open air and who are exposed to the metals noted above shall be protected with filter-type respirators; however, when working with beryllium, the employee shall be protected with an air-line respirator.

8.69.5 Fire Prevention

- When the potential for an explosive atmosphere exists in the immediate area of welding or cutting operations, air monitoring instruments shall be used to verify that no explosive atmosphere is present before or during welding or cutting operations.
- When welding or cutting on walls, floors, or ceilings, the same precautions shall be taken on the opposite side as for the welding or cutting side.
- Whenever openings or cracks in the floor, walls, or doorways cannot be closed, precautions shall be taken to prevent combustible materials in other areas from coming in contact with sparks.
- To prevent fire in enclosed spaces, the gas supply to the torch shall be shut off at some point outside the enclosed space whenever the torch is not in use or is left unattended.
- Drums or hollow structures that have contained toxic or flammable substances shall be filled with water or thoroughly cleaned, ventilated, and tested before welding or cutting on them.
- Before heat is applied to a drum, container, or structure, a vent or opening shall be provided to release built-up pressure during the application of heat.
- Before welding or cutting on any surface covered by a preservative coating whose flammability is unknown, a competent person shall test to determine its flammability.
- Preservative coatings shall be considered highly flammable when scrapings burn rapidly.
- When preservative coatings are determined to be highly flammable, they shall be stripped from the area to be heated.

8.70 Working Around Material Handling Equipment

When CH2M personnel are exposed to material handling equipment, the following safe work practices/hazard controls shall be implemented:

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.
- Never turn your back on any operating equipment.
- Never climb onto operating equipment or operate contractor/subcontractor equipment.
- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers and equipped with firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.
- Wear a high visibility safety vest or high visibility clothing.

8.71 Working Alone

(Reference CH2M Core Standard, *Working Alone*)

Personnel can only be tasked to work alone by the Project Manager who shall assess potential hazards and appropriate control measures, with assistance from the Responsible Health and Safety Manager (RHSM).

“Lone workers” with an accountability system in place is permitted, depending on the hazards presented during the execution of the task. Reference the “Lone Worker Protocol” included as an attachment to the project safety plan.

Only limited operations task are permitted to be performed alone. Activities that are not permitted to be performed by a lone worker include the following:

- Working at heights (e.g., on ladders, lifts, scaffolding);
- Energy isolation (e.g., lockout/tagout);
- Any entry into a confined space; and
- Work involving electricity or other hazardous equipment (e.g., chainsaws);
- Work over or near water; and
- Working in an area where there is an increased potential for violence.

An AHA shall be developed that shall include:

- Type or nature of work to be conducted by the lone worker;
- Location of the work
- Length of time the worker will be working alone; and
- Any characteristics of the individual working alone which may increase the risk to the worker (e.g., medical conditions).

The employee working alone shall at all times be equipped with a working voice communication device such as a cellular phone, satellite phone, personal alarms, or two-way radio to check-in to their project contact (s) at pre-

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determined times. For some work, a satellite-based communication system may be appropriate (i.e., a “SPOT” device).

Call-In System for Lone Worker Accountability

The employee working alone shall at all times be equipped with a working voice communication device such as a cellular phone, satellite phone, personal alarms, or two-way radio to check-in to their project contact (s) at pre-determined times.

Each time before going into the field, a “Call in contact Form” shall be completed by the lone worker and given to the call-in office worker contact prior to going into the field.

During field work, a copy of “The Lone Worker Call-In Contact Form” should be maintained by both the “Office Contact Worker” and the field-worker (“Lone Worker”). Lone Worker and Office Contact Worker must both have cell phones and each other’s phone number, plus one other alternate phone number.

Lone worker shall call the office contact worker when he/she has arrived on-site, before exiting his/her vehicle. On this phone call, a time shall be arranged for a “check-in” call to be made by the field worker, based on duration of task. On each “check-in” call a time should be arranged for the next “check-in” call. Document these times on the form.

Lone Worker shall carry his or her cell-phone throughout the field event and put the ringer on its loudest setting as wind or other noise can muffle the sound. If, for any reason the cell-phone becomes inoperable, the field-worker shall immediately stop work, leave the site and find an alternative method of contacting the Office Contact Worker to verify their safety and to inform them of the issue.

Work shall not proceed in the field until the Lone Worker has a working device that provides communication with the Office Contact Worker.

Upon completion of work activities, Lone Worker should pack up all materials and prepare to leave site. Then, before starting the engine of the vehicle to leave site, the Lone Worker should contact the office-worker and inform him or her that work is complete and that he or she is leaving the site. A final call shall be made by the lone work to the office worker to confirm he/she has reached their destination.

If at any time, the Office Contact Worker does not receive a “check-in” call at the scheduled time he/she should attempt to contact Lone Worker. If no contact is made then the Office Contact Worker should contact the facility contact person to check on the Lone Worker.

If no contact is made with the Lone Worker, then the Office Contact Worker shall contact the PM and/or RHSM to let them know they are going to inform emergency services inform that there is a possible emergency and instruct them to go to the field location and assist the Lone Worker. The Office Contact Worker will provide to emergency services the Lone Worker’s name, their last known location, vehicle description and their contact information.

Call in contact Form shall be completed by lone worker and given to call in contact prior to going into the field. Refer to the “Lone Worker Protocol” attached to the project safety plan.

8.72 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, Coast Guard-approved personal flotation devices (PFDs), or a life jacket, shall be worn.
- Provide employees with an approved life jacket or buoyant work vest (USCG for U.S. operations).
 - Employees should inspect life jackets or work vests daily before use for defects. Do not use defective jackets or vests.

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- 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.

9. 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 Handbook or the project safety plan, contact the RHSM so hazard controls can be addressed.

9.1 Noise

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

CH2M 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 (in Canada: Provincial OH&S Code/Regulations). 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 percent 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'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 and a copy of the OSHA standard (29 CFR 1910.95), Provincial OH&S Code/Regulation, or other governing regulation shall be posted in the workplace.

9.2 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).

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- 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.

9.3 Temperature Extremes

(Reference CH2M 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.

9.3.1 Heat

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 a gradual physiological adaptation that improves an individual’s ability to tolerate heat stress. Acclimatization requires physical activity under heat-stress conditions similar to those anticipated for the work. With a recent history of heat-stress exposures of at least two continuous hours per day for 5 of the last 7 days to 10 of the last 14 days, a worker can be considered acclimatized. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days and may be completely lost in three to four weeks. Because acclimatization is to the level of the heat-stress exposure, a person will not be fully acclimatized to a sudden higher level; such as during a heat wave.

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. Remind employees to drink water throughout their work shift.
- Alternating water consumption with a sports drinks (e.g., Gatorade, Powerade, Sqwincher) to help maintain electrolyte balance, especially when working in hot conditions for more than 2 hours, may be necessary. The recommended hydration protocol is alternating water with a sports drink at a one-to-one ratio. Also eating regular meals and salt-containing snacks can also replace electrolytes lost during sweating.
- 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 to site work conditions by slowly increasing workloads; for example, do not begin site work with extremely demanding activities. Closely monitor employees during their first 14 days of work in the field.
- Supervisors and SCs must continually observe employees throughout the work shift for signs and symptoms of heat stress or illness. Employees must monitor themselves for heat stress as well as observe their co-workers.
- Effective communication must be maintained with employees throughout the work shift either by voice, observation, or electronic device.
- 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).
- Use portable fans for convection cooling or in extreme heat conditions, an air-conditioned rest area when needed.
- In hot weather, rotate shifts of workers.
- Maintain good hygiene standards by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should consult medical personnel.
 - Brief employees initially before the project work begins and routinely as part of the daily safety briefing, on the signs and symptoms of heat-relatedness illnesses, precautions and emergency procedures to follow as described in the project safety plan.
 - Observe one another for signs of heat stress. PREVENTION and communication is key.

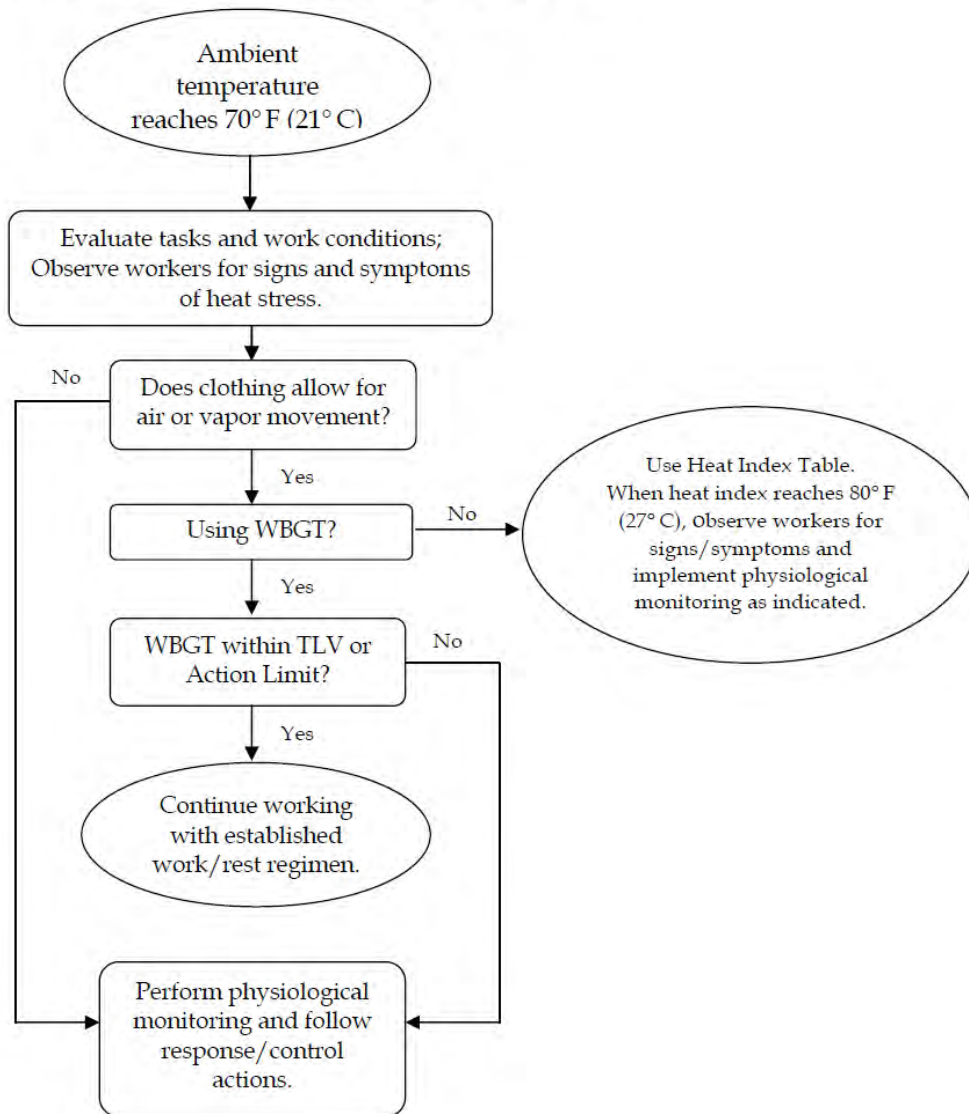
California has a specific heat illness prevention regulation that must be implemented. This includes,

- 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 area with no air conditioning is NOT considered shade. Must be a well ventilated area or have air conditioning.
- Workers shall be allowed to take a work-free cool-down rest/recovery period in the shade for a minimum of five minutes at any time when they feel the need to do so to protect themselves from overheating, or at the first sign of heat illness-related symptoms. (NOTE: 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.

Thermal Stress Monitoring

Thermal Stress Monitoring Flow Chart



Permeable Clothing – Monitoring Using WBGT

A Wet Bulb Globe Thermometer (WBGT) is the established and preferred means of measuring the environmental factors associated with heat stress and for providing indication of when physiological monitoring or rest regimens should be incorporated into the work schedule. The WBGT is the composite temperature used to estimate the effect of temperature, humidity, wind speed, and solar radiation on the human body.

When permeable work clothes are worn (street clothes or clothing ensembles over modesty clothes), physiological monitoring may be required based on the outcome of the WBGT measurements, taking into account the clothing adjustment factors. Use of the WBGT should generally begin when the heat index reaches 80° F (27° C) as indicated in the Heat Index Table below, or when workers exhibit symptoms of heat stress as indicated above.

If the WBGT is within the TLV (acclimatized workers) or Action Limit (unacclimatized workers) per the tables below, then work may continue while maintaining the established work/rest regimen. If the WBGT reading meets or exceeds either the TLV or Action Level for a work/rest regimen of 15 minutes work and 45 minutes rest, then physiological monitoring will be implemented.

Screening Criteria for TLV and Action Limit for Heat Stress Exposure

Allocation of work in a cycle of work and recovery	TLV (WBGT Values in °F/°C) (Acclimatized Workers)				Action Limit (WBGT Values in °F/°C) (Unacclimatized Workers)			
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
75-100%	88/31	82/28	—	—	82/28	77/25	—	—
50-75%	88/31	84/29	82/28	—	83/29	79/26	75/24	—
25-50%	90/32	86/30	84/29	82/28	85/30	81/27	78/26	76/25
0-25%	91/33	89/32	87/31	86/30	86/30	84/29	82/28	81/27

Work Category Descriptions:

Light	Sitting or standing with light manual work using hands or arms; occasional walking.
Moderate	Sustained moderate hand, arm, and leg work; light pushing and pulling; normal walking.
Heavy	Intense arm and trunk work, carrying, shoveling, manually sawing, pushing and pulling heavy loads, walking at a fast pace.
Very Heavy	Very intense activity at fast to maximum pace.

Notes:

WBGT values are expressed to the nearest degree.

“—”Dashes indicate the need for physiological monitoring because screening criteria are not recommended for this type of work.

Clothing Adjustment Factors for Some Clothing Ensembles*

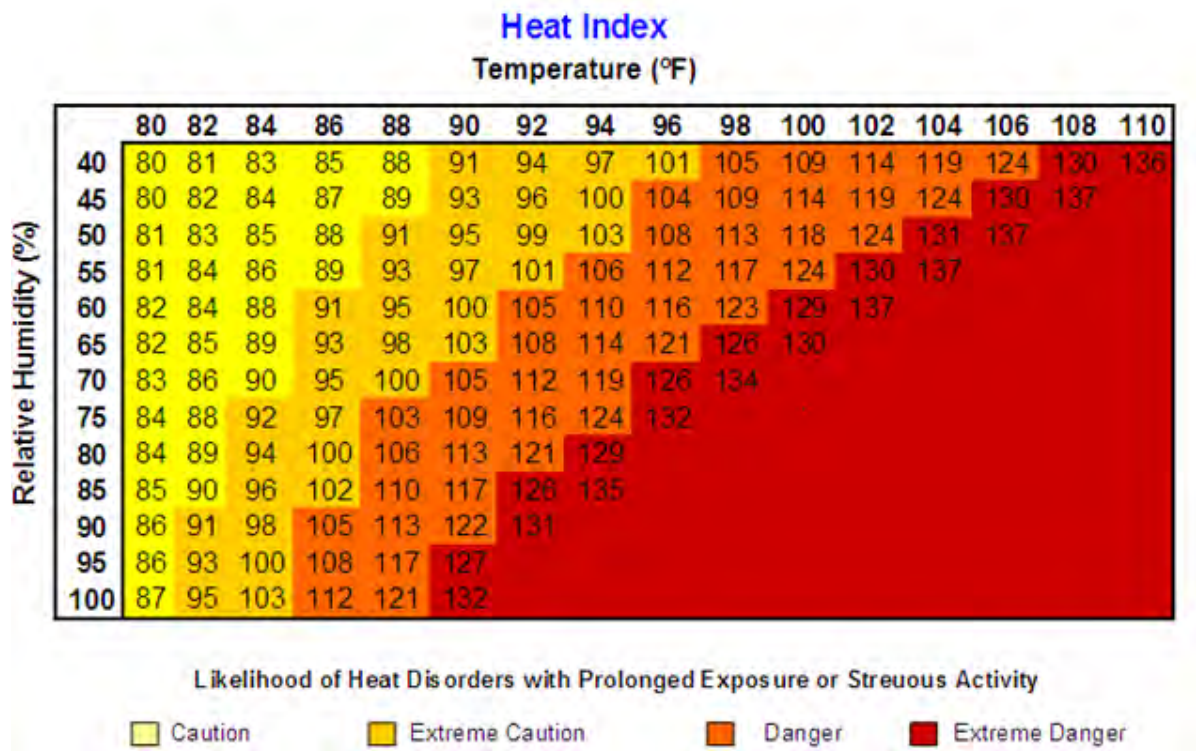
Clothing Type	Addition to WBGT °F/°C
Work Clothes (sleeved shirt and pants)	0/0
Cloth (woven material) coveralls	0/0
Double-layer woven clothing	5.4/3
Polypropylene coveralls	0.9/0.5
Limited Use Vapor barrier coveralls	19.8/11

* These values must not be used for completely encapsulating (impermeable) coveralls/suits. Coveralls assume that only modesty clothing is worn beneath.

Thermal Stress Monitoring – Permeable or Impermeable Clothing

When **permeable work clothes** are worn (street clothes or clothing ensembles over street clothes), regularly observe workers for signs and symptoms of heat stress and implement physiological monitoring as indicated below. This should start when the heat index reaches 80° F (27° C) [see Heat Index Table below], or sooner if workers exhibit symptoms of heat stress indicated in the table above. These heat index values were devised for shady, light wind conditions; exposure to full sunshine can increase the values by up to 15°F (8°C). Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

When wearing **impermeable clothing** (e.g., clothing doesn't allow for air or water vapor movement such as Tyvek), physiological monitoring as described below shall be conducted when the ambient temperature reaches 70° F (21° C) or sooner when climatic conditions may present greater risk of heat stress combined with wearing unique variations of impermeable clothing, or workers exhibit symptoms of heat stress



Heat Index	Possible Heat Disorders	Minimum Frequency of Physiological Monitoring
80°F - 90°F (27°C - 32°C)	Fatigue possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline and observe workers for signs of heat stress and implement physiological monitoring if warranted.
90°F - 105°F (32°C - 41°C)	Sunstroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline, then at least every hour, or sooner, if signs of heat stress are observed.
105°F - 130°F (41°C - 54°C)	Sunstroke, heat cramps, or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity.	Conduct initial monitoring as baseline, then every 30 minutes or sooner if signs of heat stress are observed.
130°F or Higher (54°C or Higher)	Heat/Sunstroke highly likely with continued exposure.	Conduct initial monitoring as baseline, then every 15 minutes or sooner if signs of heat stress are observed.

Source: National Weather Service

Physiological Monitoring and Associated Actions

For employees wearing permeable clothing, follow the minimum frequency of physiological monitoring listed in the Heat Index Table.

For employees wearing impermeable clothing, physiological monitoring should begin initially at a 15 minute interval, then if the employee's heart rate or body temperature is within acceptable limits, conduct the subsequent physiological monitoring at 30 minutes, and follow the established regimen protocol below.

When physiological monitoring is required, use either radial pulse or aural temperature and follow actions below:

- The sustained heart rate during the work cycle should remain below 180 beats per minute (bpm) minus the individual's age (e.g., 180 – 35 year old person = 145 bpm). The sustained heart rate can be estimated by measuring the heart rate at the radial pulse for 30 seconds as quickly as possible prior to starting the rest period.
- The heart rate after one minute rest period should not exceed 120 beats per minute (bpm).
- If the heart rate is higher than 120 bpm after the FIRST minute into the rest period, 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 120 bpm 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 120 bpm after the FIRST minute into the rest period.

Alternately, the body temperature can be measured, either oral or aural (ear), before the workers have something to drink.

- If the oral or aural temperature exceeds 99.6° F (37.6 ° F) at the beginning of the rest period, the following work cycle should be shortened by 33 percent.
- Continue this procedure until the oral or aural (ear) temperature is maintained below 99.6 ° F (37.6° C). While an accurate indication of heat stress, oral temperature is difficult to measure in the field, however, a digital aural (aural) thermometer is easy to obtain and inexpensive to purchase.

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 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 emergency medical treatment section of the project safety plan.
- Follow the Incident Notification, Reporting, and Investigation section of this Handbook.

9.3.2 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

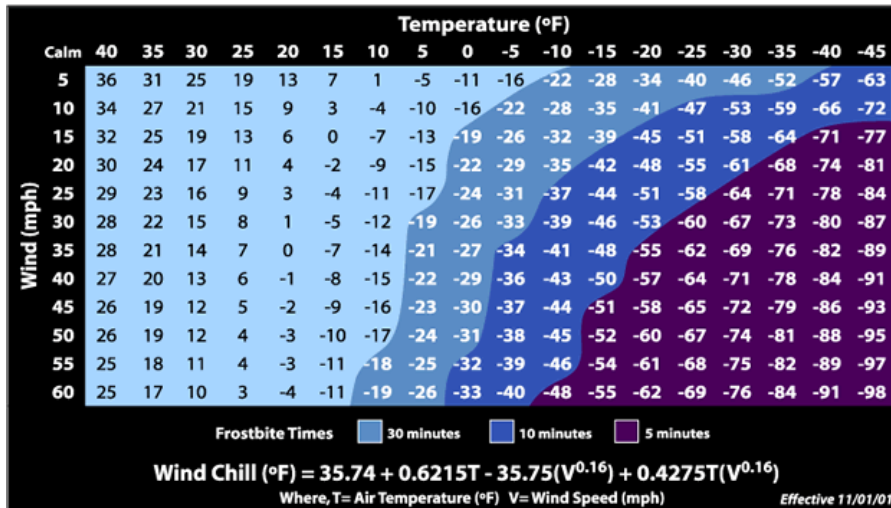
- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army wind-chill index and the National Safety Council (NSC) [in Canada: Environment Canada Will Chill Chart].
- 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.



Wind Chill Chart



Environment Canada Wind Chill Chart:

Actual Air Temperature T_{air} (°C)

T_{air} (°C)												
	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
V10 (km/h)												
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	-38	-44	-51	-57	-64	-70
30	0	-6	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	-76
55	-2	-8	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

where
 T_{air} = Actual Air Temperature in °C
 V_{10m} = Wind Speed at 10 metres in km/h (as reported in weather observations)

- Notes:
- For a given combination of temperature and wind speed, the wind chill index corresponds roughly to the temperature that one would feel in a very light wind. For example, a temperature of -25°C and a wind speed of 20 km/h give a wind chill index of -37. This means that, with a wind of 20 km/h and a temperature of -25°C, one would feel as if it were -37°C in a very light wind.
 - Wind chill does not affect objects and does not lower the actual temperature. It only describe how a human being would feel in the wind at the ambient temperature.
 - The wind chill index does not take into account the effect of sunshine. Bright sunshine may reduce the effect of wind chill (make it feel warmer) by 6 to 10 units.

10. Biological Hazards and Controls

Biological hazards are everywhere and change with the region and season. During project planning stages, ask the site Point of Contact if there are insect or other biological hazards have been noted in any of the work sites.

Biological hazards are everywhere and change with the region and season. If you encounter a biological hazard that has not been identified in the project safety plan or in this Handbook, contact the RHSM so that hazard controls can be addressed. 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.

10.1 Black Bears

Bears may inhabit wooded areas where there is scarce continuous human presence. 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, he may come closer or stand on his 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 mph, 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 bears 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.

10.2 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.

Precautions include:

- Watching for and avoiding 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. When working at a remote location, ensure that first-aid kits contain over-the-counter allergy and itch medication (e.g., Benadryl, Claritin, etc.) as well as other over-the-counter medications that may not be available to aid in symptom treatment.
- If bees or other stinging insects are known to be present, determine whether additional protective clothing should be donned before entering/working in brushy areas.

-
- Before entering a heavily vegetated or brushy area, observe the area for several minutes to see if bees or other stinging insects may be present. If nests or individual insects are observed, retreat and inquire whether a specialist or a client service can be contacted to clear the area before work proceeds.
 - Consider if heavy-weight clothing or tyvek, or head netting would provide additional protection in areas where wasps/bees are known or suspected. Be aware of heat stress conditions additional clothing may cause.
 - Use insect repellent on clothing. Wear light-colored clothing and remove bright reflective safety-colored clothing if not working near a roadway as these may attract the wasps.
 - Wear fragrance-free or lightly-scented sunscreen, and body lotions. Bees are attracted to sweet scents. Avoid using floral scented soaps, shampoos, or conditioners.
 - Move slowly and calmly through vegetated areas and try to avoid major disturbance of vegetation as wasps/bees often react to aggressive movement.
 - If you encounter a wasp, back away slowly and calmly, do not run or swat at the insect. Wait for it to leave, or gently move or brush it off gently with a piece of paper or other light object. Do not use your hand.

If you are stung, contact the occupational nurse at 1-866-893-2514, no matter how minor it may seem. If a stinger is present, remove it as soon as possible using something with a thin, hard edge (e.g., credit card) to scrape the stinger out. Be sure to sanitize the object first with hand sanitizer, alcohol or soap and water. 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.

10.3 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.

10.4 Cactus

Contact with cacti can result in dermatitis as well as causing immunologic and infectious reactions. The spines can scratch the skin or induce wounds and multiple abrasions. Some cacti have glochids (hair-like spines or short prickles, generally barbed). Glochids can induce more troublesome, more persistent, dermatological manifestations such as papules or nodules.

Set up the work area to ensure avoidance of cacti. Wear leather glove if working near cacti. Keep any clothing such as jackets away from cacti as spines can become lodged into the clothing and can be contacted by the skin later. Contact the occupational nurse if cactus contact occurs.

10.1 Canada Geese

If Canadian geese are present at the worksite, do not attempt to feed or go near geese or nesting areas. Canada Geese can be extremely aggressive during mating and nesting periods. If the project work requires staff to work in areas where geese may be nesting, please contact the SC and/or client site supervisor to determine the correct

course of action to be taken. Minimize direct contact with goose droppings, remove shoes prior to entering home or work following contact and wash hands thoroughly with antibacterial soap

10.2 Cougars/Mountain Lions

Like bears, cougars will often retreat if given the opportunity. Walking in groups and making noise will give the cougar the chance to retreat and reduce the likelihood of a sudden encounter. Be especially cautious during dusk and dawn.

If you see a cougar—do not play dead, do not run. Running may trigger an attack. Face the cougar and retreat slowly maintaining eye contact. If the cougar continues advancing, raise your arms above your head to make yourself look larger than normal. This may help to intimidate the cougar. Sometimes aggressive yelling and rock throwing may scare it off.

If attacked, fight back with whatever is at hand (without turning your back)—people have utilized rocks, jackets, garden tools, tree branches, and even bare hands to turn away cougars.

10.3 Coyotes

While far from domesticated, coyotes show little fear of humans and have become comfortable living in close proximity to our communities. Although they tend to do most of their hunting after dusk, coyotes can be active at any time. Under normal circumstances, a coyote is not a danger to humans. They are, however, territorial and will respond aggressively if they or their family are threatened.

If you encounter a coyote that behaves aggressively, you have probably gotten too close to its prey or its family. Try to scare the coyote by yelling and waving your arms. Throw rocks, sticks or other objects. Do not turn away and run.

10.4 Devil's Club

Devil's Club (scientific name: *Oplopanax horridus*) is a large plant which thrives in moist woods and along streams. The plant is native to British Columbia and found all along the Pacific coast from Alaska to southern Oregon. Devil's Club grows up to 19 feet (6 meters) tall and has large 7 to 15 inch (20 to 40 centimeters), maple-shaped leaves. It produces small white flowers in spring and bright red fruit (clustered berries) in summer. The fruit is considered poisonous to humans but is eaten by bears.

Both the stem and leaves are covered with sharp thorns that are up to over a half an in (2 centimeters) long. In addition to physical damage to the eyes and skin, there is evidence that the spiny thorns can cause serious allergic reactions in some individuals.

Wear long-sleeved shirts and long pants when working in areas where Devil's Club is growing. Protective goggles or safety glasses with side shields are recommended when walking through patches of brush that exceed shoulder height. Wear heavy, leather or canvas gloves when handling the plants. When cutting devil's club with a chainsaw make sure the hand protection is in place to protect the operators knuckles

Avoid devil's club if possible. The thorns are barbed and cannot be fully removed. Wounds from devil's club thorns often become infected and fester from the imbedded barbs. If skin contacts occurs, immediately remove any thorns with tweezers and wash the skin carefully with soap and water. Application of an anti-inflammatory cream (e.g., a 0.5% hydrocortisone cream) may reduce skin irritation. Seek medical assistance and contact the Injury Management hotline at 1-866-893-2514.



10.5 Feral Dogs and Cats

Below are hazard controls when dogs or cats are encountered.

- Do not attempt to handle or capture a stray dog or cat.
- 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.

10.6 Fire Ants

There are several types of fire ants in the United States that can cause painful bites and allergic reactions. Fire ants aggressively defend their nests by stinging several times after climbing on their victims. Large ant mounds are easily visible, but there can be smaller mounds or nests with little “worked” soil that can be stepped on inadvertently. They can also be under rocks, wood or other debris. Implement the following when fire ants are observed:

- Be aware of fire ants and take care not to stand on ant nests;
- Use insect repellents on clothing and footwear to temporarily discourage ants from climbing; and
- Tuck pants into socks.

If stung, get away from the area you are standing on, briskly brush off ants—wash affected area with soap. Call your Supervisor and HSM and contact Injury Care for Employees hotline at 1-866-893-2514.

10.7 Giant Hogweed

Giant hogweed is a noxious weed that has become established in the US and Canada.

Its sap, in combination with moisture and sunlight, can cause phytophotodermatitis—a serious skin inflammation and severe eye irritation leading to blindness. Contact between the skin and the sap of this plant occurs either through brushing against the bristles on the stem or breaking the stem or leaves. Eye exposure to the sap can occur during the breaking of the stems (during clearing/grubbing). Heat, sunlight, and moisture worsen the skin reaction.

Giant hogweed is a biennial or perennial which can grow up to 12 feet (approximately 3.5 meters) or more. Its hollow, ridged stems grow 2-4 inches (5-10 cm) in diameter and have dark reddish-purple blotches. Its large

compound leaves can grow up to five feet (1.5 meters) wide. Its white flower heads can grow up to 2.5 feet (approximately 1 meter) in diameter.

Symptoms of exposure include initial itching and redness, then painful blisters form within 48 hours with the area becoming dark and pigmented. Long-term effects include scarring, sensitivity of the affected area to sunlight, temporary or permanent blindness if it gets into the eyes.

As with all hazardous plants, recognition and avoidance is key. Do not touch any portion of the plant. Become familiar with the identity of these plants (see below). Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and cold water immediately. Keep exposed area away from sunlight for 48 hours. Contact your supervisor, RHSM and the Injury Care for Employees hotline at 1-866-893-2514.

10.8 Hantavirus

Hantavirus pulmonary syndrome (HPS) is a disease caused by a virus which can be transmitted from certain rodents to humans and is prevalent throughout North America. Avoid disturbing rodent nests. Contact is most likely to occur when there is a current rodent infestation in things like control boxes, storage sheds, wellheads, remediation equipment, or trailers. Once excreted into the environment by the rodent, hantaviruses can survive in the environment and remain infectious for a period of 2-3 days. Ultraviolet rays in sunlight inactivate hantaviruses.

Nesting material and droppings must be removed if work is necessary in a rodent-infested area. PPE for removal shall include:

- Tyvek coveralls;
- Rubber boots or disposable shoe covers;
- Rubber, latex, or vinyl gloves;
- Respiratory protection such as a full face or half-mask air-purifying respirator with a high-efficiency particulate air (HEPA) filter; and
- Protective goggles if wearing a half-mask respirator.

Spray any urine, droppings, and nesting materials with either a bleach and water solution (1 parts bleach to 9 parts water) or a household disinfectant prepared according to the label instructions for dilution and disinfection time. Soak well and let stand for 15 minutes. Use a paper towel or rag to pick up the materials and dispose of them.

Mop floors after spraying them using bleach and water solution or a disinfectant. Dirt floors can be sprayed with either bleach and water solution or a disinfectant.

Personal protective gear shall be decontaminated upon removal at the end of the day. All potentially infective waste material (including respirator filters) from clean-up operations shall be double-bagged in plastic bags.

Symptoms of HPS

Symptoms develop between 14 and 31 days after exposure to infected rodents and include fatigue, fever, and muscle aches, especially the large muscle groups—thighs, hips, back and sometimes shoulders. About half of all HPS patients also experience headaches, dizziness, chills and/or abdominal pain. Four to 10 days after the initial phase of the illness, late symptoms of HPS may appear. These include coughing and shortness of breath. If you develop symptoms suggestive of HPS, call the occupational nurse at 1-866-893-2514.

10.9 Hazards during Hunting Seasons

Various times of the year can be particularly hazardous for personnel working in the field. The danger is highest for our teams doing cross-country surveys of pipelines and transmission lines, but everyone doing field work should be aware of the hunting seasons that are active where you are working.

Big game hunting can be very dangerous, but also be aware of water fowl seasons and hunting seasons for less common game in your area. Work in wetlands can bring us in close proximity to these types of hunters.

If possible consider postponing field surveys so they do not coincide with hunting seasons but if you must be in the field be as visible as possible at all times.

(In the US, this site gives all the different hunting seasons by state: www.huntinfo.org/)

Implement the following if hunting may be a hazard:

- Do not wear kaki, brown or tan clothing, wear high visibility colors including hats and vests;
- Avoid wearing white or light colored scarves, gloves, handkerchiefs (a woman wearing white mittens hanging laundry was shot and killed as bad hunter shot at flash of white);
- When carrying white plans, field data sheets etc keep them in binder or backpack;
- Wear your safety vest at all times including standing by car/truck;
- Wear a safety hat/cap or put florescent markers on hard hats;
- Be alert particularly in early mornings and at end of day when most hunters are present;
- Avoid being in field altogether at dawn or dusk - start a little later in the morning and make sure you get out of the field earlier;
- Stop at local hardware or convenience market and pick up hunter safety gloves, caps, rolls of tape etc. All the stores carry them and they are cheap visual protection.
- Make your presence known, such as slamming car doors, honk horn, talk loudly when getting out to a field site; and
- Stop and survey your surroundings. Many hunters are up in tree stands.

10.10 Leeches

Leeches are bloodsucking aquatic or terrestrial worms. They can crawl through or over your socks or brush onto you from shrubbery. They carry no disease and there is low risk of significant blood loss. Leech bites do not hurt since they release an anesthetic, but they can bleed profusely due to an anticoagulant they release to facilitate the flow of blood.

Possible Complications

- Some people suffer allergic reaction from leech bites and require urgent medical care. Symptoms include an ulcer infection, itchy rash, red blotches or an itchy rash over the body, swelling around the lips or eyes, feeling faint or dizzy, and difficulty breathing. If you experience any of these symptoms, seek medical attention immediately.

Prevention options

- The best protection against leeches is covering up and using tropical strength insect repellent on socks and clothing.
- Use anti leech socks and fit over outer garments which served as a barrier.
- Various reports suggest applying salt, dettol spray, bath soap, eucalyptus oil or lemon juice to your skin.
- Inspect your body after leaving leech-infested waters or area, removing them promptly.

First Aid

-
- Locate the head with a sucker attached to the wound. It will be the narrow end of leech's body.
 - Use your fingernail or other flat, blunt object to break the seal of the oral sucker at which point the leech's jaws will detach. Repeat with the posterior end.
 - Quickly flick the leech away before it bites you again and reattaches.
 - Treat the wound with soap and water and antiseptic wipes; then bandage to stop bleeding.
 - Do not just pull off the leech as this may cause a severe wound and the jaws may stay imbedded in the skin
 - If the leech has attached to an orifice such ear, nose or mouth use salt or strong (drinkable) alcohol to cause it to release before it expands.
 - Apply pressure to the area and a cold pack to reduce pain or swelling.
 - The wound normally itches as it heals, but should not be scratched, as this may complicate healing and introduce other infections. Apply an antihistamine if necessary to reduce itching.
 - If assisting a bitten person, use the usual protective universal precautions to protect against blood borne pathogens
 - Call the RHSM, Workers Supervisor and Injury Management hotline at 1-866-893-2514 (as necessary).

10.11 Mosquitos and Dengue, Chikungunya, Zika, and West Nile Viruses

(Source: Centers for Disease Control)

Aside from being itchy and annoying, the bite of an infected female mosquito (*Aedes aegypti* or *Aedes albopictus*) can spread dengue, chikungunya, or Zika viruses. People become infected with dengue, chikungunya, or Zika after being bitten by an infected mosquito.

- Female mosquitoes lay several hundred eggs on the walls of waterfilled containers. Eggs stick to containers like glue and remain attached until they are scrubbed off. When water covers the eggs, they hatch and become adults in about a week.
- Adult mosquitoes live inside and outside.
- They prefer to bite during the day.
- A few infected mosquitoes can produce large outbreaks in a community and put your family at risk of becoming sick.

Protect Yourself, Your Family, and Community from Mosquitoes

1. Eliminate standing water in and around your home:

- Once a week, empty and scrub, turn over, cover, or throw out items that hold water, such as tires, buckets, planters, toys, pools, birdbaths, flowerpots, or trash containers. Check inside and outside your home.
- Tightly cover water storage containers (buckets, cisterns, rain barrels) so that mosquitoes cannot get inside to lay eggs.
- For containers without lids, use wire mesh with holes smaller than an adult mosquito.

2. If you have a septic tank, follow these steps:

- Repair cracks or gaps.
- Cover open vent or plumbing pipes. Use wire mesh with holes smaller than an adult mosquito.

3. Keep mosquitoes out of your home:

- Use screens on windows and doors.
- Repair holes in screens.
- Use air conditioning when available.
- Put plants in soil, not in water.
- Drain water from pools when not in use.
- Recycle used tires or keep them protected from rain.
- Drain & dump any standing water.
- Weekly, scrub vases & containers to remove mosquito eggs.

4. Prevent mosquito bites:

- Use an Environmental Protection Agency (EPA)-registered insect repellent with one of the following active ingredients. All EPA-registered insect repellents are evaluated to make sure they are safe and effective.

Active ingredient Higher percentages of active ingredient provide longer protection	Some brand name examples*
DEET	Offi, Cutter, Sawyer, Ultrathon
Picaridin , also known as KBR 3023 , Bayrepel , and icaridin	Cutter Advanced, Skin So Soft Bug Guard Plus, Autan (outside the United States)
IR3535	Skin So Soft Bug Guard Plus Expedition, SkinSmart
Oil of lemon eucalyptus (OLE) or para-menthane-diol (PMD)	Repel
* Insect repellent brand names are provided for your information only. The Centers for Disease Control and Prevention and the U.S. Department of Health and Human Services cannot recommend or endorse any name brand products.	

- Always follow the product label instructions.
- Reapply insect repellent every few hours, depending on which product and strength you choose.
- Do not spray repellent on the skin under clothing.
- If you are also using sunscreen, apply sunscreen first and insect repellent second.
- Treat clothing and gear (such as boots, pants, socks, and tents) with permethrin or purchase permethrin-treated clothing and gear.
 - Treated clothing remains protective after multiple washings. See product information to find out how long the protection will last.
 - If treating items yourself, follow the product instructions carefully.
 - Do not use permethrin products, intended to treat clothing, directly on skin.
- Wear long-sleeved shirts and long pants.
- Use BugOut Suits™ or equivalent as necessary.

Signs and symptoms of common mosquito-borne diseases

Below are signs and symptoms of common mosquito-borne diseases.

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.

Signs and symptoms of chikungunya virus disease (chikungunya)

Common symptoms include fever and severe joint pain. Other symptoms may include headache, muscle pain, joint swelling, or rash.

Symptoms usually begin 3—7 days after being bitten by an infected mosquito.

Most patients will feel better within a week. In some people, the joint pain may persist for months. Death is rare.

People at risk for more severe disease include newborns infected around the time of birth, older adults (≥ 65 years), and people with medical conditions such as high blood pressure, diabetes, or heart disease.

Signs and symptoms of Dengue

The principal symptoms of dengue are:

- High fever and at least two of the following:
 - Severe headache
 - Severe eye pain (behind eyes)
 - Joint pain
 - Muscle and/or bone pain
 - Rash
 - Mild bleeding manifestation (e.g., nose or gum bleed, petechiae, or easy bruising)
 - Low white cell count

Generally, younger children and those with their first dengue infection have a milder illness than older children and adults.

Watch for warning signs as temperature declines 3 to 7 days after symptoms began. Seek immediate medical attention if any of the following warning signs appear:

- Severe abdominal pain or persistent vomiting
- Red spots or patches on the skin
- Bleeding from nose or gums
- Vomiting blood
- Black, tarry stools (feces, excrement)
- Drowsiness or irritability
- Pale, cold, or clammy skin
- Difficulty breathing

Signs and symptoms of Zika

About 1 in 5 people infected with Zika virus become ill (i.e., develop Zika). The most common symptoms of Zika are:

- Fever, rash, joint pain, or conjunctivitis (red eyes).
- Other common symptoms include muscle pain and headache.

The incubation period (the time from exposure to symptoms) for Zika virus disease is not known, but is likely to be a few days to a week. The illness is usually mild with symptoms lasting for several days to a week.

People usually don't get sick enough to go to the hospital, and they very rarely die of Zika.

Zika virus usually remains in the blood of an infected person for about a week but it can be found longer in some people.

Signs and symptoms of 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 RISM with questions, and immediately report any suspicious symptoms to your supervisor, PM, and contact the Injury Care for Employees hotline at 1-866-893-2514.

10.12 Poison Ivy, Poison Oak, and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Shrubs are usually 12 to 30 inches high, or can also be a tree-climbing vine, with triple leaflets and short, smooth hair underneath. Plants are red and dark green in spring and summer, with yellowing leaves anytime especially in dry areas. Leaves may achieve bright reds in fall, but plants lose its (yellowed, then brown) leaves in winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons. These plants contain urushiol a colorless or pale yellow oil that oozes from any cut or crushed part of the plant, including the roots, stems and leaves and causes allergic skin reactions when contacted. The oil is active year round.

Become familiar with the identity of these plants (see below). Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

Poison Ivy



Poison Sumac



Poison Oak



Contamination with poison ivy, sumac or oak can happen through several pathways, including:

- Direct skin contact with any part of the plant (even roots once above ground foliage has been removed).
- Contact with clothing that has been contaminated with the oil.
- Contact from removing shoes that have been contaminated (shoes are coated with urushiol oil).
- Sitting in a vehicle that has become contaminated.
- Contact with any objects or tools that have become contaminated.
- Inhalation of particles generated by weed whacking, chipping, vegetation clearing.

If you must work on a site with poison ivy, sumac or oak the following precautions are necessary:

- Do not drive vehicles onto the site where it will come into contact with poison ivy, sumac or oak. Vehicles which need to work in the area, such as drill rigs or heavy equipment must be washed as soon as possible after leaving the site.
- All tools used in the poison ivy, sumac or oak area, including those used to cut back poison oak, surveying instruments used in the area, air monitoring equipment or other test apparatus must be decontaminated

before they are placed back into the site vehicle. If on-site decontamination is not possible, use plastic to wrap any tools or equipment until they can be decontaminated.

- Personal protective equipment, including Tyvek coveralls, gloves, and boot covers must be worn. PPE must be placed into plastic bags and sealed if they are not disposed immediately into a trash receptacle.
- As soon as possible following the work, shower to remove any potential contamination. Any body part with suspected or actual exposure should be washed with Zanfel, Tecnu or other product designed for removing urishiol. If you do not have Zanfel or Tecnu wash with cold water. Do not take a bath, as the oils can form and invisible film on top of the water and contaminate your entire body upon exiting the bath.
- Tecnu may also be used to decontaminate equipment.
- Use IvyBlock or similar products to prevent poison oak, ivy and sumac contamination. Check with a local drug store the closest CH2M warehouse to see if these products are available. Follow all directions for application.
- If you do come into contact with one of these poisonous plants and a reaction develops, contact your supervisor and the occupational nurse 1-866-893-2514. Be aware that in some instances, there can be a delay between contact with poisonous plants and the symptoms. If you are working near poison ivy or other poisonous plants and feel a mild skin irritation, apply Zanfel/Tecnu immediately and contact the occupational nurse.

10.13 Scorpions

Scorpions usually hide during the day and are active at night. They may be hiding under rocks, wood, or anything else lying on the ground. Some species may also burrow into the ground. Most scorpions live in dry, desert areas; however, some species can be found in grasslands, forests, and inside caves.

When entering an area that has the potential to contain scorpions, the following PPE is recommended: long pants, long sleeved shirts with collars, leather work gloves and leather work boots. Reaching into enclosures or recesses without prior visual inspection is not recommended. Thoroughly inspect each area before accessing. Shake out clothing, jackets, shoes or boots prior to putting them on.

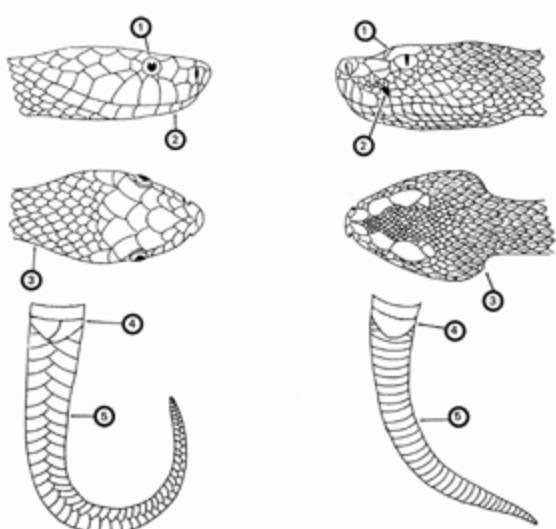
If you are stung by a scorpion, call the Injury Care for Employees hotline 1-866-893-2514 and try to note the description of the scorpion. Cleanse the sting area and apply ice.

10.14 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Call the occupational nurse at 1-866-893-2514 immediately. Do not apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings. Below is a guide to identifying poisonous snakes from non-poisonous snakes.

Ontario's only venomous snake is the Eastern Massasauga rattlesnake, which only occurs in four isolated areas: Southern Georgian Bay, the Bruce Peninsula, Wainfleet Bog near Port Colborne, and Ojibway Prairie near Windsor. The chances of encountering this rattlesnake outside of these areas is very low.

Identification of Poisonous Snakes

Major Identification Features Non-venomous Snake	Major Identification Features Venomous Snake
<ol style="list-style-type: none">1. Round pupils2. No sensing pit3. Head slightly wider than neck4. Divided anal plate5. Double row of scales on the underside of the tail	<ol style="list-style-type: none">1. Elliptical pupils2. Sensing pit between eye and nostril3. Head much wider than neck4. Single anal plate5. Single scales on the underside of the tail
	

10.15 Spiders - Brown Recluse and Widow

The Brown Recluse spider can be found most anywhere in North America. 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.

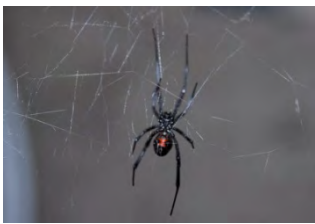
Hazard Controls

- 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 Injury Care for Employees number 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



Brown Recluse

10.16 Ticks

Every year employees are exposed to tick bites at work and at home putting them at risk of illness. Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch (6.4 mm) in size.

In some geographic areas exposure is not easily avoided. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray only outside of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

Where site conditions (vegetation above knee height, tick endemic area) or when tasks (having to sit or kneel in vegetation) diminish the effectiveness of the other controls mentioned above, bug-out suits (check with your local or regional warehouse) or Tyvek shall be used. Bug-out suits are more breathable than Tyvek.

Take precautions to avoid exposure by including pre-planning measures for biological hazards prior to starting field work. Avoid habitats where possible, reduce the abundance through habitat disruption or application of acaricide. If these controls aren't feasible, contact your local or regional warehouse for preventative equipment such as repellants, protective clothing and tick removal kits. Use the buddy system and perform tick inspections prior to entering the field vehicle. If ticks were not planned to be encountered and are observed, do not continue field work until these controls can be implemented.

See Tick Fact Sheet attached to project safety plan for further precautions and controls to implement when ticks are present. If bitten by a tick, follow the removal procedures found in the tick fact sheet, and call the occupational nurse at 1-866-893-2514.

Be aware of the symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme disease is a rash that might appear that looks like a bull's eye with a small welt in the center. RMSF is a rash of red spots under the skin 3 to 10 days after the tick bite. In both RMSF and Lyme disease, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, again contact the occupational nurse at 1-866-893-2514.

Be sure to complete an Incident Report (either use the Hours and Incident Tracking System [HITS] system on the VO) if you do come in contact with a tick.

11. Personal Protective Equipment

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

11.1 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 in each project safety 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; if you are unsure of how to use or maintain your PPE, ask your RHSM for guidance.
- Employees must be trained in the limitations of the PPE; if you are unsure, ask your RHSM for guidance.
- 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.

Each project safety plan will outline PPE to be used according to task based on project-specific hazard assessment. Long pants and short-sleeve shirts that cover the shoulders, with a minimum three-inch sleeve length, are required to be worn for all field project sites. The minimum PPE typically required for field project sites is: hard hat, safety glasses and safety footwear. The minimum PPE required on construction, operations and maintenance project sites is: hard hat, safety glasses, high visibility vest (when exposed to heavy equipment operations or vehicular traffic), safety footwear and appropriate work gloves.

11.2 Respiratory Protection

(Reference CH2M SOP HSE-121, *Respiratory Protection*)

Implement the following when using respiratory protection:

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for air-purifying respirators (APR) use and Level B training is required for supplied-air respirators (SAR) and self-contained breathing apparatus (SCBA) use. Specific training is required for the use of powered air-purifying respirators (PAPR);
- Respirator users must complete the respirator medical monitoring protocol and been approved for the specific type of respirator to be used;
- Tight-fitting facepiece respirator (negative or positive pressure) users must have passed an appropriate fit test within past 12 months;

-
- Respirator use shall be limited to those activities identified in the safety plan. If site conditions change that alters the effectiveness of the specified respiratory protection, the RHSM shall be notified to amend the written plan;
 - Tight-fitting facepiece respirator users shall be clean-shaven and shall perform a user seal check before each use;
 - Canisters/cartridges shall be replaced according to the change-out schedule specified in the safety plan. Respirator users shall notify the SC or RHSM of any detection of vapor or gas breakthrough. The SC shall report any breakthrough events to the RHSM for schedule upgrade;
 - Respirators in regular use shall be inspected before each use and during cleaning;
 - Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition;
 - Respirators shall be properly stored to protect against contamination and deformation;
 - Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service;
 - When breathing air is supplied by cylinder or compressor, the SC or RHSM shall verify the air meets Grade D air specifications; and
 - The SC or designee shall complete the Self-Assessment Checklist – Respiratory Protection included in the SOP and/or in the safety plan to verify compliance with CH2M’s respiratory protection program.

12. Worker Training and Qualification

12.1 CH2M Worker Training

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

12.1.1 CH2M Worker Category Training

All employees shall be assigned a worker category by their supervisor with assistance from the RHSM or SPA based on the type of work activities they are anticipated to perform throughout the year. It is CH2M policy to require an appropriate level of HSE training for all employees, including contingent workers or contractors under CH2M supervision, so they can recognize and mitigate workplace hazards and perform their jobs in a safe and environmentally sound manner, and to comply with applicable regulations.

An employee's Worker Category may change based on changing work assignments, and/or the employee may have more than one Worker Category based on assigned work scope or location. If an employee falls into more than one category listed below, or works on a site with multiple hazards (e.g., construction and hazardous waste), they must meet the training requirements for each category.

See the [Worker Category resources](#) on the Enterprise HSE VO page for additional information.

12.1.2 Hazardous Waste Operations Training

All employees engaging in hazardous waste operations and emergency response (HAZWOPER) activities, as well as site investigations, characterization, remedial action, shall receive appropriate training as required by US regulations 29 CFR 1910.120/29 CFR 1926.65. At a minimum, the training shall have consisted of instruction in the topics outlined in 29 CFR 1910.120/29 CFR 1926.65. CH2M International Regions will provide HAZWOPER-equivalent training, with concurrence from the Enterprise HSE Training Manager, and to meet any country-specific training related to hazardous waste operations or emergency response. Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities.

12.1.2.1 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 the US regulation 29 CFR 1910.120.

12.1.2.2 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.

12.1.2.3 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.

12.1.2.4 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.

12.1.3 Competent Person

The term "Competent Person" is used in many US (OSHA) and International standards and documents. Generally, a "competent person" is defined as one who, by way of training and/or experience, is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. Some standards add additional specific requirements which must be met by the competent person.

CH2M's practice is that the employer responsible for directing the means and methods of an activity (typically the employer responsible for actually performing the work) is responsible for designating the qualified competent person for that activity. This is typically a subcontractor or a third party contractor, unless CH2M is actually self-performing the work. The RHSM will review and accept subcontractor competent persons.

Should CH2M self-perform work and an employee needs to be designated as a competent person, the CH2M site or project manager and/or supervisor shall coordinate with the client sector HSE Lead or RHSM to verify that the employee has the requisite training and experience to be identified as the competent person. A competent person designation form must be completed and kept with the project files, along with any accompanying documentation (training, experience) in accordance with SOP HSE-110, Training.

12.1.4 First Aid/Cardiopulmonary Resuscitation

First aid and CPR training consistent with the requirements of a nationally recognized organization such as the Red Cross Association, National Safety Council, or equivalent country organization 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's Virtual Office is also required for those designated as first aid/CPR trained.

12.1.5 Safety Coordinator Training

SCs are trained to implement the HSE program on CH2M field projects. A qualified SC is required to be identified in the project safety plan for CH2M 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).

12.1.6 Site-Specific Training

Site-specific training will be addressed in the project safety plan. Prior to commencement of field activities, all field personnel assigned to a project will have completed site-specific training that will address the contents of applicable project safety plans, 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.

13. Medical Surveillance and Qualification

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

All site workers participating in HAZWOPER work will maintain an adequate medical surveillance program in accordance with the Medical Surveillance Enterprise Standard Operating Procedure HSE-113, 29 CFR 1910.120/29 CFR 1926.65 and other applicable OSHA standards or provincial requirements. Documentation of employee medical qualification (e.g., physician's written opinion) will be maintained in the project files and made available for inspection.

13.1 Hazardous Waste Operations and Emergency Response

CH2M 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.

13.2 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 or provincial requirement.

13.3 Hearing Conservation

Personnel working in hazardous waste operations or operations that fall under 29 CFR 1910.95 (in the US), Provincial OH&S Code/Regulations (in Canada) or other country norms, 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.

14. Site-Control Plan

14.1 Site-Control Procedures

(Reference CH2M 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.”

14.2 Remediation Work Area Zones

(Reference CH2M 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.

14.2.1 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.

14.2.2 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.

14.2.3 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.

14.2.4 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.

15. Decontamination

(Reference CH2M 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.

15.1 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.

15.2 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.

15.3 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.

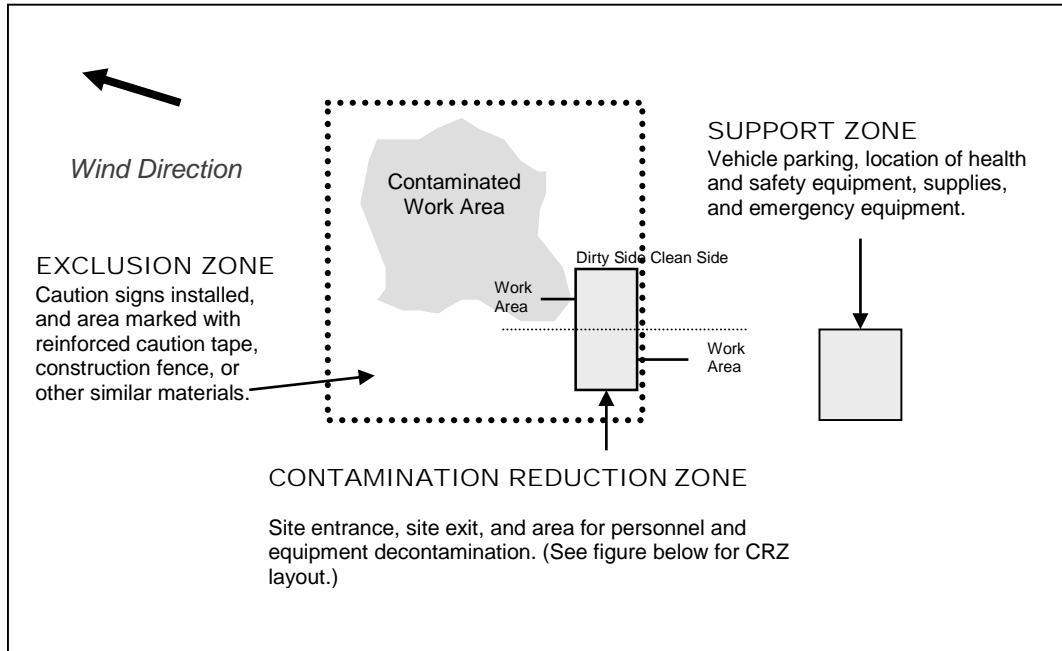
15.4 Waste Collection and Disposal

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.

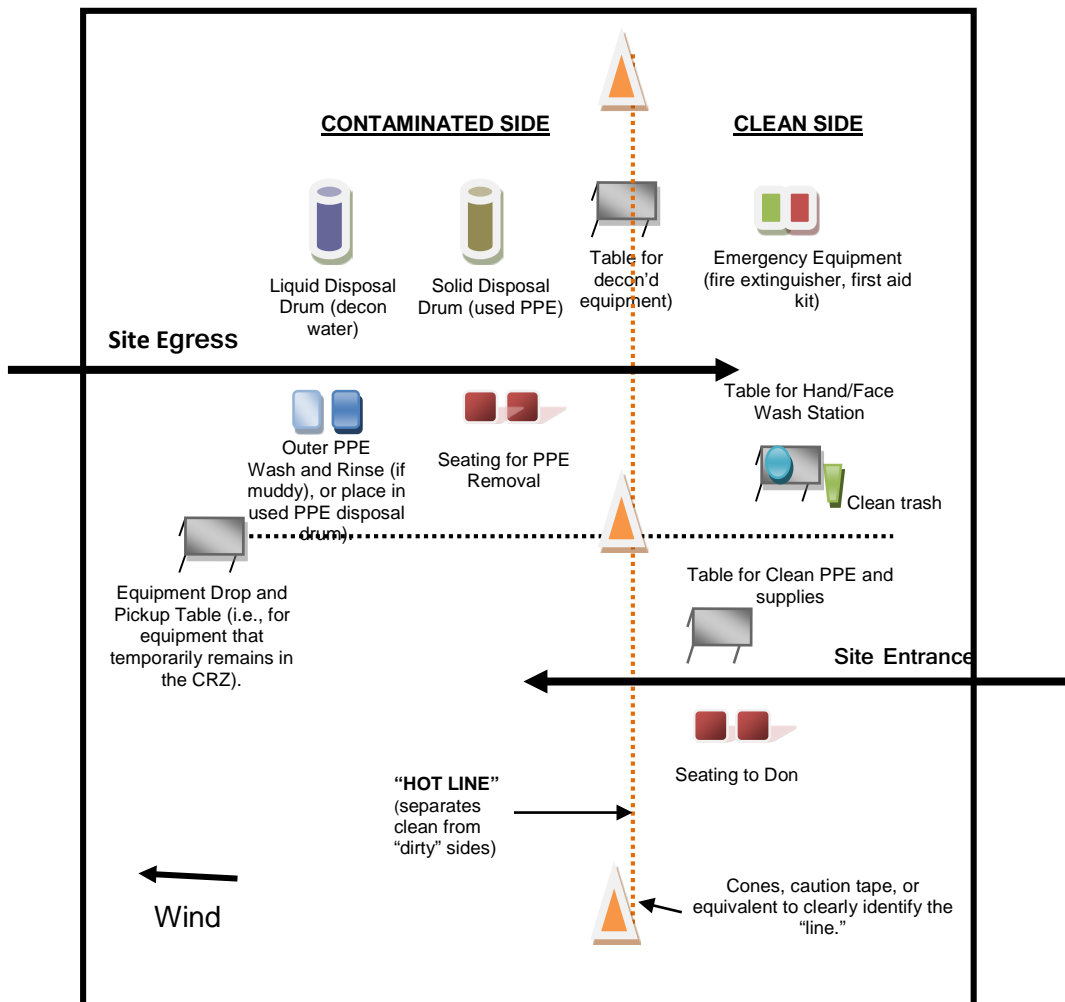
15.5 Diagram of Personnel-Decontamination Line

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



16. Emergency Preparedness

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

16.1 Pre-Emergency Planning

The Emergency Response Coordinator (ERC), typically the SC or their designee, performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M 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.

16.2 Incident Response

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

- Notify appropriate response personnel;
- Shut down CH2M 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 Handbook.

16.3 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 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 the project safety plan.
- Notify and submit reports to client as required in contract.

16.4 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 Handbook.

16.5 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy’s wrist	Leave area now.

16.6 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.

16.6.1 Tornado Safety

Recognizing imminent tornado signs include seeing an unusually dark sky, possibly with some green or yellow clouds. You may hear a roaring or rumbling sound like a train, or a whistling sound like a jet. Large hail may also be falling. You may be able to see funnels, or they may be hidden by rain or hail.

Listen to your radio for tornado warnings during bad thunderstorms. If a tornado warning is issued, don't panic. Instead, listen and look. Quickly but calmly follow directions for getting to shelter.

Take cover. Indoors you should go down into the basement and crouch down under the stairs, away from windows. Do not take an elevator. If you can't get to a basement, go into a closet or bathroom and pull a mattress over you or sit underneath a sturdy piece of furniture on the ground floor near the center of the building. Pull your knees up under you and protect your head with your hands.

A bad place to be in a tornado is in a building with a large freestanding roof such as a gymnasium, arena, auditorium, church or shopping mall. If you are caught in such a building, take cover under something sturdy.

More than half of tornado deaths occur in mobile homes. If a tornado threatens, get out and go to a building with a good foundation, or lay down in a ditch away from vehicles and other objects.

If you are driving, get to a shelter, lie down in a ditch or seek cover up under the girders of an overpass or bridge. Stay as close to the ground as you can. Protect your head and duck flying debris.

Stay away from metal and electrical equipment because lightning accompanies tornadoes.

If you have time before the tornado strikes, secure objects such as garbage cans and lawn furniture which can injure people. While most tornado damage is a result of the violent winds, most injuries and deaths actually result from flying debris.

16.1 International Travel

It is the employee's responsibility to:

- Book ALL international travel (all modes of transportation and all accommodations) through your local CH2M-approved travel agent. This is essential to keep track of international travelers in times of crisis, and allows for the Travel Department to provide international travelers with up-to-date information regarding safety and security risks associated with their intended destination.
- Advise the in country CH2M office of your travel arrangements, including local hotel details and itinerary changes. Make changes through the approved travel agency.
- If the country you are visiting is categorized as a high or extreme risk country, complete the high/extreme risk travel form and notify the cognizant Regional Security Manager (RSM).
 - To determine a country's rating please go to the [Enterprise Security site](#) and look for Country/Area Risk/Threat Ratings under Quick Links
- Should CH2M not have an office in the country you are traveling to, advise your home HR contact of your travel arrangements, including your contact details.

If working on an international project site, ensure the HSM and Enterprise Security is involved and has had input into the safety plan, including any precautions for emergency planning and evacuation. Ensure that International SOS (ISOS) contact numbers and instructions are included with the safety plan. A separate security asset protection plan may be advised by Enterprise Security depending on country threat level.

17. Inspections

17.1 Management/Leadership Health, Safety, Security, and Environment Inspections

Management Leadership is an integral part of CH2M's HSE culture. The [Management Inspection Checklist](#) is intended to facilitate PM leadership, provide an opportunity for PM's to mentor field staff on HSE and identify any big picture actions that need to be addressed. Observations that would improve global HSE program should also be included on the form. This Checklist does NOT take the place of a formal HSE audit. The PM shall:

- Complete one checklist per month during field work when visiting the site. The PM may delegate completion to the task lead, field team leader, or construction manager if the project is short duration and a visit is not planned for.
- Complete applicable sections of the checklist (can be typed or hand-written). Address issues with the field team, taking the opportunity to mentor staff by identifying the "root cause" of observation (e.g., why are SBOs not being completed, had this hazard been noted by any other team members?).
- E-mail the completed form to the address listed at the bottom of the form, and courtesy copy the Project Delivery Manager, Sector HSE Lead, and RHSM for tracking and review. Original should be kept in the project files.

The results of the site visit should be communicated with the site or project team during the visit. Other forms may be used to document management/leadership site visits.

17.2 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 the project safety plan. 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.

17.3 Safe Work Observations

Safe Work Observations (SWOs, formerly referred to as 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 SWO each week for any field work performed by subcontractors or when there are at least two CH2M personnel performing field work.

The SC or designee shall complete the SWO form (attached to the project safety plan) for the task/operation being observed and submit them weekly.

E-mail the completed form to the appropriate e-mail address at the bottom of the [SWO Form](#).

18. Incident Notification, Reporting, and Investigation

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

18.1 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 incidents.

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.

18.2 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 operations, including offices, warehouses, project sites, private property, or public spaces. Incidents include:

- Injury or illness to a CH2M employee or subcontractor employee
- Property damage
- Spill or release of hazardous or regulated material
- Environmental or permit violation
- A “near-miss”
- A “near serious injury”
- Other such as a Worker Welfare issue, fire, explosion, bomb threat, workplace violence, or threats

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.

Near Serious Injury Incident: A near serious injury is an incident that could have resulted in a serious injury (as described below) if not for an intervening factor that reduced or eliminated the severity.

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 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.

18.3 Incident Notification and Reporting Requirements

All employees and subcontractors' employees shall immediately report any incident in which they are involved or witness verbally to the SC or HS Manager and Field Team Leader/Site Supervisor or PM (including "near misses").

Incident notification is made verbally through both the HSE and the Operations chain of command. Upon notification of an incident, the SC or HS Manager initiates the HSE notification chain, and the Field Team Leader or Supervisor initiates the Operations notification chain.

All recordable incidents and regulatory agency actions are reported up to the Sector President and the HSE Director. Other incident notification is made up the chains to the indicated group depending on the severity, and any project, geographic, or client specific notification and reporting requirements.

For serious injury and near serious injury incidents (CH2M or CH2M Subcontractor), the Sector HSE Manager must notify the HSE Director as soon as practical but within two hours of knowledge of the injury, and ensure that a rigorous incident investigation/root cause analysis process is implemented in a timely manner. Also, the incident cause analysis must identify the Plan, Do, Check, Act classification in accordance with Attachment 5 of SOP HSE-111.

If the incident was an environmental permit issue (potential permit non-compliance, other situation that result in a notice of violation) or a spill or release, contact the Project EM immediately so evaluation of reportable quantity requirements and whether agency reporting is required. Spills and releases must be reported without delay because "immediately" has been interpreted in many jurisdictions to mean 15 minutes.

The CH2M team shall comply with all applicable statutory incident reporting requirements (e.g., OSHA, OH&S (MOL, MOE) the police, or state or Federal environmental agency).

For all Worker Welfare incidents (listed in Policy 113, Worker Welfare, Section 3, Figure 1, The Division of Worker Welfare Issues), CH2M project worker, subcontractor worker, and third party contractor worker (when CH2M has health and safety oversight) will be reported to the PM and RHSM, who will contact the Regional Managing Director.

CH2M project workers, subcontractor workers, and third party Contractor workers when CH2M has health and safety oversight may submit a confidential concern regarding a Worker Welfare issue through the [The Guideline](#). The issue will be assigned to the RHSM and/or Region HSM.

18.4 Drug and Alcohol Testing for CH2M Employees

As required by CH2M Policy 810, employees may be subject to post-incident and reasonable suspicion drug and alcohol testing. The Employee must submit to drug and alcohol testing if the supervisor has a reasonable suspicion, and when any of the following occur:

- Work-related injury in which the Company reasonably believes (under the Reasonable Suspicion provisions in the Policy) that drug and/or alcohol use is a contributing factor;
- Incident resulting in property damage over USD\$500 as determined by the Company;
- Injury on or in Company Property/Workplace (to Employee or third parties) involving the Employee's use of heavy machinery as determined by the Company;
- Incident considered to be a serious near-miss injury that occurs in the field or in the office as determined by the Company and where the Company reasonably believes (under the Reasonable Suspicion provisions in the Policy) that drug and/or alcohol use is a contributing factor to the serious near miss injury;

-
- Other circumstances as dictated by Employee Relations; or
 - An Employee contributes to any of the above.

Except in emergencies, the employee must remain available for testing. Failure to remain available will be considered as a refusal to submit to the testing, which will result in disciplinary action. Following the test, if there is no reasonable suspicion, the Employee returns to work. The employee will not be allowed to operate any company vehicle or company equipment, or work in any designated areas, pending the result of the drug and/or alcohol test.

Employees who are required to submit to reasonable suspicion testing are prohibited from transporting themselves to or from the collection site. The supervisor will arrange for transportation; the employee will be transported by a CH2M staff member. The employee must remain under the direct observation of the supervisor until turned over to the transporter. The employee will not be allowed to eat or drink unless instructed by the collector as this may hinder or decrease the company's ability to obtain a valid sample once the drug and/or alcohol test is administered.

After returning from the collection site, the employee must make arrangements to be transported home or to his/her residence. Supervisors must contact local authorities if an employee insists on driving a vehicle. Pending receipt of the drug and alcohol test results, the employee may not return to work.

18.5 Drug and Alcohol Testing for Subcontractors

The drug and alcohol testing requirements stated above apply to subcontractors when required by the subcontract.

18.6 HITS System and Incident Report Form

CH2M 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'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.

18.7 Injury Care for Employees (for U.S./Canada/Puerto Rico based CH2M Staff Only)

(Reference CH2M, SOP HSE-124, Injury Care for Employees)

18.7.1 Background

The Injury Care for Employees (ICE) 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 ICE Program successfully, supervisors and/or SC should:

- Ensure employees are informed of the ICE Program;
- Become familiar with the Notification Process (detailed below); and
- Post the ICE Poster.

18.7.2 The Injury Care for Employees Notification Process:

- If the injury or illness is serious, get help and start the emergency response process.

- Employee verbally informs their supervisor. Verbal **notifications must be made as soon as possible: notify the Safety Coordinator (SC), the Project Manager (PM), the Responsible H&S Manager (RHSM), and the Operations Leader (OL).**
- Employee calls the ICE 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. **Employees are encouraged to enter this phone number into their cell phones prior to starting field work.**
- Supervisor ensures employee immediately calls the ICE 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 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.

18.8 Serious Incident Reporting Requirements

(Reference CH2M 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 HSE and Firm Wide Security Operations requirements for the consistent reporting of and managing of serious events throughout our operations.

18.8.1 Serious Incident Determination

The following are general criteria for determining whether an incident on CH2M 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 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.

18.8.2 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.

Ontario and Alberta have additional serious incident reporting requirements; refer to your health and safety plan for details or speak to your health and safety manager.

18.9 Cause Analysis/Incident Investigation

The sector conducts incident investigations to determine how an incident happened, to identify the root causes, and to prevent recurrence by implementing corrective actions.

Specific guidelines for conducting an incident investigation are described in Section 5.6 of [SOP HSE-111](#).

All incidents must be investigated, and the investigation must be based on facts that clearly identify the sequence of events and the factors that contributed to the incident to determine the immediate and basic causes.

In accordance with the SOP, a Root Cause Analysis (RCA) is completed for all recordable incidents, serious injuries/near serious injuries, property damage incidents in excess of \$5,000.00 (U.S.), environmental permit violations, spills and releases, which are required to be reported to regulatory agencies, and any other incident, including near misses, where the HSE Manager/RHSM or PM determines a RCA is appropriate.

A RCA must be completed using the process or equivalent described in Attachment 5 of the SOP. The incident investigation team should include the HSE Manager/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.

During the incident investigation phase, one of the tools that can be used is the Det Norske Veritas (DNV) Systematic Cause Analysis Technique (SCAT) chart. The chart consistently identifies direct and root causes and facilitates tracking and trending areas for improvement. By using a consistent cause analysis system, trending can be performed for individual projects, programs, Sectors or regions as needed. The SCAT chart can be used along with any client-required cause analysis system, or other common cause analysis techniques such as the "5-WHYS."

Recordable injury and near serious injury incidents must include identifying the Plan, Do, Check, Act incident cause(s).

The HSE Manager/RHSM/REM makes certain that an investigation is complete and results are entered into HITS.

Investigation information, including the results of a RCA, is entered into the applicable evaluation sections in HITS, such as the immediate cause(s), root cause(s), and corrective action(s). When corrective actions are verified as completed, the HITS should be closed by the HSE Manager/RHSM/EM. Non-crisis investigations will be documented by updating the HITS incident report and describing the investigation facts in the Evaluation sections.

19. 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 employees can easily and quickly find documents;
- Records are readily available for review;
- Records may be needed during regulatory agency investigations, audits, or other legal matters;
- Records may be needed on short notice in case of an injury, 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'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), SDSs, 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, provincial, or state agency inspection records;
- Waste analytical data;
- Waste profiles;
- Manifests;
- Permit inspection records;
- Agency submittals and reports;
- Certifications [such as Notice(s) of Intent, state-required erosion and sediment control inspector certifications, Stormwater Pollution Prevention Plan (if permit requires certification), and discharge, wastewater, and monitoring data];
- Other Records:
 - Ergonomic evaluations;
 - HSE audits and assessments;
 - Project-specific HSE plans;
 - Confined space entry permits;
 - Equipment inspections;

- Equipment maintenance;
 - Emergency equipment inspection records;
 - SBOs;
 - Self-assessment checklists
- 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 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 Employee Sign-Off

I hereby acknowledge that I have received, read, understand, and will comply with this Handbook.

Name (printed): _____

Signature: _____

Employee Number (GEN): _____

Date: _____

Make a photo copy or scan and send this completed sign-off page to your CH2M Safety Program Assistant (SPA).

Subcontractor Sign-Off

CH2M HSE FIELD HANDBOOK

The CH2M subcontractors listed below have been provided with this Handbook, have read and understand it, and agree to abide by its provisions.

This sign-off sheet shall be maintained with the project safety plan.

Project Name:

Project Number:

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

CH2M HILL Health and Safety Plan
Attachment 2

Chemical Inventory/Register Form

CHEMICAL INVENTORY/REGISTER FORM

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

Location: HCC: <input type="checkbox"/> Office <input type="checkbox"/> Warehouse <input type="checkbox"/> Laboratory <input type="checkbox"/> 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

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

Biological Safety

Hand and Power Tools

Hazardous Materials Handling

Heat stress physiological monitoring form

Manual Lifting

Personal Protective Equipment

HS&E Self-Assessment Checklist—Biological Prevention Measures

CH2MHILL

HS&E Self-Assessment Checklist

Page 1 of 3

This checklist shall be used by personnel and shall be completed by each crew entering the work area at the frequency of one per day or otherwise specified in the project’s Health and Safety Plan/Field Safety Instruction (HSP/FSI). The checklist should be completed prior to entry and at the end of the day to document that appropriate checks have been completed.

This checklist is to be used at locations where the possibility exists that contact with biological hazards is possible.

Site Safety Coordinator (SSC) will request any CH2M HILL subcontractor to take necessary precautions in eliminating the exposure to biological hazards, but shall not direct the means and methods.

Project Name: _____	Project No.: _____
Location: _____	PM: _____
Auditor: _____	Title: _____ Date: _____

- Check “Yes” if an assessment item is complete or correct.
- Check “No” if an item is incomplete or deficient. Section 2 must be completed for all items checked “No.”
- Check “N/A” if an item is not applicable.
- Check “N/O” if an item is applicable but was not observed during the assessment.

	<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
SECTION 1 – PRE-ENTRY				
SITE HAZARD EVALUATION				
1. Inform field members of hazards (types, symptoms)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Can work be completed without entering the work zone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Have controls been implemented where possible (clearing vegetation, spraying)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Has an inspection been made to identify nests, hives or areas where insects may concentrate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Will working at different time will reduce exposure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SENSATIVITIES				
6. Does any staff have existing reactions to stings or bites	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. If yes to #6, is special required and medication available on site (epi-pen)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Has anyone with an existing condition briefed other team members about symptoms and first aid which may be required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EMERGENCY RESPONSE				
9. Are first aid kits, along with tick removal kits, readily available to all staff	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Does each member of the field staff have ability to communicate (phone, radios, and visual)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Are emergency contacts available (base emergency, local police, or local EMT)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. If working in remote areas, is transport readily available (less than 5 minutes)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Have you planned an emergency exit from the site in the event of a swarm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>SECTION 2 - PPE</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
SELECTION OF PPE				
14. Will weather (heat, rain, ice) impact the safety of workers wearing protective suits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Will visibility be limited to unacceptable levels if a hood is worn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Will the use of equipment be difficult if a suit is worn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Will heavy vegetation be encountered that could rip or damage a suit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Will a Bug-Out suit or Tyvek suit be used by staff (if not, please give additional rationale in writing in Section 4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TYPE OF PPE USED OTHER THAN BUG-OUT OR TYVEK SUIT				
19. Is staff wearing light-colored clothes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Is staff wearing long sleeve shirts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Are pant legs tucked into socks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Are shirts tucked into pants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Has tape been placed around sock/pant leg line and around waist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Have hand and wrist areas been sealed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Are hats being worn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Have clothes been pre treated with Permethrin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Has team member inspected coworker's suits or clothing to ensure no spaces exist for insects to penetrate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>SECTION 3 – CHECKS AND DECONTAMINATION</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
DAILY CHECKS (TO BE COMPLETED DURING AND AT END OF DAY)				
28. Were tick/insect checks performed during the day (if not, please provide reason in Section 4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Was one unclothed tick check completed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Were ticks found on the outerwear (if yes, please note the number in Section 4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Were ticks found inside the Bug-Out, Tyvek, or personal clothing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Were suits turned inside out and inspected prior to putting away	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Were showers taken by field staff immediately upon arrive from the field	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Were clothing placed in a garbage bag and sealed to prevent any insects from spreading	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. If ticks were found embedding in skin, were they properly removed and saved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Have vehicles been inspected for ticks on a daily basis and before the vehicle is turned in	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
REPORTING				
37. If a tick was found on your skin, could you tell where it entered so that it could be addressed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. If a tick was found embedded, did you contact the PM, complete a HITS form and contact the Occupational Physician at 1-866-893-2514	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Did you contact field staff on the project to provide potential corrective measures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. Did you follow the IM/RTW procedure to ensure you received the proper medical attention (if not, provide an explanation in Section 4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Attachment 2 - HSE Self-Assessment Checklist—HAND AND POWER TOOLS Page 1 of 4

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project’s HSP/FSI.

This checklist is to be used at locations where: (1) CH2M HILL employees are exposed to hand and power tool hazards and/or (2) CH2M HILL provides oversight of subcontractor personnel who are exposed to hand and power tool hazards.

SC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of hand and power tool use nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered being imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Project Name: _____ Project No.: _____
Location: _____ PM: _____
Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

- Evaluate CH2M HILL employee exposure to hand and power tool hazards.
- Evaluate a CH2M HILL subcontractor’s compliance with hand and power tool requirements.
Subcontractors Name: _____

- Check “Yes” if an assessment item is complete/correct.
- Check “No” if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked “No.”
- Check “N/A” if an item is not applicable.
- Check “N/O” if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-210.

SECTION 1

Yes No N/A N/O

SAFE WORK PRACTICES (5.1)

1. All tools operated according to manufacturer’s instructions and design limitations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. All hand and power tools maintained in a safe condition and inspected and tested before use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Defective tools are tagged and removed from service until repaired.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. PPE is selected and used according to tool-specific hazards anticipated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Power tools are not carried or lowered by their cord or hose.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Tools are disconnected from energy sources when not in use, servicing, cleaning, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Safety guards remain installed or are promptly replaced after repair.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Tools are stored properly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Cordless tools and recharging units both conform to electrical standards and specifications.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Tools used in explosive environments are rated for such use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Knives/open blade tools only used when approved with written precautions, PPE, and training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Consider controls to avoid muscular skeletal, repetitive motion, and cumulative trauma stressors.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION 2

Yes No N/A N/O

GENERAL (5.2.2)

- 13. PPE is selected and used according to tool-specific hazards anticipated.
- 14. Tools are tested daily to assure safety devices are operating properly.
- 15. Damaged tools are removed from service until repaired.
- 16. Power operated tools designed to accommodate guards have guards installed.
- 17. Rotating or moving parts on tools are properly guarded.
- 18. Machines designed for fixed locations are secured or anchored.
- 19. Floor and bench-mounted grinders are provided with properly positioned work rests.
- 20. Guards are provided at point of operation, nip points, rotating parts, etc.
- 21. Fluid used in hydraulic-powered tools is approved fire-resistant fluid.

ELECTRIC-POWERED TOOLS (5.2.3)

- 22. Electric tools are approved double insulated or grounded and used according to SOP HSE-206.
- 23. Electric cords are not used for hoisting or lowering tools.
- 24. Electric tools are used in damp/ wet locations are approved for such locations or GFCI installed.
- 25. Hand-held tools are equipped with appropriate on/off controls appropriate for the tool.
- 26. Portable, power-driven circular saws are equipped with proper guards.

ABRASIVE WHEEL TOOLS (5.2.4)

- 27. All employees using abrasive wheel tools are wearing eye protection.
- 28. All grinding machines are supplied with sufficient power to maintain spindle speed.
- 29. Abrasive wheels are closely inspected and ring-tested before use.
- 30. Grinding wheels are properly installed.
- 31. Cup-type wheels for external grinding are protected by the proper guard or flanges.
- 32. Portable abrasive wheels used for internal grinding are protected by safety flanges.
- 33. Safety flanges are used only with wheels designed to fit the flanges.
- 34. Safety guards on abrasive wheel tools are mounted properly and of sufficient strength.

PNEUMATIC-POWERED TOOLS (5.2.5)

- 35. Tools are secured to hoses or whip by positive means to prevent disconnection.
- 36. Safety clips or retainers are installed to prevent attachments being expelled.
- 37. Safety devices are installed on automatic fastener feed tools as required.
- 38. Compressed air is not used for cleaning unless reduced to < 30 psi, with PPE, and guarded.
- 39. Manufacturer’s safe operating pressure for hoses, pipes, valves, etc. are not exceeded.
- 40. Hoses are not used for hoisting or lowering tools.
- 41. All hoses >1/2-inch diameter have safety device at source to reduce pressure upon hose failure.
- 42. Airless spray guns have required safety devices installed.
- 43. Blast cleaning nozzles are equipped with operating valves, which are held open manually.
- 44. Supports are provided for mounting nozzles when not in use.
- 45. Air receiver drains, handholes, and manholes are easily accessible.
- 46. Air receivers are equipped with drainpipes and valves for removal of accumulated oil and water.
- 47. Air receivers are completely drained at required intervals.
- 48. Air receivers are equipped with indicating pressure gauges.
- 49. Safety, indicating, and controlling devices are installed as required.
- 50. Safety valves are tested frequently and at regular intervals to assure good operating condition.

HSE Self-Assessment Checklist—HAND AND POWER TOOLS**SECTION 2 (continued)****Yes No N/A N/O****LIQUID FUEL-POWERED TOOLS (5.2.6)**

- | | | | | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 51. Liquid fuel-powered tools are stopped when refueling, servicing, or maintaining. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 52. Liquid fuels are stored, handled, and transported in accordance with SOP HSE-403 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 53. Liquid fuel-powered tools are used in confined spaces in accordance with SOP HSE-203. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 54. Safe operating pressures of hoses, valves, pipes, filters, and other fittings are not exceeded. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

POWDER-ACTUATED TOOLS (5.2.7)

- | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 55. Only trained employee operates powder-actuated tools. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 56. Powder-actuated tools are not loaded until just prior to intended firing time. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 57. Tools are not pointed at any employee at any time. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 58. Hands are kept clear of open barrel end. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 59. Loaded tools are not left unattended. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 60. Fasteners are not driven into very hard or brittle materials. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 61. Fasteners are not driven into easily penetrated materials unless suitable backing is provided. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 62. Fasteners are not driven into spalled areas. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 63. Powder-actuated tools are not used in an explosive or flammable atmosphere. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 64. All tools are used with correct shields, guards, or attachments recommended by manufacturer. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

JACKING TOOLS (5.2.8)

- | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 65. Rated capacities are legibly marked on jacks and not exceeded. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 66. Jacks have a positive stop to prevent over-travel. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 67. The base of jacks are blocked or cribbed to provide a firm foundation, when required. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 68. Wood blocks are place between the cap and load to prevent slippage, when required. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 69. After load is raised, it is cribbed, blocked, or otherwise secured immediately. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 70. Antifreeze is used when hydraulic jacks are exposed to freezing temperatures. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 71. All jacks are properly lubricated. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 72. Jacks are inspected as required. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 73. Repair or replacement parts are examined for possible defects. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 74. Jacks not working properly are removed from service and repaired or replaced. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 75. Wrenches are not used when jaws are sprung to the point of slippage. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 76. Impact tools are kept free of mushroomed heads. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 77. Wooden handles of tools are kept free of splinters or cracks and are tightly fitted in tool. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 78. Cutting tools maintained and used following requirements in AHA or procedure | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

CHAIN SAWS (5.2.10)

- | | | | | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 79. Chainsaw equipped with spark arrestor and fully functioning chain brake | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 80. Chainsaw operator's manual readily available | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 81. Fully stocked first aid kit and multipurpose fire extinguisher available | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 82. Appropriate personal protective equipment available and worn | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 83. Clothing free of loose edges that could become entangled in the saw | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 84. Chainsaw handles kept dry, clean, and free of oil or fuel mixture | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 85. Chainsaws held firmly with both hands and used right-handed | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 86. Operator standing to the left of the saw out of the plane of the chain | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 87. Saw used between the waist and mid-chest level | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 88. Full throttle maintained while cutting | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 89. Operator aware of position of guide bar tip, does not contact tip with anything being cut | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 90. Bumper spikes maintained as close to the object as possible | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 91. Operator aware of what is in the saw's downward path after the cut | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 92. No attempt made to cut material that is larger than the guide bar of the saw | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 93. Cuts avoided that will cause chain to jam | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 94. Non-metallic wedges used to prevent compression cuts from jamming the blade | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 95. Bystanders and helpers kept at a safe distance from operation | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 96. Chainsaw not operated when fatigued | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 96. Fire extinguisher present when operating the chainsaw in forest or brushy areas | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

This checklist is provided as a method of verifying compliance with regulations pertaining to the handling of hazardous materials. It shall be used at locations where CH2M HILL employees handle hazardous materials, or are required to perform oversight of subcontractor personnel handling hazardous materials, or both.

CH2M HILL staff shall not direct the means and methods of subcontractor operations nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies, and CH2M HILL staff must carefully rely on the subcontractor's expertise. Items considered imminently dangerous (possibility of serious injury or death) must be corrected immediately, or all exposed personnel must be removed from the hazard until it is corrected.

Project Name: _____ Project No.: _____
Location: _____ PM: _____
Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to (check only one of the boxes below):

- Evaluate CH2M HILL compliance with hazardous material handling requirements (SOP HSE-403)
 - Evaluate a CH2M HILL subcontractor's compliance with hazardous material requirements
- Subcontractor's Name: _____

- Check "Yes" if an assessment item is complete or correct.
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-403.

	<u>SECTION 1</u>			
	<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
GENERAL GUIDELINES (5.2)				
1. Acids are stored away from bases.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Oxidizers and organics are stored away from inorganic reducing agents.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Flammables and corrosives are stored in appropriate storage cabinets.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Paper and other combustibles are not stored near flammables.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Secondary containment and lipped shelving are in place in storage areas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. A fire suppression system is available.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FLAMMABLE AND COMBUSTIBLE LIQUIDS (5.3)				
GENERAL STORAGE (5.3.1)				
7. Only approved containers/portable tanks used to store flammable and combustible liquids.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Approved safety cans used for handling flammable liquids in quantities 1-5 gallons.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. For quantities of one gallon or less, the original container must be used for storage.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Flammable or combustible liquids are not stored in stairways or personnel passageways.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION 1 (continued)

Yes No N/A N/O

INDOOR STORAGE (5.3.2)

- | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 11. Quantities of flammable or combustible liquids > 25 gallons stored in approved storage cabinet. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. No more than 25 gallons of flamm. or comb. liquids can be stored outside an approved cabinet. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. Cabinets are labeled with "FLAMMABLE: KEEP FIRE AWAY." | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. No more than 60 gallons of flamm. or 120 gallons of comb. liquids stored in one storage cabinet. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15. Not more than three cabinets located in a single storage area. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

OUTSIDE STORAGE (5.3.3)

- | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 16. Storage of containers (not more than 60 gallons each) do not exceed 1,100 gallons in any area. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17. Storage areas are not within 20 feet of any building. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18. Storage areas graded to divert spills away from buildings and surrounded by an earth dike. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19. Storage areas are free from weeds, debris, and other combustible materials. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20. Outdoor portable tanks are provided with emergency vent devices. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 21. Outdoor portable tanks are no closer than 20 feet from any building. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22. Signs indicating no smoking are posted around the storage area. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

DISPENSING (5.3.4)

- | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 23. Areas where liquids are dispensed in >5-gal quantities are separated from other operations by 25'. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24. Drainage or other means provided to control spills. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25. Adequate natural or mechanical ventilation provided to maintain concentration of flammable vapor < 10% of the lower flammable limit. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26. Dispensing of flammable liquids from one container to another is done only when containers are electrically interconnected (bonded). | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 27. Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks prohibited. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28. Dispensing devices and nozzles for flammable liquids are of an approved type. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

USE (5.3.5)

- | | | | | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 29. Flammable liquids are kept in closed containers when not in actual use. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30. Leakage or spillage of flammable or combustible liquids is disposed of promptly and safely. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31. Sources of ignition are kept at least 50 feet from flammable liquids. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

LIQUID PETROLEUM GAS (5.4)

- | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 32. LPG containers meet DOT requirements. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 33. Each container or system has a safety relief device or valve in good working order. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34. Portable heaters using LPG have an automatic shutoff device in the event of flame failure. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 35. Storage of LPG within buildings is prohibited. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 36. LPG storage location has at least one portable fire extinguisher rated not less than 20-B:C. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

COMPRESSED GAS CYLINDERS (5.5)

GENERAL (5.5.1)

- | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 37. Cylinders and apparatus inspected for defects and leakage prior to use. Damaged items not used. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 38. Gas distributor notified and subsequent instructions followed for defective cylinders. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 39. Leaking cylinders removed from the work area. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 40. Cylinder users do not modify, tamper, or attempt repair on cylinders or apparatus. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 41. Only cylinder owners or authorized agent refill cylinders or attempt to mix gases in a cylinder. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 42. Cylinders labeled with the identity of the contents. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

SECTION 1 (continued)

Yes No N/A N/O

TRANSPORTING (5.5.2)

- 43. Cylinders not rolled in the horizontal position or dragged; suitable material-handling device used.
- 44. Cylinders being transported have valve protection caps installed.
- 45. Cylinders in vertical position when transported by motor vehicle, hoisted, or carried.
- 46. Cylinders hoisted by a cradle or pallet designed for such use, and not by magnets, slings, or their valve protection caps.

STORAGE (5.5.3)

- 47. Cylinders are stored in the vertical position with valve protection caps installed.
- 48. Cylinders are secured from being knocked over by a chain or other stabilizing device.
- 49. Cylinders are stored away from readily ignitable substances.
- 50. Cylinders are protected from exposure to temperature extremes.
- 51. Oxygen cylinders in storage are separated from fuel gas cylinders or combustible materials > 20' or by a ½-hour fire-resistant barrier at least 5' high.
- 52. Cylinders inside buildings are stored in dry, well-ventilated locations > 20' from comb. materials.
- 53. Cylinders are stored in definitely assigned places away from elevators, stairs, or gangways.
- 54. Signs indicating no smoking are provided for storage areas containing flammable gas cylinders.

PLACEMENT FOR USAGE (5.5.4)

- 55. Cylinders are located where they will not be knocked over or damaged.
- 56. Cylinders are secured in the vertical position.
- 57. Cylinders are not placed where they can become part of an electrical circuit.
- 58. Cylinders are kept far enough away from welding and cutting operations to prevent sparks, hot slag, or flames from reaching them. When impractical, fire resistant shields are provided.
- 59. Cylinders are not taken into confined spaces.

CYLINDER CONNECTIONS (5.5.5)

- 60. Pressure-controlling apparatus is compatible with the particular gas used.
- 61. Cylinders and pressure-controlling apparatus are kept free of oil and grease.
- 62. Pressure-controlling apparatus is kept gastight to prevent leakage.
- 63. Cylinders not attached to process where backflow could occur unless check valves or traps used.
- 64. Manifolds designed for product used at the appropriate temperatures, pressures, and flow rates.
- 65. Manifolds are labeled and placed in well-ventilated and accessible locations.
- 66. Cylinders are not cross-connected with plant air lines.
- 67. Flash arrestors or reverse flow check valves are installed on all flammable gas cylinders.

USAGE (5.5.6)

- 68. Eye protection (safety glasses or goggles) is worn when using cylinders.
- 69. Cylinder valve and regulator are inspected for foreign material before connecting.
- 70. If cylinders are frozen, warm (not boiling) water is used to thaw cylinders.
- 71. Cylinder valve remains closed except when the cylinder is in use.
- 72. Fuel gas cylinder valves are not opened more than 1½ turns, for quick closing.
- 73. If a special wrench is used to open a cylinder valve, it is left in position on the valve.
- 74. Acetylene cylinders are used in the vertical position.
- 75. Acetylene cylinders are not used > 15 psig or > 30 psia.
- 76. Copper pipe or fittings are not used with acetylene systems.
- 77. Compressed gas is not used to dust off clothing.
- 78. Cylinder valve closed and regulator relieved of internal pressure before regulators are removed.

HEAT STRESS PHYSIOLOGICAL MONITORING FORM

Project Name:

Date:

Company:

1. Record start and stop time for break, pulse at the beginning of your break and a second pulse 60 seconds later, fluid intake (water or electrolyte replacement), shade (Y/N) and A/C (Y/N).
2. Follow the Physiological Monitoring Protocol in the attached safety bulletin or FSI.
3. Never continue work if you are experiencing sudden and severe fatigue, nausea, dizziness, or lightheadedness, immediately call your Field Lead/Safety Coordinator/RHSM.

Employee:

Describe action taken if heart rate measurements are exceeded:

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Pulse								
Fuilds								
Shade								
A/C								

Employee:

Describe action taken if heart rate measurements are exceeded:

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Pulse								
Fuilds								
Shade								
A/C								

Employee:

Describe action taken if heart rate measurements are exceeded:

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Pulse								
Fuilds								
Shade								
A/C								

Employee:

Describe action taken if heart rate measurements are exceeded:

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Pulse								
Fuilds								
Shade								
A/C								



HSE Self-Assessment Checklist—Lifting

This checklist shall be used **only** by CH2M HILL personnel and shall be completed at the frequency specified in the project’s HSP/FSI.

This checklist is to be used at locations where: (1) CH2M HILL employees perform manual lifting activities (office or projects), and/or (2) CH2M HILL provides oversight of a subcontractor performing manual lifting activities. SC or Office Safety Coordinators/Committee members may consult with subcontractors (if applicable) when completing this checklist but shall not direct the means and methods of activities nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and we must carefully rely on their expertise. Conditions considered imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazardous area until corrected. Complete the appropriate project or office information:

<i>Project Information</i>					
Project Name: _____		Project No.: _____			
Location: _____		PM: _____			
Auditor: _____		Title: _____		Date: _____	
<i>Office Information</i>					
Office Location: _____					
Auditor: _____		Title: _____		Date: _____	
This specific checklist has been completed to:					
<input type="checkbox"/> Evaluate CH2M HILL employee manual lifting activities. <input type="checkbox"/> Evaluate a CH2M HILL subcontractor’s manual lifting activities. Subcontractor Name: _____					
<ul style="list-style-type: none"> • Check “Yes” if an assessment item is complete/correct. • Check “No” if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. • Check “N/A” if an item is not applicable. • Check “N/O” if an item is applicable but was not observed during the assessment. 					
Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-112.					
Planning Activities		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
1.	Efforts have been made to inquire about receiving equipment or supplies in containers weighting less than 50 pounds (23 kilograms).	○	○	○	○
2.	Equipment or supplies are being delivered as close as possible to their use point.	○	○	○	○
3.	Heavy equipment or supplies are being stored off the ground and no lower than knee height.	○	○	○	○
4.	Adequate space has been provided to access and lift equipment or supplies without reaching or twisting.	○	○	○	○
Safe Work Practices (5.1)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
5.	Tasks or activities have been modified to reduce or minimize manual lifting.	○	○	○	○
6.	All employees performing manual lifting have received training on how to lift safely.	○	○	○	○
7.	Manual lifting control measures are evaluated during assessments.	○	○	○	○

8.	Manual lifting incidents are reviewed as part of the HSE Program reviews.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9.	Manual lifting incidents are reviewed as part of the HSE Program reviews.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Office Environments (5.1.1)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
10.	Employees have received lifting training.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.	Mechanical devices are readily available to employees handling equipment or supplies weighing more than 40 pounds (18 kilograms).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Projects (5.1.2)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
12.	All manual lifting tasks or activities have been addressed in the written site safety plan.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13.	Employees have received safe lifting training as required by the written site safety plan.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mechanical Lifting (5.2)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
14.	Hand trucks and trolleys are visually inspected before use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15.	Hand trucks and trolleys do not have any broken or damaged parts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.	Hand truck and trolley paths are free of uneven surfaces, water, oil, or cracks and holes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.	Loads carried by hand trucks are balanced and sturdy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.	Hand trucks or dollies are being pushed when on level ground.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.	When going up or down a slope using a hand truck or trolley, the load is downslope of the person.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.	Employees using hand trucks or dollies are moving slowly and cautiously.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.	Employees using hand trucks or trolleys are able to see over the load.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assisted Lifting (5.3)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
22.	Personnel are not performing manual lifting beyond their physical capabilities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23.	Loads are evenly distributed when being handled by multiple people.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manual Lifting (5.4)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
24.	Before the lift, the load and path was assessed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.	Loads being lifted are free of sharp edges, splinters, or wet or greasy spots.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26.	Gloves are used for manual lifts of loads with sharp or splintered edges.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27.	Employees performing manual lifts use the proper lifting techniques.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28.	Special tools fabricated for lifting grates or manhole covers are used.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

HSE Self-Assessment Checklist: PPERSONAL PROTECTIVE EQUIPMENT

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where CH2M HILL employees are required to wear PPE or are required to perform oversight of a subcontractor using PPE or both.

CH2M HILL staff shall not direct the means and methods of subcontractor use of PPE nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies and CH2M HILL staff must carefully rely on their expertise. Conditions considered to be imminently dangerous (possibility of serious injury or death) must be corrected immediately or all exposed personnel must be removed from the hazard until corrected.

Project Name: _____	Project No.: _____

Location: _____	PM: _____

Auditor: _____	Title: _____ Date: _____

This specific checklist has been completed to (check only one of the boxes below):	
<input type="checkbox"/> Evaluate CH2M HILL compliance with its PPE program (SOP HSE-117) <input type="checkbox"/> Evaluate a CH2M HILL subcontractor's compliance with its PPE program Subcontractor's Name: _____	
Check the appropriate box, as follows:	
<ul style="list-style-type: none"> • Check "Yes" if an assessment item is complete or correct. • Check "No" if an item is incomplete or deficient. Section 2 must be completed for all items checked "No." • Check "N/A" if an item is not applicable. • Check "N/O" if an item is applicable but was not observed during the assessment. 	
Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-117.	
<u>SECTION 1</u>	<u>Yes</u> <u>No</u> <u>N/A</u> <u>N/O</u>
<u>GENERAL</u>	
1. Required PPE listed in HSP FSI or AHA.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
2. PPE available for use by employees.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
3. PPE cleaning supplies available for use.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
4. PPE stored appropriately to prevent deformation or distortion.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
5. PPE written certification has been completed.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<u>EYEWEAR (Glasses/Goggles/Face Shields)</u>	
6. Eyewear cleaning supplies available.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7. Safety glasses in good condition and lenses free of scratches.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
8. Goggles adjustment strap not cracked or frayed, not deformed, or lenses not scratched.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
9. Face shields in good condition, including adjustment band, and free of scratches or chips.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

SECTION 1 (Continued)	Yes	No	N/A	N/O
HEAD PROTECTION				
10. Hard hat bill and suspension attached as allowed by manufacturer.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Shell is pliable, free of dents, cracks, nicks, or any damage due to impact.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Suspension maintained at 1.25 inches from inside of shell.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Suspension free of cuts or fraying, torn headband, adjustment strap workable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Electrical hard hat matched to hazard classification.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Dated to determine whether within manufacturer's allowable 5-year use time period.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HAND PROTECTION				
16. Available in sizes matched to employee.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Gloves free of rips tears, abrasions, or holes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Matched to manufacturer's specification for chemicals used onsite.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Electrical gloves matched to hazard and periodically inspected for insulating rating.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Maintained in a clean and sanitary condition, decontaminated or disposed properly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BODY PROTECTION				
21. Available in sizes matched to employee.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Maintained in a clean and sanitary condition, decontaminated or disposed properly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Vapor-tight fully encapsulated suits tested at required periodic intervals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Flame-resistant clothing matched to electrical hazard and arc flash rating.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Welding gear matched to degree of hazard and free of cuts, tears or burn holes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Flotation gear available for work near or on water and in good condition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HOT AND COLD BODY PROTECTION				
27. Cooling gear available based on degree of heat stress hazard.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. Cooling gear in operable, clean, and sanitary condition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Cold-weather gear provided based on needs assessment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Cold-weather gear available in sizes to match employees.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Cold-weather gear is in free of tears, rips, or holes and in maintained in a clean condition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TRAINING				
32. Initial PPE training completed by employees.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Training conducted when new types or styles of PPE are issued.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. PPE selection, use, and maintenance reviewed at daily safety briefings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CH2M HILL Health and Safety Plan

Attachment 5

Key Target Zero Program Elements (Blank forms for field use)

Project Health and Safety Field Change Request Log
Management Health, Safety, Security and Environment Inspection
Activity Hazard Analysis
Pre-Task Safety Plans
Safe Behavior Observation
Incident Report and Investigation
(use electronic form when possible)
[HITS](#)
Lessons Learned Template
Air Monitoring Form



Management Health, Safety, Security and Environment Inspection

Program/Project Name: _____
Management Inspector: _____
Date: _____

Work Being Performed: _____
Project Number: _____
Sector: _____

1. Job Information/Postings	A	C	I	N/A	Comments/Corrective Action(s)
a. Required postings in place (OSHA/State/Country)					
b. Emergency Contacts and Phone list posted					
c. Directions and map to hospital posted					
d. Incident Reporting Flow Chart posted					
2. HSSE Documentation					
a. HASP current (within 1 year), onsite, and signed					
b. AHAs available for all work and reviewed/signed					
c. Daily Pre-Task Safety Plan/Meeting completed					
d. SBO's completed weekly and emailed					
e. Self-Assessment checklists completed per HASP					
f. Environmental Plan available					
g. Emergency drill completed and documented					
h. E Permit compliance assurance measures documented					
i. HSE training up to date and documented					
3. Housekeeping/First Aid					
a. Work areas clean and organized					
b. Fire extinguisher, eye wash, 1 st aid/BBP kit in place					
c. Materials and waste labeled and in closed containers					
4. PPE and Air Monitoring					
a. PPE being worn as specified in HASP/AHA					
b. Air monitoring done per HASP and documented					
5. Heavy Equipment and Construction Operations					
a. Documentation of Competent/Qualified Operators					
b. Back-up alarms audible & no cell phone use					
c. High-visibility vests on ground personnel					
d. Daily inspections completed and documented					
e. Windshields/mirrors OK and seat belts worn					
6. Excavation, Trenching, and Land Disturbing Activities					
a. Competent person identified					
b. Daily inspection completed prior to entry					
c. Proper setup (sloping, shoring, exits, spoils)					
d. 3 rd party Utility Locate service used					
d. Storm water PPP and inspections/sampling conducted					
d. Erosion/sediment controls and dust controls in place					
7. Hand Tools					
a. Hand tools inspected prior to use					
b. Guards in place on tools					
c. Right tool for the job at hand					
8. Electrical					
a. All electrical cords, prongs, receptacles OK					
b. GFCI used on all circuits					
c. No energized electrical work incl. voltage testing					
d. Written Lockout Tagout system in use					











(Column - A=Adequate, C=Needs Consideration, I=Needs Immediate Action, N/A= Not Applicable or Not Assessed)

9. Ladders and Scaffolds	A	C	I	N/A	Comments/Corrective Action(s)
a. Ladders extend 36" above the landing and secured					
b. Ladders selected and used properly					
c. Scaffold planked, unaltered, and in good condition					
d. Scaffold/ladder users trained in inspection and use					
10. Hot Work					
a. Gas cylinders stored upright and secured					
b. Minimum 20' distance between fuels and oxygen					
c. PPE in use per HASP/AHA					
d. Fire watch in place w/adequate fire extinguishers					
11. Cranes					
a. Outriggers extended, swing radius protected					
b. Operator CCO licensed, competent person for rigging					
c. Annual certified crane inspection					
d. Chains and slings inspected, have rating tag					
e. Suspended load tag lines - no one underneath					
12. Drill Rigs					
a. Overhead electrical clearance adequate					
b. Daily inspections completed and available					
c. Emergency shut off functioning					
d. 3 rd party Utility Locate service used					
13. Hazard Communication and Chemical Use					
a. MSDS's present for all chemicals					
b. Chemical Inventory current and in HSP or on file					
c. Hazard communication briefing for all chemicals					
d. All chemicals labeled/stored as required					
e. SPPC Plan implemented for >1320 gals fuels/oils on site					
14. Fall Protection					
a. Full body harness worn properly, workers tied off over 6'					
b. Guard rails 42" high					
15. Material Handling					
a. Proper body positioning					
b. Objects less than 40 lbs. for one person lift					
16. Site Control					
a. Work Zones delineated, necessary signage in place					
b. Decontamination method is adequate					
17. Waste and Hazardous Materials Management					
a. Waste Tracking Log					
b. Hazardous waste onsite for <90 days					
c. Containers labeled, inspections conducted/documentated					
d. HW manifests signed, tracked, copies kept on site					
e. HW Transporters trained and licensed, placards used					
18. Security and Emergency Planning					
a. Emergency coordinator designated					
b. Severe weather plans/controls in place					
c. Security plan/measures adequate					
19. Demolition					
a. ACM and Hazardous Materials Survey					
b. Asbestos/Lead based paint work approved per policy					

(Column - A=Adequate, C=Needs Consideration, I=Needs Immediate Action, N/A= Not Applicable or Not Assessed)

ACTIVITY HAZARD ANALYSIS

Date:	Task Risk Assessment Code (RAC): L = Low E = Extremely High Risk H = High Risk M = Moderate Risk	<table border="1"> <tr> <th colspan="6">Probability</th> </tr> <tr> <th>Frequent</th> <th>Likely</th> <th>Occasional</th> <th>Seldom</th> <th>Unlikely</th> <th></th> </tr> <tr> <td>Catastrophic</td> <td>E</td> <td>E</td> <td>H</td> <td>H</td> <td>M</td> </tr> <tr> <td>Critical</td> <td>E</td> <td>H</td> <td>H</td> <td>M</td> <td>L</td> </tr> <tr> <td>Marginal</td> <td>H</td> <td>M</td> <td>M</td> <td>L</td> <td>L</td> </tr> <tr> <td>Negligible</td> <td>M</td> <td>L</td> <td>L</td> <td>L</td> <td>L</td> </tr> </table>					Probability						Frequent	Likely	Occasional	Seldom	Unlikely		Catastrophic	E	E	H	H	M	Critical	E	H	H	M	L	Marginal	H	M	M	L	L	Negligible	M	L	L	L	L
Probability																																										
Frequent							Likely	Occasional	Seldom	Unlikely																																
Catastrophic							E	E	H	H	M																															
Critical							E	H	H	M	L																															
Marginal	H	M	M	L	L																																					
Negligible	M	L	L	L	L																																					
Project:																																										
Site Supervisor:																																										
Site Safety Coordinator:																																										
HSM Review/Approval:																																										
Job/Activity:	Severity																																									
Description of the work:																																										

TYPES OF POTENTIAL ENERGY:									
									
1	2	3	4	5	6	7	8	9	10
BIOLOGICAL	CHEMICAL	ELECTRICAL	GRAVITY	MECHANICAL	MOTION	PRESSURE	RADIATION	SOUND	TEMPERATURE

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed...)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to EN&N Market HSE Handbook for required controls)

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed...)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to EN&N Market HSSE Handbook for required controls)

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

Hazard Control Measures (Check All That Apply):			
PPE <input type="checkbox"/> Thermal/lined <input type="checkbox"/> Eye <input type="checkbox"/> Dermal/hand <input type="checkbox"/> Hearing <input type="checkbox"/> Respiratory <input type="checkbox"/> Reflective vests <input type="checkbox"/> Flotation device <input type="checkbox"/> Hard Hat <input type="checkbox"/> Safety-Toed Boots	Protective Systems <input type="checkbox"/> Sloping <input type="checkbox"/> Shoring <input type="checkbox"/> Trench box <input type="checkbox"/> Barricades <input type="checkbox"/> Competent person <input type="checkbox"/> Locate buried utilities <input type="checkbox"/> Daily inspections <input type="checkbox"/> Entry Permits/notification	Fire Protection <input type="checkbox"/> Fire extinguishers <input type="checkbox"/> Fire watch <input type="checkbox"/> Non-spark tools <input type="checkbox"/> Grounding/bonding <input type="checkbox"/> Intrinsically safe equipment	Electrical <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Grounded <input type="checkbox"/> Panels covered <input type="checkbox"/> GFCI/extension cords <input type="checkbox"/> Power tools/cord inspected <input type="checkbox"/> Overhead line clearance <input type="checkbox"/> Underground utils ID'd
Fall Protection <input type="checkbox"/> Harness/lanyards <input type="checkbox"/> Adequate anchorage <input type="checkbox"/> Guardrail system <input type="checkbox"/> Covered opening <input type="checkbox"/> Fixed barricades <input type="checkbox"/> Warning system	Air Monitoring <input type="checkbox"/> PID/FID <input type="checkbox"/> Detector tubes <input type="checkbox"/> Radiation <input type="checkbox"/> Personnel sampling <input type="checkbox"/> LEL/O2 <input type="checkbox"/> No visible dust <input type="checkbox"/> Other	Proper Equipment <input type="checkbox"/> Aerial lift/ladders/scaffolds <input type="checkbox"/> Forklift/heavy equipment <input type="checkbox"/> Backup alarms <input type="checkbox"/> Hand/power tools <input type="checkbox"/> Crane with current inspection <input type="checkbox"/> Proper rigging <input type="checkbox"/> Operator qualified	Welding & Cutting <input type="checkbox"/> Cylinders secured/capped <input type="checkbox"/> Cylinders separated/upright <input type="checkbox"/> Flash-back arrestors <input type="checkbox"/> No cylinders in CSE <input type="checkbox"/> Flame retardant clothing <input type="checkbox"/> Appropriate goggles
Confined Space Entry <input type="checkbox"/> Isolation <input type="checkbox"/> Air monitoring <input type="checkbox"/> Trained personnel <input type="checkbox"/> Permit completed <input type="checkbox"/> Rescue	Medical/ER <input type="checkbox"/> First-aid kit <input type="checkbox"/> Eye wash <input type="checkbox"/> FA-CPR trained personnel <input type="checkbox"/> Route to hospital	Heat/Cold Stress <input type="checkbox"/> Work/rest regime <input type="checkbox"/> Rest area <input type="checkbox"/> Liquids available <input type="checkbox"/> Monitoring <input type="checkbox"/> Training	Vehicle/Traffic <input type="checkbox"/> Traffic control <input type="checkbox"/> Barricades <input type="checkbox"/> Flags <input type="checkbox"/> Signs
Permits <input type="checkbox"/> Hot work <input type="checkbox"/> Confined space <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Excavation <input type="checkbox"/> Demolition <input type="checkbox"/> Energized work	Demolition <input type="checkbox"/> Pre-demolition survey <input type="checkbox"/> Structure condition <input type="checkbox"/> Isolate area/utilities <input type="checkbox"/> Competent person <input type="checkbox"/> Hazmat present	Inspections: <input type="checkbox"/> Ladders/aerial lifts <input type="checkbox"/> Lanyards/harness <input type="checkbox"/> Scaffolds <input type="checkbox"/> Heavy equipment <input type="checkbox"/> Drill rigs/geoprobe rigs <input type="checkbox"/> Cranes and rigging <input type="checkbox"/> Utilities marked	Training: <input type="checkbox"/> Hazwaste (current) <input type="checkbox"/> Construction <input type="checkbox"/> Competent person <input type="checkbox"/> Task-specific <input type="checkbox"/> FA/CPR <input type="checkbox"/> Confined Space <input type="checkbox"/> Hazcom
Underground Utilities <input type="checkbox"/> Dig alert called <input type="checkbox"/> 3 rd Party locator <input type="checkbox"/> As-builts reviewed <input type="checkbox"/> Interview site staff <input type="checkbox"/> Client review <input type="checkbox"/> soft locate necessary?	Incident Communications <input type="checkbox"/> Work stops until cleared by TM/CM <input type="checkbox"/> Immediate calls to TM/CM <input type="checkbox"/> Client notification <input type="checkbox"/> 24 hour notification setup <input type="checkbox"/> Clear communications	AHA' s <input type="checkbox"/> reviewed and approved by HSM <input type="checkbox"/> on site and current <input type="checkbox"/> applicable for this day's work <input type="checkbox"/> Communication and incident processes included?	
Field Notes (including observations from prior day, etc.): <hr/> <hr/> <hr/>			

Name (Print): _____

Signature: _____

Date: _____

Safe Behavior Observation Form			
<input type="checkbox"/> Federal <input type="checkbox"/> Commercial (check one)		<input type="checkbox"/> Construction or <input type="checkbox"/> Consulting (check one)	
<input type="checkbox"/> International			
Project Number (required):		Client/Program:	
Project Name:		Observer:	Date:
Position/Title of worker observed:		Background Information/ comments:	
Task/Observation Observed:			
<ul style="list-style-type: none"> ❖ 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			Observer's Corrective Actions/Comments:
Focus/attentiveness			
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			Observed Worker's Corrective Actions/Comments:
Repetitive motion			
Other...			

For ES Federal Sector projects please email completed forms to: [CH2M HILL ES FED Safe Behavior Observation](mailto:CH2MHILL.ES.FED.Safe.Behavior.Observation@ch2m.com)
 For ES Commercial Sector projects please email completed forms to: [CH2M HILL ES COM Safe Behavior Observation](mailto:CH2MHILL.ES.COM.Safe.Behavior.Observation@ch2m.com)
 For CNR ES staff please email completed forms to: cnr_safe@ch2m.com
 For International ES projects please e-mail completed forms to: ESINTLSafeBehaviorObservation@ch2m.com

HITS Incident Report Hardcopy (Phase 1 – Initial Entry)

Phase 1 – Initial Entry

Type of Incident (May select more than one)

- | | | |
|--|---|------------------------------------|
| <input type="checkbox"/> Injury/Illness | <input type="checkbox"/> Spill/Release | <input type="checkbox"/> Near Miss |
| <input type="checkbox"/> Property Damage | <input type="checkbox"/> Environment/Permit | <input type="checkbox"/> Other |

General Information Section

Preparer's Name: _____ Preparer's Phone Number: _____

Date of Incident: _____ Time of Incident: _____ AM / PM

What Business Group is accountable for this incident: _____

What Business Group SubGroup is accountable for this incident: _____

What CH2M HILL Company is accountable for this incident: _____

Where did the Incident occur?

- United States, Geographic Region: _____
- Canada, Province/Territory: _____
- International, County: _____

Location of Incident?

- Company Premises, CH2M HILL Office (use 3 letter office code if available): _____
- Project, Project name: _____
- In Transit
Traveling from: _____
Traveling to: _____
- At Home
- Other, Specify: _____

Describe the incident: _____

Describe how this event could have been prevented: _____

Provide Witness Information:

Name: _____ Phone: _____

Name: _____ Phone: _____

Name: _____ Phone: _____

Personnel Notified of Incident (Provide name, date and time):

CH2M HILL Personnel: _____

Client Personnel: _____

Additional Comments:

Injury/Illness Section [Complete only if Injury/Illness Incident type selected]

Who was injured?

- CH2M HILL Employee or CH2M HILL Temp Employee
- Subcontractor to CH2M HILL (Non-LLC Joint Venture Project)
- LLC Joint Venture Partner Employee
- LLC Joint Venture Project Subcontractor/Contractor
- Other

Name of Injured: _____ Job Title: _____

Employer Name: _____ Supervisor of Employee: _____

Complete for CH2M HILL Employee Injuries

Business Group of Injured Employee: _____

Has the employee called the Injury Management Administrator (1-866-893-2514)?

- Yes No Not Sure

Has the injured employee's supervisor been notified of this incident?

Yes No Not Sure

Complete for Non-CH2M HILL Employee Injuries

Has the project safety coordinator been notified of this incident?

Yes No Not Sure

Project Safety Coordinator: _____

Body Part Affected: _____

Injury/Illness (Result): _____

Describe treatment provided (if medication provided, identify whether over-the-counter or prescription): _____

Describe any work restriction prescribed (include dates and number of days): _____

Physician/Health Care Provider Information

Name: _____ Phone: _____

Was treatment provided away from the worksite?

No
 Yes

Facility Name: _____

Address: _____

City: _____ Phone Number: _____

Was injured treated in an emergency room?

No Yes

Was injured hospitalized overnight as an in-patient?

No Yes

General Information Environmental Section [Complete only if Environment/Permit or Spill/Release Incident type selected]

Who had control of the area during the incident?

- CH2M HILL, Company: _____
 - Subcontractor, Company: _____
 - Joint Venture Partner/Contractor/Subcontractor, Company: _____
 - Other, Company: _____
- Relationship to CH2M HILL: _____

Property Damage Section [Complete only if Property Damage Incident type selected]

Property Damaged: _____

Property Owner: _____

Damage Description: _____

Estimated US Dollar Amount: _____

Spill or Release Section [Complete only if Spill/Release Incident type selected]

Substance: _____

Estimated Quantity: _____

Did the spill/release move off the property?: _____

Spill/Release From: _____

Spill/Release To: _____

Environment/Permit Section [Complete only if Environment/Permit Incident type selected]

Describe Environmental or Permit Issue: _____

Permit Type: _____

Permitted Level or Criteria (e.g., discharge limit): _____

Permit Name and Number (e.g., NPDES No. ST1234): _____

Substance and Estimated Quantity: _____

Duration of Permit Exceedence: _____



Lessons Learned

[Date] ESBG LL-11-xx

Subject	[Insert Descriptive Name of Lessons Learned]
CH2M HILL Project?	[Yes or No]
Situation	[Describe incident or situation that occurred in general terms. Try to be brief and avoid unnecessary details such as names of people or projects, business groups, divisions, dates, location, etc.]
Lessons Learned (Recommendations and Comments)	<ul style="list-style-type: none">• Bullet out any lessons learned, recommendations or other important “take away” information that would benefit others. Tie the recommendations to the incident or event, and avoid including information that is not directly tied to the event.
Submitted By	[Name/Office Location/Phone]
Additional Information Contact	[Name/Office Location/Phone]
Keywords/Categories	[Insert any keywords or incident categories that would aid in a search for this lessons learned]

Send completed Lessons Learned to the ESBG HSSE Director for posting and distribution. Please include a recommended distribution list.

CH2M HILL Health and Safety Plan
Attachment 6

Fact Sheets

Benzene Fact Sheet

Tick Fact Sheet

Vehicle Accident Guidance

Working Alone

Tick-Borne Pathogens — A Fact Sheet

Most of us have heard of Lyme disease or Rocky Mountain Spotted Fever (RMSF), but there are actually six notifiable tick-borne pathogens that present a significant field hazard. In some areas, these account for more than half of our serious field incidents. The following procedures should be applied during any field activity—even in places that are predominantly paved with bordering vegetation.

Hazard Recognition

An important step in controlling tick related hazards is understanding how to identify ticks, their habitats, their geographical locations, and signs and symptoms of tick-borne illnesses.

Tick Identification

There are five varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These include:

- Deer (Black Legged) Tick (eastern and pacific varieties)
- Lone Star Tick
- Dog Tick
- Rocky Mountain Wood Tick

These varieties and their geographical locations are illustrated on the following page.

Tick Habitat

In eastern states, ticks are associated with deciduous forest and habitat containing leaf litter. Leaf litter provides a moist cover from wind, snow, and other elements. In the north-central states, is generally found in heavily wooded areas often surrounded by broad tracts of land cleared for agriculture.

On the Pacific Coast, the bacteria are transmitted to humans by the western black-legged (deer) tick and habitats are more diverse. For this region, ticks have been found in habitats with forest, north coastal scrub, high brush, and open grasslands. Coastal tick populations thrive in areas of high rainfall, but ticks are also found at inland locations.

Illnesses and Signs & Symptoms

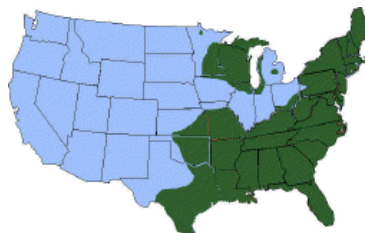
There are six notifiable tick-borne pathogens that cause human illness in the United States. These pathogens may be transmitted during a tick bite—normally hours after attachment. The illnesses, presented in approximate order of most common to least, include:

- Lyme (bacteria)
- RMSF (bacteria)
- Ehrlichiosis (bacteria)
- STARI (Southern Tick-Associated Rash Illness) (bacteria)
- Tularemia (Rabbit Fever) (bacteria)
- Babesia (protozoan parasite)

Symptoms will vary based on the illness, and may develop in infected individuals typically between 3 and 30 days after transmission. Some infected individuals will not become ill or may develop only mild symptoms. These illnesses present with some or all of the following signs & symptoms: fever, headache, muscle aches, stiff neck, joint aches, nausea, vomiting, abdominal pain, diarrhea, malaise, weakness, small solid, ring-like, or spotted rashes. The bite site may be red, swollen, or develop ulceration or lesions. For Lyme disease, the bite area will sometimes resemble a target pattern. A variety of long-term symptoms may result if the illness is left untreated, including debilitating effects and death.



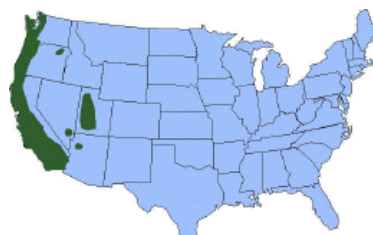
Deer Tick



Distribution of Deer Tick (dark green)



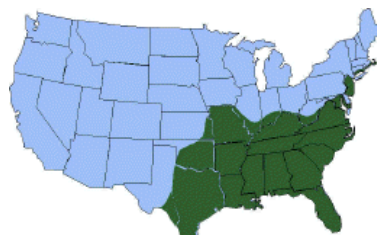
From Left: adult female, adult male, nymph, and larvae Deer Tick (cm scale)



Distribution of Pacific Deer Tick (dark green)



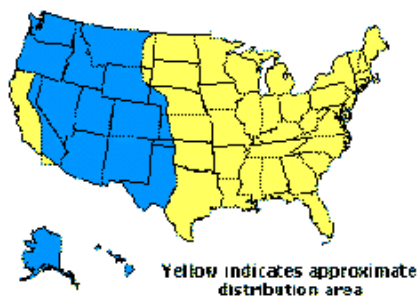
Lone Star Tick



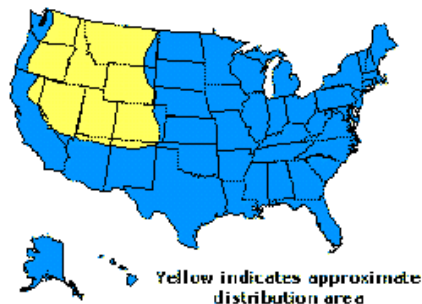
Distribution of Lone Star Tick (Green)



Dog Tick



Rocky Mountain Wood Tick



Hazard Control

The methods for controlling exposure to ticks include, in order of most- to least-preferred:

- Avoiding tick habitats and ceasing operations in heavily infested areas
- Reducing tick abundance through habitat disruption or application of acaricide
- Personal protection through use of repellants and protective clothing
- Frequent tick inspections and proper hygiene

Vaccinations are not available and preventative antibiotic treatment after a bite is generally not recommended.

Avoidance and Reduction of Ticks

To the extent practical, tick habitats should be avoided. In areas with significant tick infestation, consider stopping work and withdrawing from area until adequate tick population control can be achieved. Stopping and withdrawing should be considered as seriously as entering an area without proper energy control or with elevated airborne contaminants—tick-borne pathogens present risk of serious illness!

In areas where significant population density or infestation exists, tick reduction should be considered. Tick reduction can be achieved by disrupting tick habitats and/or direct population reduction through the use of tick-toxic pesticides (Damminix, Dursban, Sevin, etc.).

Habitat disruption may include only simple vegetative maintenance such as removing leaf litter and trimming grass and brush. Tick populations can be reduced by between 72 and 100 percent when leaf litter alone is removed. In more heavily infested areas, habitat disruption may include grubbing, tree trimming or removal, and pesticide application (Damminix, Dursban, Sevin, etc.). This approach is practical in smaller, localized areas or perimeter areas that require occasional access. Habitat controls are to be implemented with appropriate health and safety controls, in compliance with applicable environmental requirements, and may be best left to the property owner or tenant or to a licensed pesticide vendor. Caution should be exercised when using chemical repellents or pesticides in or around areas where environmental or industrial media samples will be collected for analysis.

Personal Protection

After other prevention and controls are implemented, personal protection is still necessary to control exposure to ticks. Personal protection must include all of the following steps:

- So that ticks may be easily seen, wear light-colored clothing. Full-body New Tyvek (paper-like disposable coveralls) may also be used
- To prevent ticks from getting underneath clothing tuck pant legs into socks or tape to boots
- Wear long-sleeved shirts, a hat, and high boots
- Apply DEET repellent to exposed skin or clothing per product label
- Apply permethrin repellent to the outside of boots and clothing before wearing, per product label
- Frequently check for ticks and remove from clothing
- At the end of the day, search your entire body for ticks (particularly groin, armpits, neck, and head) and shower

- To prevent pathogen transmission through mucous membranes or broken/cut skin, wash or disinfect hands and/or wear surgical-style nitrile gloves any time ticks are handled

Pregnant individuals and individuals using prescription medications should consult with their physician and/or pharmacists before using chemical repellents. Because human health effects may not be fully known, use of chemical repellents should be kept to a minimum frequency and quantity. Always follow manufacturers' use instructions and precautions. Wash hands after handling, applying, or removing protective gear and clothing. Avoid situations such as hand-to-face contact, eating, drinking, and smoking when applying or using repellents.

Remove and wash clothes per repellent product label. Chemical repellents should not be used on infants and children.

Vaccinations are generally not available for tick-borne pathogens. Although production of the LYMERix™ Lyme disease vaccination has been ceased, vaccination may still be considered under specific circumstances and with concurrence from the consulting physician.

Tick Check

A tick check should be performed after field survey before entering the field vehicle (you do not want to infest your field vehicle with ticks). Have your field partner check your back; the backs of your legs, arms, and neck; and your hairline. Shake off clothing as thorough as possible before entering the vehicle. Once the field day is complete, repeat this procedure and perform a thorough self check.

If a tick has embedded itself into the skin, remove the tick as described below.

Tick Removal

1. Use the tick removal kit obtained through the CH2M HILL Milwaukee warehouse, or a fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.

Error! Objects cannot be created from editing field codes.

2. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with tweezers. Consult your healthcare provider if infection occurs.



3. Avoid squeezing, crushing or puncturing the body of the tick because its fluids (saliva, hemolymph, gut contents) may contain infectious organisms. Releasing these organisms to the outside of the tick's body or into the bite area may increase the chance of infectious organism transmission.

4. Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin. This precaution is particularly directed to individuals who remove ticks from domestic animals with unprotected fingers. Children, elderly persons, and immunocompromised persons may be at greater risk of infection and should avoid this procedure.

5. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

6. Should you wish to save the tick for identification, place it in a plastic bag, with the date of the tick bite, and place in your freezer. It may be used at a later date to assist a physician with making an accurate diagnosis (if you become ill).

Note: Folklore remedies such as petroleum jelly or hot matches do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided. In addition, a number of tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.

First-Aid and Medical Treatment

Tick bites should always be treated with first-aid. Clean and wash hands and disinfect the bite site after removing embedded tick. Individuals previously infected with Lyme disease does not confer immunity—re-infection from future tick bites can occur even after a person has contracted a tick-borne disease.

The employee should contact the Injury Management/Return To Work provider (IMRTW), WorkCare using the toll-free number 866-893-2514 to report the tick bite. WorkCare will follow-up with each CH2M Hill employee who reports a tick bite and is at risk of developing Lyme disease by monitoring for symptoms up to 45 days, and will refer the employee to a medical provider for evaluation and treatment as necessary.



Vehicle Accident Guidance—ENBG

Remember that if you are **renting** a non-CH2M HILL owned vehicle (short-term rental) in the U.S., you should carry the [insurance card](#) from the state where your driver’s license is issued.

If you operate a **fleet vehicle**, carry the [insurance card](#) where the vehicle is registered.

For ALL Vehicles if you are in an accident:

1. If you are injured, call 911 for emergency medical treatment or 1-866-893-2514 to contact the CH2M HILL Occupational Nurse/Physician for minor injuries. If you feel you have not been injured, contact the RHSM for guidance on whether calling the CH2M HILL Occupation Nurse/Physician is applicable.
2. **Call the Police**--For any vehicle accident/damage, it is recommended that the local police (or site security/emergency services if working on a client site that provides such services) be called to determine if a report needs to be filed. In some instances, a report may not be required (during accident alerts, or in public parking lots). Document that the authorities were called and follow up with any guidance they give you. State requirements vary. If a report is filed, obtain a copy.
3. Notify Supervisor, (and PM/RHSM if working on a project site)
4. Complete a HITS report on the VO.

Additional Steps

To report an auto accident, and before a claim can be taken by telephonic reporting, have available your name (the company name alone is no longer accepted, a driver’s name must be provided even for fender benders), location of accident and your office address if different than the accident location, business group and project number. A claim cannot be taken without your name, address, business group and your project number. By location the state where the accident occurred, and which office you are aligned to, i.e., accident occurs in Idaho, but you are out of the Denver office. Advise the claim recorder the accident occurred in ID, but that your office location is Denver. This will assist the claim intake person in identifying location coding for the claims.

Auto accidents involve two different sections of an Auto policy:

- 1) Liability to others due to Bodily Injury and Property Damage
- 2) Physical Damage - Comprehensive and Collision - damage to the vehicle CH employee is driving

CH2M Hill has Liability coverage for any auto - our policy will respond on either a primary or excess basis.

Refer to the table below for additional notifications to make based on the type of accident experienced and vehicle being used.

Liability - Bodily Injury or Property Damage to Others

Scenario	Which Coverage Responds	What to do if in an accident
CH2M Hill fleet, pool or project vehicle - long term lease - lower 48	CH2M Hill - Primary	Contact Broadspire (1-800-753-6737); Mary Ellegood-Oberts/DEN (720-286-2291); Linda George/DEN (720-286-2057)
CH2M Hill fleet, pool or project vehicle - long term lease - Alaska (North Slope)	CH2M Hill - Primary	Mary Ellegood-Oberts/DEN (720-286-2291)
Client vehicle driven by CH2M Hill employee	Client’s auto policy unless client has made CH2M Hill responsible for vehicle	Contact Broadspire (1-800-753-6737); Mary Ellegood-Oberts/DEN (720-286-2291); contact client



Short term lease (30 days or less)	Rental car company if rented through Enterprise, Budget or Hertz; CH2M Hill excess	Contact Broadspire (1-800-753-6737); Contact local branch of rental car company where vehicle leased (ERAC includes 24 hour roadside assistance) and Mary Ellegood-Oberts/DEN (720-286-2291)
Short term lease (30 days or less)	CH2M Hill - Primary if rented through company other than our national agreements; \$100,000 deductible	Contact Broadspire (1-800-753-6737); Contact rental car company and Mary Ellegood-Oberts/DEN (720-286-2291)
Personal vehicle used on business	Employee's personal auto policy; CH2M Hill on an excess basis	Contact personal auto insurance company; contact Mary Ellegood-Oberts/DEN (720-286-2291)

Physical Damage - damage to vehicle CH employee was driving

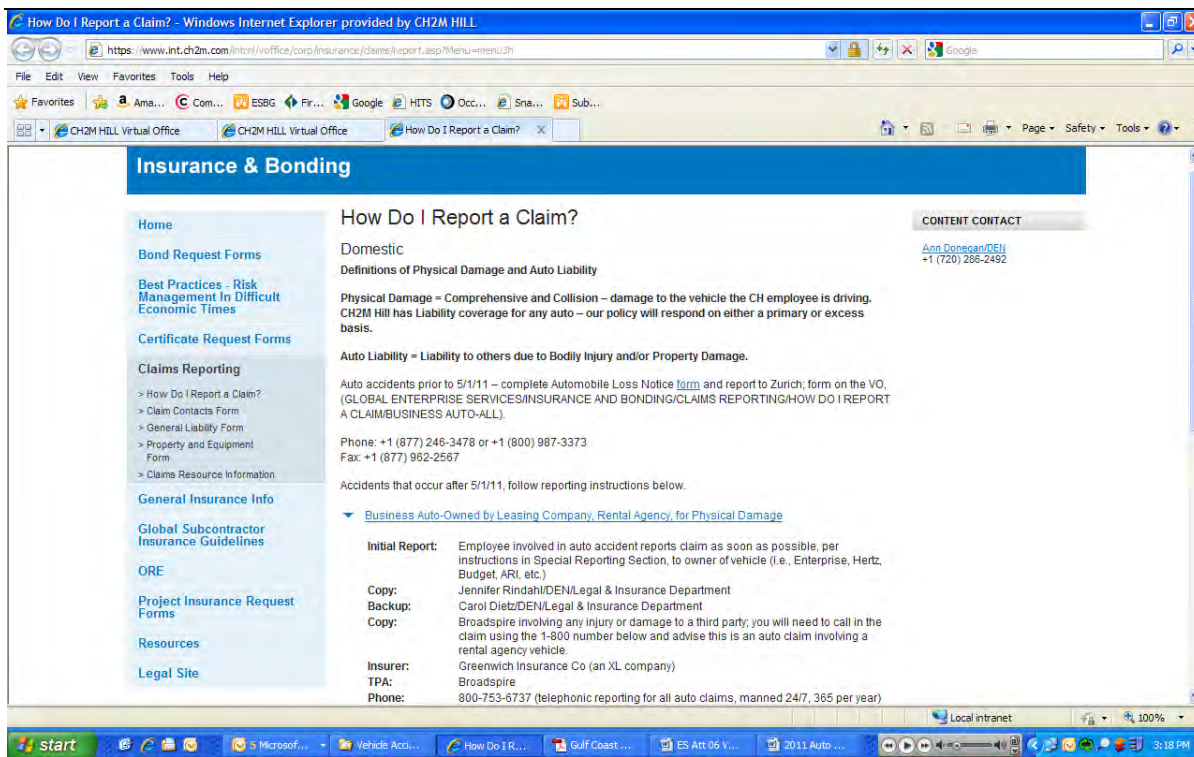
Scenario	Which Coverage Responds	What to do if in an accident
CH2M Hill fleet, pool or project vehicle - long term lease - lower 48	CH2M Hill ONLY if vehicle is scheduled on policy - \$5,000 deductible	Contact Broadspire (1-800-753-6737); Mary Ellegood-Oberts/DEN (720-286-2291); Linda George/DEN (720-286-2057)
CH2M Hill fleet, pool or project vehicle - long term lease - Alaska (North Slope)	CH2M Hill Equipment Schedule if scheduled on policy	Contact Mary Ellegood-Oberts/DEN (720-286-2291)
CH2M Hill fleet, pool or project vehicle - long term lease	ARI if physical damage coverage purchased - \$500 deductible	Contact Mary Ellegood-Oberts/DEN (720-286-2291); call ARI at 1-800-221-1645 give them Client Code and ARI fleet vehicle number; and notify Linda George/DEN - Fleet Coordinator - 720-286-2057
Client vehicle CH2M Hill Employee is driving	Client's auto policy unless client has made CH2M Hill contractually responsible for vehicle	Contact Mary Ellegood-Oberts/DEN (720-286-2291); contact client; contact Broadspire (1-800-753-6737)
Short term lease (30 days or less) using corporate VISA	VISA if corporate credit card used and vehicle is not a pickup, truck, cargo van or used off-road	Contact VISA - 1-800-847-2911 or http://www.visa.com/eclaim
Short term lease (30 days or less) through Enterprise (ERAC) and vehicle is used off-road and physical damage coverage included when vehicle leased	ERAC up to \$3,000 in damage; CH2M Hill's coverage is excess	Notify Rental Car Company; contact Mary Ellegood-Oberts/DEN (720-286-2291) if damage over \$5,000
Short term lease (30 days or less) did not use corporate VISA	CH2M Hill - \$5,000 deductible (project responsibility)	Contact Broadspire (1-800-753-6737); Contact Mary Ellegood-Oberts/DEN (720-286-2291); contact VISA - 1-800-847-2911 or http://www.visa.com/eclaim
Personal vehicle used on business	CH will reimburse the amount of the deductible carried on the employee's policy up to \$500 whichever is less	Contact Mary Ellegood-Oberts/DEN (720-286-2291); contact client; contact Broadspire (1-800-753-6737)

Details for reporting a claim on the CH2M Hill VO are accessed by going to the VO home page and clicking:

GLOBAL ENTERPRISE SERVICES/INSURANCE & BONDING/CLAIMS REPORTING

HOW DO I REPORT A CLAIM TAB or access the following URL:

<https://www.int.ch2m.com/intrnl/voffice/corp/insurance/claims/report.asp?Menu=menu3h>



Insurance & Bonding

How Do I Report a Claim?

Domestic
Definitions of Physical Damage and Auto Liability

Physical Damage = Comprehensive and Collision – damage to the vehicle the CH employee is driving. CH2M Hill has Liability coverage for any auto – our policy will respond on either a primary or excess basis.

Auto Liability = Liability to others due to Bodily Injury and/or Property Damage.

Auto accidents prior to 5/1/11 – complete Automobile Loss Notice [form](#) and report to Zurich; form on the VO, (GLOBAL ENTERPRISE SERVICES/INSURANCE AND BONDING/CLAIMS REPORTING/HOW DO I REPORT A CLAIM/BUSINESS AUTO-ALL).

Phone: +1 (877) 246-3478 or +1 (800) 987-3373
Fax: +1 (877) 962-2567

Accidents that occur after 5/1/11, follow reporting instructions below.

- Business Auto-Owned by Leasing Company, Rental Agency, for Physical Damage

Initial Report:	Employee involved in auto accident reports claim as soon as possible, per instructions in Special Reporting Section, to owner of vehicle (i.e., Enterprise, Hertz, Budget, ARI, etc.)
Copy:	Jennifer Rindahl/DEN/Legal & Insurance Department
Backup:	Carol Diez/DEN/Legal & Insurance Department
Copy:	Broadspire involving any injury or damage to a third party; you will need to call in the claim using the 1-800 number below and advise this is an auto claim involving a rental agency vehicle.
Insurer:	Greenwich Insurance Co (an XL company)
TPA:	Broadspire
Phone:	800-753-6737 (telephonic reporting for all auto claims, manned 24/7, 365 per year)

For Personally Owned Vehicles (POVs):

CH2M HILL does not provide auto insurance for POVs, it is responsibility of the owner. If you are in a vehicle accident conducting company business, contact the police as above, supervisor, and 911 or CH2M HILL’s occupational nurse/physician as stated above. Complete a HITS report. Contact Julie Zimmerman/DEN for assistance for meeting personal insurance deductibles (up to \$500) with proof of insurance and deductible.

If using your POV for extended project use, notify the PM to make sure a rental car is not needed. Check your insurance policy for guidance on using the POV for business use.

Additional Resources:

[Claims Resource Manual](#)

**WORKING ALONE PROTOCOL
CALL - IN CONTACT FORM**

Date of site work: _____ Expected start time: _____

Name of CH2M HILL employee in the field: _____

Name of CH2M HILL employee responsible to receive contact:

Client Emergency Contact (if any):

CH2M HILL employee's contact numbers:

Radio # _____

Cell Phone # _____

Address and Location of work: _____

Directions/Map:

Planned Activity: _____

Specified Frequency and time for call in: _____

Time

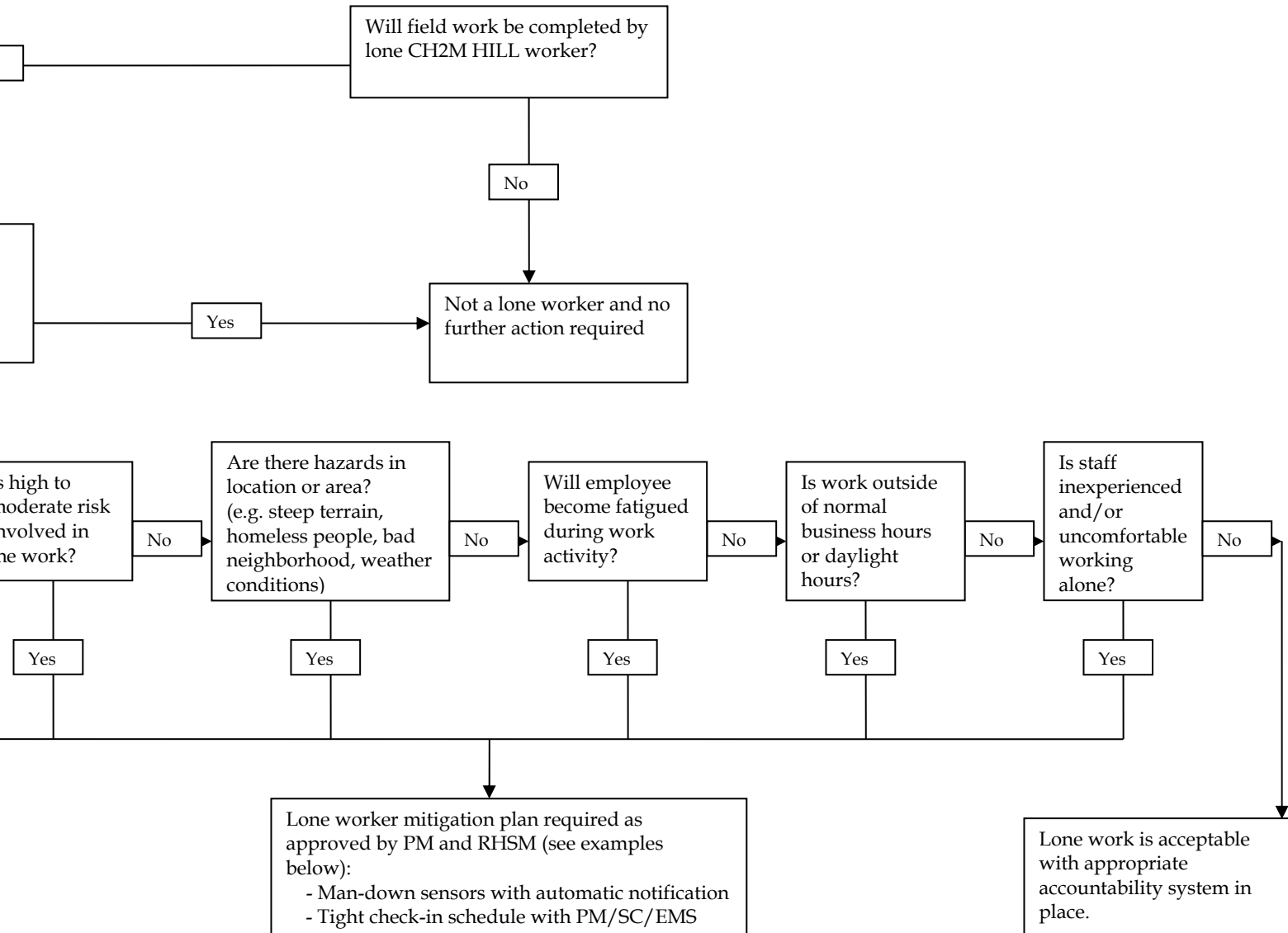
Verified

Location

If lone worker fails to call in at specified frequency/time:

- 1) Call worker's radio and cell to determine if an emergency exists.
- 2) If no reply, immediately call Client security/emergency service if there is one at the site.
- 3) If there is no client security call Emergency Services (911). Inform the dispatcher there is a lone worker that cannot be contacted and there may be an emergency on site. Provide the lone worker's name, their last known location, and your contact information.
- 4) After Emergency Services have been contacted, call the other emergency contacts, Project Manager, and Responsible Health and Safety Manager.

Lone Worker Protocol



CH2M HILL HEALTH AND SAFETY PLAN

Attachment 7

Observed Hazard Form

OBSERVED HAZARD FORM

Name/Company of Observer (*optional*):

Date reported: _____

Time reported: _____

Contractor/s performing unsafe act or creating unsafe condition:

- 1. _____
- 2. _____
- 3. _____

Unsafe Act or Condition:

Location of Unsafe Act or Condition:

Name of CH2M HILL Representative:

Corrective Actions Taken:

Date: _____

Project Safety Committee Evaluation:

Date: _____

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 8

Stop Work Order Form

CH2MHILL

Stop Work Order

REPORT PREPARED BY:

Name:	Title:	Signature:	Date:

ISSUE OF NONPERFORMANCE:

Description:	Date of Nonperformance:

SUBCONTRACTOR SIGNATURE OF NOTIFICATION:

Name:	Title:	Signature:	Date:

** Corrective action is to be taken immediately. Note below the action taken, sign and return to CCI.* Work may not resume until authorization is granted by CH2M HILL Constructors, Inc. Representative,*

SUBCONTRACTOR'S CORRECTIVE ACTION

Description:	Date of Nonperformance:

SUBCONTRACTOR SIGNATURE OF CORRECTION

Name:	Title:	Signature:	Date:

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 9

Agency Inspection Target Zero Bulletin

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.

CH2M HILL HEALTH AND SAFETY PLAN


Attachment 10

Completed CH2M HILL AHAs

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 11

Material Safety Data Sheets

	13095 E. Temple Avenue City of Industry, CA 91746 PHONE: 626-858-1888 FACSIMILE: 626-628-3716 www.PROMINENTINC.COM	DOC NUMBER: 021-REC	MSDS ACTIVATED CARBON
		RELEASE DATE: 01/07/09	
		PREPARED BY: J.N.S.	

ACTIVATED CARBON MSDS

Section I - Substance Identification

Product Name: ACTIVATED CARBON

Chemical Name: Carbon, Activated Carbon, Activated Charcoal

Section II – Hazardous Ingredients

This material is 100% activated carbon. There are no established PEL, TWA, or TLV values for this material. Caution should be taken for respirable dust.

The ACCGIH TWA for respirable dust is 2.2 mg/m³. The product has no carcinogenic properties.

Section III - Physical Data

Description : Colorless black solid, granule, pellet or flake/powder

Vapor Pressure : N/A Boiling Point : N/A

Vapor Density : N/A Volatile Percent : N/A

Solubility : Not Soluble Apparent Density : 0.48-0.52 g/cc

Stability : Stable

Incompatibility : Avoid Contact with strong oxidizers

Section IV - Health Data

Overexposure Effects : This product is non-toxic through ingestion. It is non-toxic through skin absorption. It is not a primary skin irritant. No sensitization effects are known. It is non-toxic through inhalation. Due to its physical properties, carbon dust may irritate the respiratory system and produce eye irritation. In case of eye contact, flush with water for at least 15 minutes. Contact a doctor immediately. For inhalation, remove the person from the area

First Aid: In case of eye contact, flush with water for at least 15 minutes. Contact a doctor immediately. For inhalation, remove the person from the area

Section V – Spill or Leak Procedures

Reportable Quantities: No EPA RQ for this product

If spilled or leaked: Sweep/shovel up and discard or repackage

Waste Disposable Method: Unused carbon may be disposed of in refuse container.

Section VI – Handling & Storage

Protective Gloves: Recommended

Eye Protection: Safety glasses recommended

Other Protective Clothing: None

Ventilation: Local exhausts to control dust

Work/Hygienic Practices: Wash thoroughly after handling.

Respiratory Protection: A high efficiency particulate filter is recommended for dust.

Section VII - Special Precautions

Wet activated carbon removes oxygen from air causing a severe hazard to workers in confined spaces. Sampling and work procedures for low oxygen levels should be taken to ensure ample oxygen availability, in accordance with all local, state and federal regulations.



Univar USA Inc Material Safety Data Sheet

MSDS No:

Version No:

Order No:

Univar USA Inc., 17425 NE Union Hill Rd., Redmond WA 98052
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

The Version Date and Number for this MSDS is : 09/24/2009 - #009

PRODUCT NAME: HYDROCHLORIC ACID (HCl) (ALL GRADES)
MSDS NUMBER: OZ34514
DATE ISSUED: 07/30/2008
SUPERSEDES: 01/26/2006
ISSUED BY: 008730

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Distributed by:
Univar USA Inc.
17425 NE Union Hill Road
Redmond, WA 98052
425-889-3400

Trade Name: HYDROCHLORIC ACID (HCl) (ALL GRADES)

Synonyms:
Muriatic Acid
HCl Solution
Aqueous hydrogen chloride

Product Use: Process chemical, Metal cleaning, Water purification, Petroleum Industry

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

Color: Colorless
Physical State: Liquid
Appearance: Clear
Odor: Irritating, Pungent, Sharp
Signal Word: Danger

MAJOR HEALTH HAZARDS: CAUSES BURNS TO THE RESPIRATORY TRACT, SKIN AND EYES.
CAUSES PERMANENT EYE DAMAGE. DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING.

PHYSICAL HAZARDS: May spatter or generate heat when mixed with water. Contact

Annotation:

with metals may evolve flammable hydrogen gas.

PRECAUTIONARY STATEMENTS: Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Wash thoroughly after handling. Use only with adequate ventilation.

2. HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS:

Inhalation: May cause irritation (possibly severe), chemical burns, and pulmonary edema.

Skin contact: May cause irritation (possibly severe) and chemical burns.

Eye contact: May cause irritation (possibly severe), chemical burns, eye damage, and blindness. Ingestion: Not a likely route of exposure.

Target Organs Affected: Respiratory System, Skin, Eye

Chronic Effects: Repeated or prolonged exposure to dilute solutions may result in dermatitis. Discoloration of the teeth may occur as a result of long term exposure.

Interaction with Other Chemicals Which Enhance Toxicity: None known

Medical Conditions Aggravated by Exposure: None known

See Section 11: TOXICOLOGICAL INFORMATION

3. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Component	Concentration (by weight %)	CAS - No.
Water	63 91	7732-18-5
Hydrogen chloride	9 - 36	7647-01-0

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. If respiration or pulse has stopped, have a trained person administer basic life support (Cardio-Pulmonary Resuscitation and/or Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

SKIN CONTACT: Immediately flush contaminated areas with water. Remove contaminated clothing, jewelry, and shoes immediately. Wash contaminated areas with soap and water. Thoroughly clean and dry contaminated clothing and shoes before reuse. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT: Immediately flush eyes with a directed stream of water for at

Annotation:

least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION: Not a likely route of exposure.

5. FIRE-FIGHTING MEASURES

Fire Hazard: Negligible fire hazard.

Extinguishing Media: Use media appropriate for surrounding fire

Fire Fighting: Keep unnecessary people away, isolate hazard area and deny entry. Wear NIOSH approved positive-pressure self-contained breathing apparatus operated in pressure demand mode. Move container from fire area if it can be done without risk. Cool non-leaking containers with water. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.

Sensitivity to Mechanical Impact: Not sensitive.

Sensitivity to Static Discharge: Not sensitive.

Flash point: Not flammable

Hazardous Combustion Products: Hydrogen chloride, Chlorine, Hydrogen gas

6. ACCIDENTAL RELEASE MEASURES

Occupational Release:

Remove sources of ignition. Wear appropriate personal protective equipment recommended in Section 8 of the MSDS. Stop leak if possible without personal risk. Consider evacuation of personnel located downwind if material is leaking. Shut off ventilation system if needed. Completely contain spilled material with dikes, sandbags, etc. Neutralize with soda ash or dilute caustic soda. Collect with appropriate absorbent and place into suitable container. Liquid material may be removed with a properly rated vacuum truck. Keep out of water supplies and sewers. This material is acidic and may lower the pH of the surface waters with low buffering capacity. Releases should be reported, if required, to appropriate agencies.

7. HANDLING AND STORAGE

Storage Conditions: Store and handle in accordance with all current regulations and standards. Store in rubber-lined steel, acid-resistant plastic or glass containers. Keep container tightly closed. Store in a cool, dry area. Store in a well-ventilated area. Keep away from heat, sparks and open flames. Keep separated from incompatible substances. Do not store in aluminum container or use aluminum fittings or transfer lines. Protect from physical damage. Dike and vent storage tanks.

Handling Procedures: Avoid breathing vapor or mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. When mixing, slowly add to water to minimize heat generation and spattering.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

OSHA Regulatory Exposure limit(s):

Hazardous Component	CAS-No.	OSHA Final PEL TWA	OSHA Final PEL STEL	OSHA Final PEL Ceiling
Hydrogen chloride	7647-01-0			5 ppm 7 mg/m3

Non-Regulatory Exposure Limit(s):

The Non-Regulatory OSHA limits shown in the table are the Vacated 1989 PEL's (vacated by 58 FR 35338, June 30, 1993).

Hazardous Component	CAS-No.	ACGIH TWA	ACGIH STEL	ACGIH Ceiling	OSHA TWA	OSHA STEL	OSHA Ceiling (Vacated)
Hydrogen chloride	7647-01-0			2 ppm			5 ppm 7 mg/m3

ENGINEERING CONTROLS: Use closed systems when possible. Provide local exhaust ventilation where vapor or mist may be generated. Ensure compliance with applicable exposure limits.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection: Wear chemical safety goggles with a faceshield to protect against eye and skin contact when appropriate. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin and Body Protection: Wear chemical resistant clothing and rubber boots when potential for contact with the material exists. Always place pants legs over boots.

Hand Protection: Wear appropriate chemical resistant gloves

Protective Material Types: Nitrile, Neoprene, Butyl rubber, Polyvinyl chloride (PVC), Responder, Trelchem, Tychem

Hazardous Component	Immediately Dangerous to Life/ Health (IDLH)
Hydrogen chloride	50 ppm IDLH

Respiratory Protection: A NIOSH approved full-face respirator equipped with acid gas cartridges (appropriate for hydrogen chloride) may be permissible under certain circumstances where airborne concentrations of hydrogen chloride are expected to exceed exposure limits, or when symptoms have been observed that are indicative of overexposure. When the level may be above the

Annotation:

IDLH, use an SCBA or pressure-demand supplied air with an auxiliary self-contained escape pack. Pressure-demand SCBA (self-contained breathing apparatus) must be used when there is a potential for uncontrolled release or unknown concentrations. A respiratory protection program that meets 29 CFR 1910.134 must be followed whenever workplace conditions warrant use of a respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Appearance:	Clear
Color:	Colorless
Odor:	Irritating, Pungent, Sharp
Odor Threshold	0.3 ppm (causes olfactory fatigue)
Molecular Weight:	36.46
Molecular Formula:	HCl
Flash point:	Not flammable
Boiling Point/Range:	140 - 221 deg F (60 - 105 deg C)
Freezing Point/Range:	-29 to 5 deg F (-34 to -15 deg C)
Vapor Pressure:	14.6 - 80 mmHg @ 20 deg C
Vapor Density (air=1):	1.3 @ 20 deg C
Specific Gravity (water=1):	1.05 - 1.18
Density:	8.75 - 9.83 lbs/gal
Water Solubility:	100%
pH:	2 (0.2% solution)
Volatility:	9 - 36% by volume
Evaporation Rate (ether=1):	< 1.00 (butyl acetate=1)

10. STABILITY AND REACTIVITY

Reactivity/ Stability: Stable at normal temperatures and pressures.

Conditions to Avoid: Avoid heat, flames, sparks and other sources of ignition. Avoid contact with water. Will react with some metals forming flammable hydrogen gas. Hydrogen chloride may react with cyanide, forming lethal concentrations of hydrocyanic acid. Avoid contact with incompatible materials.

Incompatibilities/Materials to Avoid: Metals, Alkalis, Oxidizing agents, Mercuric sulfate, Perchloric acid, Carbides of calcium, cesium, rubidium, Acetylides of cesium and rubidium, Phosphides of calcium and uranium, Lithium Silicide

Hazardous Decomposition Products: Chlorine, Hydrogen chloride, Hydrogen gas

Hazardous Polymerization: Will not occur

11. TOXICOLOGICAL INFORMATION

Standard Draize (Eye):	rabbit-eye mild
Standard Draize (Skin):	human-skin mild

TOXICITY DATA:

Hazardous Component	LD50 Oral	LC50 Inhalation	LD50 Dermal
	700 mg/kg (Rat)	3124 ppm (1 hr-Rat)	5010 mg/kg
Hydrogen chloride	900 mg/kg (Rabbit)		(Rabbit)

TOXICITY:

Inhalation will cause severe irritation and possible burns with coughing and choking. If inhaled deeply, edema and hemorrhage of the lungs may occur. Prolonged exposure may cause discoloration and/or erosion of teeth. Contact with eyes causes immediate severe irritation with possible burns, permanent visual impairment, or total loss of sight. Skin contact with this material may cause severe irritation and corrosion of tissue. Ingestion may cause immediate burns of the mouth, esophagus, and stomach. Ingestion may cause intense pain, nausea, vomiting, bleeding, circulating collapse, shock and death.

CARCINOGENICITY: This product is not classified as a carcinogen by NTP, IARC or OSHA.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

LC50 Gambusia affinis: 282 mg/L 96 h
LC50 goldfish: 178 mg/L (1 to 2 hour survival time)
LC50 bluegill: 3.6 mg/L 48 h
LC50 shrimp: 100 330 mg/L

FATE AND TRANSPORT:

BIODEGRADATION: This material is inorganic and not subject to biodegradation.

PERSISTENCE: This material is believed not to persist in the environment. This material is believed to exist in the disassociated state in the environment. If released to soil, hydrogen chloride will sink into the soil. The acid will dissolve some soil material (in particular, anything with a carbonate base) and will be somewhat neutralized. The remaining portion is thought to transport downward to the water table. If released to water, it dissociates almost completely and will be neutralized by natural alkalinity and carbon dioxide.

BIOCONCENTRATION: This material is not expected to bioconcentrate in organisms.

ADDITIONAL ECOLOGICAL INFORMATION: This material has exhibited toxicity to terrestrial organisms. May decrease pH of waterways and adversely affect aquatic life.

13. DISPOSAL CONSIDERATIONS

Annotation:

Reuse or reprocess, if possible. Dispose in accordance with all applicable regulations. May be subject to disposal regulations: U.S. EPA 40 CFR 261.

Hazardous Waste Number(s): D002

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Hydrochloric acid solution
DOT UN NUMBER: UN1789
HAZARD CLASS/ DIVISION: 8
PACKING GROUP: II
LABELING 8
REQUIREMENTS:
DOT RQ (lbs): RQ 5,000 Lbs. (Hydrochloric acid)

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME: Hydrochloric acid solution
UN NUMBER: UN1789
CLASS: 8
PACKING/RISK GROUP: II

15. REGULATORY INFORMATION

U.S. REGULATIONS

OSHA REGULATORY STATUS:

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200) (US).

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):

If a release is reportable under CERCLA section 103, notify the state emergency response commission and local emergency planning committee. In addition, notify the National Response Center at (800) 424-8802 or (202) 4262675.

Hazardous Component	CERCLA Reportable Quantities:
Hydrogen chloride	5000 lb (final RQ)

EPCRA EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30):

If a release is reportable under EPCRA, notify the state emergency response commission and local emergency planning committee. If the TPQ is met, facilities are subject to reporting requirements under EPCRA Sections 311 and 312.

Hazardous Component	EPCRA RQs	Threshold Planning Quantity (TPQs)
Hydrogen chloride	5000 lb (EPCRA RQ)	500 lb (TPQ)

EPCRA SECTIONS 311/312 HAZARD CATEGORIES (40 CFR 370.21):

Sudden Release of Pressure, Extremely Hazardous, Acute Health Hazard

EPCRA SECTION 313 (40 CFR 372.65):

The following chemicals are listed in 40 CFR 372.65 and may be subject to Community Right-to Know Reporting requirements.

Hazardous Component	Status:
Hydrogen chloride	Listed

DEPARTMENT OF HOMELAND SECURITY (DHS)- Chemical Facility Anti-Terrorism Standards (6 CFR 27):

Hydrogen chloride is regulated under DHS as follows:

- DHS - Release Min. Concentration
- DHS - Release Screening Threshold Quantity
- DHS - Security Issue
- DHS - Theft Screening Threshold Quantity

OSHA PROCESS SAFETY (PSM) (29 CFR 1910.119):

Not regulated

NATIONAL INVENTORY STATUS

U.S. INVENTORY STATUS (TSCA): All components are listed or exempt

TSCA 12(b): This product is not subject to export notification

CANADIAN DOMESTIC SUBSTANCE LIST (DSL/NDSL): All components are listed.

STATE REGULATIONS

Hazardous Component	Hydrogen chloride	
California Proposition 65 Cancer WARNING:		Not Listed
California Proposition 65 CRT List - Male reproductive toxin:		Not Listed
California Proposition 65 CRT List - Female reproductive toxin:		Not Listed.
Massachusetts Right to Know Hazardous Substance List		Listed
New Jersey Right to Know Hazardous Substance List	sn 1012; sn 2909 (gas only)	
New Jersey Special Health Hazards Substance List		corrosive
New Jersey - Environmental Hazardous Substance List		Listed
Pennsylvania Right to Know Hazardous Substance List		Listed
Pennsylvania Right to Know Special Hazardous Substances		Not Listed
Pennsylvania Right to Know Environmental Hazard List		Listed
Rhode Island Right to Know Hazardous Substance List		Listed

CANADIAN REGULATIONS

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

Hazardous Component	Hydrogen chloride	
Canada - CEPA Schedule I - Toxic Substance list		Not Listed
WHMIS Classification:		E

16. OTHER INFORMATION

Disclaimer:

This information is intended solely for the use of individuals trained in the NFPA and/or HMIS systems. HMIS: (SCALE 0-4) (Rated using National Paint & Coatings Association

HMIS: Rating Instructions, 2nd Edition)

Health: 3 Flammability: 0 Reactivity: 1

NFPA 704 - Hazard Identification Ratings (SCALE 0-4)

Health: 3 Flammability: 0 Reactivity: 1

Univar USA Inc Material Safety Data Sheet

For Additional Information contact MSDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process

Please reduce your browser font size for better viewing and printing.

MSDS**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865




24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9309

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7516

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

METHYL TERT-BUTYL ETHER

MSDS Number: B7222 --- *Effective Date: 09/08/97*

1. Product Identification

Synonyms: 2-Methoxy-2-methylpropane; tert-Butyl methyl ether; Methyl 1,1-dimethyl ethyl ether; MTBE

CAS No.: 1634-04-4

Molecular Weight: 88.15

Chemical Formula: C₅H₁₂O

Product Codes:

J.T. Baker: 9034, 9042, 9043

Mallinckrodt: 5398

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methyl tert-butyl Ether	1634-04-4	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. MAY AFFECT CENTRAL NERVOUS SYSTEM,

**BLOOD, AND KIDNEYS. A CENTRAL NERVOUS SYSTEM DEPRESSANT.
CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.**

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 4 - Extreme (Flammable)

Reactivity Rating: 2 - Moderate

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;
PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:

Inhalation of vapor can irritate respiratory tract. Causes central nervous system effects. Breathing high concentrations in air can cause lightheadedness, dizziness, weakness, nausea, headache.

Ingestion:

May cause nausea, vomiting. Other symptoms similar to inhalation may occur. Laryngeal, ocular, and respiratory muscles are affected in severe poisoning.

Skin Contact:

A mild skin irritant which causes loss of natural oils. May be a route of absorption into the body.

Eye Contact:

Vapors can irritate eyes; splashes may cause damage to eye tissue.

Chronic Exposure:

Symptoms noted above may be produced by cumulative exposure.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Remove any contaminated clothing. Wash skin with soap and water for at least 15

minutes. Get medical attention if irritation develops or persists.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Flash point: -27C (-17F)

Autoignition temperature: 435C (815F)

Flammable limits in air % by volume:

lel: 1.6; uel: 8.4

Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.

Explosion:

Above the flash point, explosive vapor-air mixtures may be formed. Vapors can flow along surfaces to distant ignition source and flash back. Sealed containers may rupture when heated. Sensitive to static discharge.

Fire Extinguishing Media:

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB(tm) solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from

any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-ACGIH Threshold Limit Value (TLV): 40 ppm (TWA)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details. Use explosion-proof equipment.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a full facepiece respirator with dust/mist filter may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear protective gloves and clean body-covering clothing.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Characteristic ethereal odor.

Solubility:

4.8 g/100g of water.

Specific Gravity:

0.74

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

4.8 g/100g

40 ppm TLV

Boiling Point:

55C (131F)

Melting Point:

-110C (-166F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

245 @ 25C (77F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Unstable in acid solutions.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Oxidizers, acids.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 4 gm/kg; inhalation rat LC50: 23576 ppm/4H.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Methyl tert-butyl Ether (1634-04-4)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material is not expected to biodegrade. When released into the air, this material is expected to adversely affect the ozone layer. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. This material has an estimated bioconcentration factor (BCF) of less than 100. This material is not expected to

significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is not expected to be degraded by photolysis. When released into the air, this material is expected to have a half-life between 1 and 10 days.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: METHYL TERT-BUTYL ETHER

Hazard Class: 3

UN/NA: UN2398

Packing Group: II

Information reported for product/size: 335LB

International (Water, I.M.O.)

Proper Shipping Name: METHYL TERT-BUTYL ETHER

Hazard Class: 3.1

UN/NA: UN2398

Packing Group: II

Information reported for product/size: 335LB

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Methyl tert-butyl Ether (1634-04-4)	Yes	Yes	Yes	Yes
-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	DSL	--Canada-- NDSL	Phil.
Methyl tert-butyl Ether (1634-04-4)	Yes	Yes	No	Yes


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-----\Federal, State & International Regulations - Part 1\-----
                                     -SARA 302-   -----SARA 313-----
Ingredient                           RQ      TPQ      List  Chemical Catg.
-----
Methyl tert-butyl Ether (1634-04-4)  No      No       Yes   No

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-----\Federal, State & International Regulations - Part 2\-----
                                     -RCRA-   -TSCA-
Ingredient                           CERCLA   261.33   8(d)
-----
Methyl tert-butyl Ether (1634-04-4)  1000     No       No

```

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 3[Y]E

Poison Schedule: No information found.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 4 Reactivity: 0

Label Hazard Warning:

WARNING! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. MAY AFFECT CENTRAL NERVOUS SYSTEM, BLOOD, AND KIDNEYS. A CENTRAL NERVOUS SYSTEM DEPRESSANT. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

Label Precautions:

Keep away from heat, sparks and flame.
Avoid contact with eyes, skin and clothing.
Avoid breathing vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 15.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

CH2M HILL HEALTH AND SAFETY PLAN
Attachment 12

Kinder Morgan California Notification Guide for Releases

**CALIFORNIA
NOTIFICATION GUIDE**

KINDER  MORGAN

**Effective: June 20, 2005
Revised: August 1, 2006
Revised: April 17, 2007**

Revision 3.0

**Pacific Northern and Southern Region
General Information
Table of Contents**

- **What is Reportable?**
- **California Notification Requirements**
- **Special Agreement Agencies Contact List**
- **California Notification Form**
- **California Notification Form**

What is Reportable?

Basically
EVERYTHING !

If it comes in contact with the
Ground or Water
Or
Threatens to contact Water

Report it !



Revised California Notification Requirements
as of **0800 PDT - June 20, 2005**

Revised 04-05-06

KM Employee or Agent
becomes aware of a release or threatened release

1. Call 911, as appropriate

2. Initiate Shutdown of source, if possible

- If shutdown takes longer than 5 minutes, make notifications first.
- Notify Area Mgr (or designee) or ORCC (714-560-4839), as appropriate

3. Call CA OES 800-852-7550

See
KM California Field Notification Form
for details on
reporting information and documentation

4. Call NRC 800-424-8802

5. Call CUPAs

- See attached lists of CUPAs by facility, P/L operating system & mile post

6. Call Bureau of Reclamation

- In PSR, call 702-293-8060
- In PNR, call 916-979-3400

7. Call Orange Control Center (ORCC) 714-560-4839

8. Call Local Area Mgr (or designee)
Note: Area Manager must notify the OSRO (oil spill contractor) whenever CA F&G-OSPR jurisdiction is involved. See ICP Vol.2, Section 9.
Call Project Managers on project related issues

9. Call Local Agencies required by **Special Agreement**

- See attached lists of Local Agencies with Special Agreements

Special Agreement Agencies Contact List

Listed below is contact information for agencies requiring notification per special agreements with KM.

- **San Bernardino County Communications Center -**

24 Hours: 800-338-6942 (or 800-33-TOXIC)

Note: This is the **same number as the San Bernardino County Fire CUPA. Do not repeat notifications – only call one time. Once KM has received an official, documented decision, the number will be deleted from this page.**

- **San Diego County Regional Water Quality Control Board -**

24 Hours: 858-467-2980

- **Contra Costa County Health Services -**

24 Hours: 925-646-1112

- **Solano County Department of Resource Management -**

24 Hours: 707-784-6765

California Field Notification Form

Date of Incident: _____
Time of Incident: _____

Name of Person(s) Making Notifications: _____

1. 911 N/A
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____

2. Initiate Shutdown
Method Used: _____

KM Contact, if any: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____

3. CA OES 800-852-7550
OES Control #: _____
OES Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____

4. NRC 800-424-8802
NRC Control #: _____
NRC Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____

5. CUPA(s) See CUPA list
County Notified: _____
CUPA Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____
County Notified: _____
CUPA Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____
County Notified: _____
CUPA Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____

5. CUPA(s) Continued See CUPA list
County Notified: _____
CUPA Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____

6. Bureau of Reclamation
 Southern Region 702-293-8060
 Northern Region 916-978-5000
BOR Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____

7. ORCC 714-560-4839
ORCC Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____

8. Area Manager (or designee)
AM Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Note: Area Manager must notify the OSRO (oil spill contractor) whenever OSPR jurisdiction is involved. See ICP Vol.2, Section 9.
OSRO Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____
Contact: _____
 Project Manager N/A
Contact: _____
Call start time: _____ end time: _____
Follow-up call* - Time: _____ Date: _____

9. Local Special Agreement Agencies

- San Bernardino Cnty Communications Center 800-338-6942
Contact _____ Time _____
- San Diego County RWQCB 858-467-2980
Contact _____ Time _____
- Contra Costa Cnty Hlth Services 925-646-1112
Contact _____ Time _____
- Solano Cnty Dept of Resource Mgmt 707-784-6765
Contact _____ Time _____

Follow-up call* - Time: _____ Date: _____
Contact: _____

LM = Left Message – a message **MUST** be left for any agency if a person does not pick up and there is voice mail.

NR = No response – Indicate “NR” if no one at the agency answered the call and there is no voice mail available to leave a message.

*** Record Follow-up Call information in the last box on Page 2 of this form**

California Field Notification Form

- Below are variations of the questions you will be asked when making notifications.
- **Have this information readily available during the notifications.**
- To ensure KM reports uniform information when calling multiple agencies, write down the information and report it consistently.

Name and phone number of KM caller:
Name and phone number of designated KM employee for follow-up calls (Area Manager or Designee):
Company Name and Mailing Address: <i>Mailing address for reports: Kinder Morgan Energy Partners L.P. 1100 Town & Country Rd. Orange, CA 92868</i>
Date and Time of Incident:
Product Type:
Location of Release or Threatened Release (see facility address list as needed): <input type="checkbox"/> Terminal _____ <input type="checkbox"/> Breakout Facility _____ <input type="checkbox"/> Pump Station/ Booster _____ <input type="checkbox"/> Pipeline: LS _____ / PLMP _____ Line size _____ Cross Street / Landmark _____
County:
Weather Conditions:
Description of what happened:
Amount Released (area dimensions not quantity); estimate size of release area (i.e. 5ft by 5ft): Approximately = by
Water Affected or Threatened , if any:
Measures taken or plans to abate, contain and cleanup the spill:
Death or Injuries , if any:
Other Agencies Notified , if any:
Information provided in follow-up calls:

If the answer to any question is unknown, tell the agency the information is "unknown at this time"; then document the response to the agencies was "unknown at this time".

Pacific Northern Region

Pacific Northern Region (PNR) Table of Contents

- **PNR Manager Contact List**
- **PNR Facility Address**
- **PNR CUPA by Facility**
- **PNR CUPA by Pipeline**
- **PNR CUPA by PLMP**

PACIFIC NORTHERN REGION NOTIFICATION LIST

Manager	Direct Connect	Nextel	Pager	Desk	Home
Lies, G.A. Gregg) Director of Operations	116*1590*17	707 580-5751	877 379-3603	707 438-2102	530 666-1897
Johnson, K.W. (Kelly) Operations Manager – Bradshaw, Stockton, Chico, Rocklin Station, Fresno and Reno.	116*1590*116	707 580-5764	800 205-6324	916 624-2431x19	916 783-3383
Figueira, M.L. (Merlin) Operations Manager – Portland, Eugene, Willbridge, Linnton and Harbor Island.	112*18144*23	503 209-4138	888 789-4448	503 220-1257	TBD
Rounds, M.S. (Mike) Operations Manager – Concord, Richmond Station, Richmond Terminal, San Jose and Brisbane.	116*1590*100	707 580-5759	800 204-7357	510 412-8826	707 448-1913
Carr, S.J. (Sid) Area Manager – Eugene, Portland	112*18144*6	503 209-4575	503 294-3691	541 461-2517	541 686-9867
Holbrook, Andrew Area Manager – Harbor Island	112*18144*26	206 510-1273	888 787-9784	206 682-4706	TBD
Gonyeau, G.E. (Girard) Area Manager - Reno	116*1590*117	775 745-9279	775 321-6767	775 358-6971x12	775 852-4199
McWhorter, M.G. (Mike) Area Manager – Fresno	116*1590*125	559 647-7749	559 262-2801	559 493-2975	559 255-3352
Murphy, P.G. (Pete) Area Manager – Concord	116*1590*1335	510 453-6961	925 210-4143	925 682-0764	925 261-0124
Stevenson, W.H. (Wally) Area Manager – Willbridge, Linnton	112*18144*19	503 209-7309		503 220-1263	
Sudheimer, M.G. (Mike) Area Manager – Richmond Station, Richmond Terminal	116*1590*1336	510 453-6963	510 539-4982	510 412-8819	707 422-4439
Villalovos II, F.L. (Frank) Area Manager – Chico, Rocklin	116*1590*27	530 624-4048	888 971-4632	530 342-6140	530 589-3084
Wagner, C.R. (Chuck) Area Manager – Brisbane, San Jose	116*1590*107	408 210-9230	877 330-8521	415 467-8107	510 223-5537
Yeo, K.W. (Ken) Area Manager – Bradshaw, Stockton	116*1590*138	916 416-7938	916 522-9876	916 369-9772	530 823-0226
Hosler, Larry Mgr. Pipeline Maintenance	116*1590*18	707-580-5766	877-689-6668	707-438-2104	707-434-3661

Pacific Northern Region Facility Address List

<p><u>NORTHERN REGION ADMINISTRATION</u> 100 CEMENT HILL ROAD, SUITE 500 FAIRFIELD, CA 94533 Phone: 707-424-6080</p>	<p><u>CONCORD STATION</u> 1550 SOLANO WAY CONCORD, CA 94520 Phone: 925-682-6850/51</p>
<p><u>BRADSHAW TERMINAL</u> 2901 BRADSHAW ROAD SACRAMENTO, CA 95827 Phone: 916-363-1666</p>	<p><u>CONCORD YARD</u> 5625 IMHOFF DRIVE CONCORD, CA. 94520 Phone: 925-798-8587</p>
<p><u>BRISBANE TERMINAL</u> 950 TUNNEL AVE BRISBANE, CA 94005 Phone: 415-467-8107</p>	<p><u>CHICO TERMINAL</u> 2570 HEGAN LANE CHICO, CA. 95928 Phone: 530-342-6140</p>
<p><u>RICHMOND STATION</u> 520 CASTRO STREET RICHMOND, CA. 94801 Phone: 510-233-2027</p>	<p><u>FRESNO TERMINAL</u> 4149 SO. MAPLE AVE. FRESNO, CA 93725 Phone: 559-237-4612</p>
<p><u>ROCKLIN STATION</u> 6050 PACIFIC STREET, "A" ROCKLIN, CA 95677 Phone: 916-624-2433</p>	<p><u>ROCKLIN ADMINISTRATION</u> 6050 PACIFIC STREET, "B" ROCKLIN, CA 95677 Phone: 916-624-2431</p>
<p><u>SAN JOSE</u> 2150 KRUSE DRIVE SAN JOSE, CA 95131 Phone: 408-435-7399</p>	<p><u>RICHMOND TERMINAL</u> 1140 CANAL BLVD. RICHMOND, CA. 94804 Phone: 510-412-8810</p>
<p><u>STOCKTON TERMINAL</u> 2947 NAVY DRIVE STOCKTON, CA 95206 Phone: 209-465-7369</p>	<p><u>CONCORD LAB</u> 1550 SOLANO WAY CONCORD, CA 94520 Phone: 925-825-7557</p>

Pacific Northern Region CUPAs by Facility - CA only

Staffed Facilities	CUPA	Phone #
Bradshaw Terminal	Sacramento County Env Mgmnt Dept	(916) 875-8469
Brisbane Terminal	San Mateo County Environmental Health	(650) 363-4366
Chico Terminal	Butte County Environmental Health	(530) 891-2727
Concord Station	Contra Costa County Health Services Dept	(925) 646-2286
Concord Yard		
Richmond Station		
Richmond Terminal		
Fresno Terminal	Fresno County Environmental Health	(559) 445-3391
Rocklin Station	Placer County Environmental Health	(530) 745-2300
San Jose Terminal	Santa Clara County Environmental Health	(408) 918-1973
	San Jose Fire Department, Fire Prevention/Hazmat	(408) 277-4659
Stockton Terminal	San Joaquin County Environmental Health	(209) 468-3420
Remote Facilities	CUPA	Phone #
Amorco Station	Contra Costa County Health Services Dept	(925) 646-2286
Atwater Station	Merced County Environmental Health	(209) 381-1087
Bakersfield Station	Kern County Environmental Health	(661) 862-8700
Brentwood Booster	Contra Costa County Health Services Dept	(925) 646-2286
Cisco Grove Booster	Placer County Environmental Health	(530) 745-2300
Colfax Booster	Placer County Environmental Health	(530) 745-2300
Dougherty Booster	Alameda County Environmental Health	(510) 567-6862
ERLE Junction	Yuba County Environmental Health	(530) 749-5450
Feather Booster	Sutter County Community Services Dept	(530) 822-7400
Mather Meter Station	Sacramento County Env Mgmnt Dept	(916) 875-8469
Martinez Booster	Contra Costa County Health Services Dept	(925) 646-2286
Oakland Terminal	Alameda County Environmental Health	(510) 567-6862
Oakland Airport	Alameda County Environmental Health	(510) 567-6862
Sacramento Terminal	Yolo County Environmental Health	(530) 666-8646
San Francisco Airport	San Mateo County Environmental Health	(650) 363-4366
Travis AFB	Solano County Department of Resource Management	(707) 784-6765

Pacific Northern Region CUPAs by Pipeline - CA only

Pipeline System	Line Section	CUPA	Phone #
Bakersfield - Fresno 8"	15	Kern County Environmental Health	(661) 862-8700
		Tulare County Environmental Health	(559) 733-6441
		Fresno County Environmental Health	(559) 445-3391
Bakersfield Gathering 8"	91		
Chevron - Bakersfield 8" (NIS)	92	Kern County Environmental Health	(661) 862-8700
Golden Bear to UPRR 4" (NIS)	93		
Atwater - Castle AFB 6" (NIS)	63	Merced County Environmental Health	(209) 381-1087
Bradshaw - McClellan 4"3"6" (NIS)	56	Sacramento County Env Mgmt Dept	(916) 875-8469
Bradshaw - Mather AFB 4"	57		
Concord - Bradshaw 10"	9	Contra Costa County Health Services Dept	(925) 646-2286
		Sacramento County Env Mgmt Dept	(916) 875-8469
		San Joaquin County Environmental Health	(209) 468-3420
Concord - Fresno 12"	90, 50, 60	Contra Costa County Health Services Dept	(925) 646-2286
		San Joaquin County Environmental Health	(209) 468-3420
		Stanislaus County Environmental Resources	(209) 525-6700
		Merced County Environmental Health	(209) 381-1087
		Madera County Environmental Health	(559) 661-6333
Fresno County Environmental Health	(559) 445-3391		
Concord Gathering 12"	27		
Concord Gathering 8"	72	Contra Costa County Health Services Dept	(925) 646-2286
Concord Gathering 8"	73		
Concord Gathering 10" / 12"	103, 33	Solano County Department of Resource Management	(707) 784-6765
		Contra Costa County Health Services Dept	(925) 646-2286
Concord - Travis AFB 8"	47	Contra Costa County Health Services Dept	(925) 646-2286
		Solano County Department of Resource Management	(707) 784-6765
Concord - Sacramento 20" / Sacramento - Rocklin 12"	130, 20	Contra Costa County Health Services Dept	(925) 646-2286
		Solano County Department of Resource Management	(707) 784-6765
		Yolo County Environmental Health	(530) 666-8646
		Sacramento County Env Mgmt Dept	(916) 875-8469
		Placer County Environmental Health	(530) 745-2300
Concord - Sacramento 14" (NIS)	25	Contra Costa County Health Services Dept	(925) 646-2286
		Solano County Department of Resource Management	(707) 784-6765
		Yolo County Environmental Health	(530) 666-8646
Concord - San Jose 10"	16	Contra Costa County Health Services Dept	(925) 646-2286
		Alameda County Environmental Health	(510) 567-6862
		Santa Clara County Environmental Health	(408) 918-1973
		San Jose Fire Department, Fire Prevention/Hazmat	(408) 277-4659
Erle Junction - Beale AFB 6"	65	Yuba County Environmental Health	(530) 749-5450
Fresno - Lemoore NAS 6"	119	Fresno County Environmental Health	(559) 445-3391
		Kings County Environmental Health	(559) 584-1411
Martinez - Amorcio 8"	68		
Amorcio - Bridgehead 10"	88		
Martinez - Concord 8" (NIS)	26	Contra Costa County Health Services Dept	(925) 646-2286
Richmond - Arco 8"	74		
Richmond - Pt. Molate 12" (NIS)	70		
Richmond - Brisbane 8" / 10"	46, 41	Contra Costa County Health Services Dept	(925) 646-2286
		Alameda County Environmental Health	(510) 567-6862
		San Mateo County Environmental Health	(650) 363-4366
Richmond - Brisbane - San Francisco Airport 12"	36, 42, 38	Contra Costa County Health Services Dept	(925) 646-2286
		Alameda County Environmental Health	(510) 567-6862
		San Mateo County Environmental Health	(650) 363-4366
Brisbane - SPTCO 8" (NIS)	106		
Brisbane - UNOCAL 8" (NIS)	39	San Mateo County Environmental Health	(650) 363-4366

Pacific Northern Region CUPAs by Pipeline - CA only

Pipeline System	Line Section	CUPA	Phone #
Richmond - Concord 8"	8	Contra Costa County Health Services Dept	(925) 646-2286
Chevron - Richmond 8"	69		
Unocal - Arco	89		
Unocal - Richmond	71		
Shore - Richmond	75		
IMTT - Richmond	76		
Richmond Gathering 10"	99		
Richmond Gathering 10"	104		
Richmond Gathering 8" (NIS)	32		
Richmond Lateral 12"	37		
Richmond Lateral 10"	95	Solano County Department of Resource Management	(707) 784-6765
		Contra Costa County Health Services Dept	(925) 646-2286
Rocklin - Chico 8"	64	Placer County Environmental Health	(530) 745-2300
		Yuba County Environmental Health	(530) 749-5450
		Sutter County Community Services Dept	(530) 822-7400
		Butte County Environmental Health	(530) 891-2727
Rocklin - Reno 10" / 8" / 6"	11, 12, 13	Placer County Environmental Health	(530) 745-2300
		Nevada County Environmental Health	(530) 265-1449
		Sierra County Environmental Health	(530) 993-6700
Rocklin - SP Diesel 4"	48	Placer County Environmental Health	(530) 745-2300
Sacramento - Arco 10"	29	Yolo County Environmental Health	(530) 666-8646
Sacramento - Arco 8"	31		
Sacramento - Sacramento River Junction	28	Yolo County Environmental Health	(530) 666-8646
		Sacramento County Env Mgmt Dept	(916) 875-8469
Sacramento - Shell Sacramento 8"	34	Yolo County Environmental Health	(530) 666-8646
Sacramento - Shell Sacramento 8"	35		
Sacramento - Bradshaw 10" (NIS)	24	Yolo County Environmental Health	(530) 666-8646
		Sacramento County Env Mgmt Dept	(916) 875-8469
Stockton Junction - Atwater 8"	62	San Joaquin County Environmental Health	(209) 468-3420
		Stanislaus County Environmental Resources	(209) 525-6700
		Merced County Environmental Health	(209) 381-1087
Stockton - Arco 8"	43	San Joaquin County Environmental Health	(209) 468-3420
Stockton - Shell/Mobil 8"	45		
Stockton - Time Oil 8" (NIS)	44		

NIS = Not In Service

Pacific Northern Region CUPAs by PLMP - CA only

Pipeline Segment	Line Section	PLMP	CUPA	Phone #
Bakersfield - Fresno 8"	15	0.00 - 28.28	Kern County Environmental Health	(661) 862-8700
		28.28 - 81.59	Tulare County Environmental Health	(559) 733-6441
		81.59 - 96.04	Fresno County Environmental Health	(559) 445-3391
Bakersfield Gathering 8"	91	0.00 - 3.88	Kern County Environmental Health	(661) 862-8700
Chevron - Bakersfield 8" (NIS)	92			
Golden Bear to UPRR 4" (NIS)	93			
Atwater - Castle AFB 6" (NIS)	63		Merced County Environmental Health	(209) 381-1087
Bradshaw - McClellan 4"/3"/6" (NIS)	56		Sacramento County Env Mgmt Dept	(916) 875-8469
Bradshaw - Mather AFB 4"	57	0.00 - 2.71		
Concord - Bradshaw 10"	9	0.00 - 33.19	Contra Costa County Health Services Dept	(925) 646-2286
		33.19 - 66.51	San Joaquin County Environmental Health	(209) 468-3420
		66.51 - 90.86	Sacramento County Env Mgmt Dept	(916) 875-8469
Concord - Fresno 12"	90, 50, 60	0.00 - 25.90	Contra Costa County Health Services Dept	(925) 646-2286
		25.90 - 35.35		
		35.35 - 36.75	Alameda County Environmental Health	(510) 567-6862
		36.75 - 56.25	San Joaquin County Environmental Health	(209) 468-3420
		56.25 - 85.56	Stanislaus County Environmental Resources	(209) 525-6700
		85.56 - 105.86	Merced County Environmental Health	(209) 381-1087
		105.86-126.21		
		126.21-155.39	Madera County Environmental Health	(559) 661-6333
155.39-177.31	Fresno County Environmental Health	(559) 445-3391		
Concord Gathering 12"	27	0.00 - 5.46	Contra Costa County Health Services Dept	(925) 646-2286
Concord Gathering 8"	72	0.00 - 13.18		
Concord Gathering 8"	73	0.00 - 2.25		
Benicia - Concord 10"/12"	103, 33	0.00 - 0.96	Solano Co Dept. Of Resource Mgmt.	(707) 784-6765
		0.96 - 7.78	Contra Costa County Health Services Dept	(925) 646-2286
Concord - Travis AFB 8"	47	0.00 - 5.28	Contra Costa County Health Services Dept	(925) 646-2286
		5.28 - 20.65	Solano Co. Dept of Resource Mgmt	(707) 784-6765
Concord - Sacramento 20" - 14" - 20"	130	0.00 - 5.41	Contra Costa County Health Services Dept	(925) 646-2286
		5.41 - 50.75	Solano Co. Dept of Resource Mgmt	(707) 784-6765
		50.75 - 70.08	Yolo County Environmental Health	(530) 666-8646
Sacramento - Rocklin 12"	20	70.08 - 72.03	Yolo County Environmental Health	(530) 666-8646
		72.03 - 87.85	Sacramento County Env Mgmt Dept	(916) 875-8469
		87.85 - 93.70	Placer County Environmental Health	(530) 745-2300
Concord - Sacramento 14" (NIS)	25	0.00 - 5.53	Contra Costa County Health Services Dept	(925) 646-2286
		5.53 - 47.63	Solano Co Dept of Resource Mgmt	(707) 784-6765
		47.63 - 61.20	Yolo County Environmental Health	(530) 666-8646

Pacific Northern Region CUPAs by PLMP - CA only

Pipeline Segment	Line Section	PLMP	CUPA	Phone #		
Concord- San Jose 10"	16	0.00 - 22.13	Contra Costa County Health Services Dept	(925) 646-2286		
		22.13 - 46.28	Alameda County Environmental Health	(510) 567-6862		
		46.28 - 51.64	Santa Clara County Environmental Health	(408) 918-1973		
			San Jose Fire Department, Fire Prevention/Hazmat	(408) 277-4659		
Erle Junction - Beale AFB 6"	65	0.00 - 5.74	Yuba County Environmental Health	(530) 749-5450		
Fresno - Lemoore NAS 6"	119	0.00 - 28.68	Fresno County Environmental Health	(559) 445-3391		
		28.68 - 36.12	Kings County Environmental Health	(559) 584-1411		
Martinez - Amorco 8"	68	0.00 - 1.14	Contra Costa County Health Services Dept	(925) 646-2286		
Amorco - Bridgehead 10"	88	1.00 - 0.26				
Martinez - Concord 8" (NIS)	26					
Richmond - Arco 8"	74	0.00 - 2.36				
Richmond - Pt. Molate 12" (NIS)	70					
Richmond - Brisbane 8" / 10"	46, 41	0.00 - 5.98			Contra Costa County Health Services Dept	(925) 646-2286
		5.98 - 30.63	Alameda County Environmental Health	(510) 567-6862		
		30.63 - 37.64	San Mateo County Environmental Health	(650) 363-4366		
Richmond - Brisbane - San Francisco Airport 12"	36, 42, 38	0.00 - 6.01	Contra Costa County Health Services Dept	(925) 646-2286		
		6.01 - 30.72	Alameda County Environmental Health	(510) 567-6862		
		30.72 - 43.42	San Mateo County Environmental Health	(650) 363-4366		
Brisbane - SPTCO 8" (NIS)	106		San Mateo County Environmental Health	(650) 363-4366		
Brisbane - UNOCAL 8" (NIS)	39					
Richmond - Concord 8"	8	0.00 - 22.90	Contra Costa County Health Services Dept	(925) 646-2286		
Chevron - Richmond 8"	69	0.00 - 1.25				
Unocal - Arco	89	0.00 - 0.36				
Unocal - Richmond	71	0.00 - 2.47				
Shore - Richmond	75	0.00 - 1.81				
IMTT - Richmond	76	0.00 - 2.22				
Richmond Gathering 10"	99	0.00 - 1.20				
Richmond Gathering 10"	104	0.00 - 1.20				
Richmond Gathering 8" (NIS)	32					
Richmond Lateral 12"	37	2.73 - 23.57				
Richmond Lateral 10"	95	0.00 - 2.19			Solano Co Dept of Resource Mgmt	(707) 784-6765
		2.19 - 2.73			Contra Costa County Health Services Dept	(925) 646-2286
Rocklin - Chico 8"	64	0.00 - 21.61	Placer County Environmental Health	(530) 745-2300		
		21.61 - 37.69	Yuba County Environmental Health	(530) 749-5450		
		37.69 - 48.26	Sutter County Community Services Dept	(530) 822-7400		
		48.26 - 77.47	Butte County Environmental Health	(530) 891-2727		

Pacific Northern Region CUPAs by PLMP - CA only

Pipeline Segment	Line Section	PLMP	CUPA	Phone #	
Rocklin - Reno 10" / 8" / 6"	11, 12, 13	0.00 - 33.38	Placer County Environmental Health	(530) 745-2300	
		33.38 - 58.80			
		58.80 - 61.68	Nevada County Environmental Health	(530) 265-1449	
		61.68 - 68.95	Placer County Environmental Health	(530) 745-2300	
		68.95 - 73.71	Nevada County Environmental Health	(530) 265-1449	
		73.71 - 75.96	Placer County Environmental Health	(530) 745-2300	
		75.96 - 77.65	Nevada County Environmental Health	(530) 265-1449	
		77.65 - 78.21	Placer County Environmental Health	(530) 745-2300	
		78.21 - 90.21	Nevada County Environmental Health	(530) 265-1449	
		90.21 - 93.73			
		93.73 - 105.21	Sierra County Environmental Health	(530) 993-6700	
		105.21 - 127.43	<i>State Of Nevada - If any release enters or threatens to enter CA call:</i>		(530) 265-1449
		127.43 - 134.58	<i>Nevada County Environmental Health</i>		
Rocklin - SP Diesel 4"	48	0.00 - 3.78	Placer County Environmental Health	(530) 745-2300	
Sacramento - Arco 10"	29	0.00 - 0.13	Yolo County Environmental Health	(530) 666-8646	
Sacramento - Arco 8"	31	0.00 - 0.13			
Sacramento - Sacramento River Junction	28	0.00 - 0.30	Yolo County Environmental Health	(530) 666-8646	
		0.30 - 0.50	Sacramento County Env Mgmt Dept	(916) 875-8469	
Sacramento - Shell Sacramento 8"	34	0.00 - 0.18	Yolo County Environmental Health	(530) 666-8646	
Sacramento - Shell Sacramento 8"	35	0.00 - 0.18			
Sacramento - Bradshaw 10" (NIS)	24		Yolo County Environmental Health	(530) 666-8646	
			Sacramento County Env Mgmt Dept	(916) 875-8469	
Stockton Junction - Atwater 8"	62	0.00 - 4.13	San Joaquin County Environmental Health	(209) 468-3420	
			Stanislaus County Environmental Resources	(209) 525-6700	
			Merced County Environmental Health	(209) 381-1087	
Stockton - Arco 8"	43	0.00 - 0.21	San Joaquin County Environmental Health	(209) 468-3420	
Stockton - Shell/Mobil 8"	45	0.00 - 0.91			
Stockton - Time Oil 8" (NIS)	44				

NIS = Not In Service

Pacific Southern Region

Pacific Southern Region Table of Contents

- **PSR Manager Contact List (in pocket)**
- **PSR Facility Address**
- **PSR CUPA by Facility**
- **PSR CUPA by Pipeline**
- **PSR CUPA by PLMP**

PACIFIC SOUTHERN REGION PHONE LIST

Name	Nextel	Mobile	Pager	Desk	Home
Vasquez, P. L. (Phil) Director of Operations – Confidential Fax #: 909-877-5593	122*956*358	951 712-8796	909 420-4769	909 873-5123	909 862-5945 or 909 337-3843
Andries, D. (Dave) Operations Manager - Barstow, Colton-North & South, Las Vegas, Orange, Mission Valley – Confidential Fax #: 303-984-3035	122*956*3002	951 712-8874	888 204-6739	909 873-5102	909 798-2948
Harmon, R.B. (Richard) Operations Manager - El Paso, Imperial, Niland, Tucson, Phoenix, Yuma – Confidential Fax #: 714-560-6556	128*19951*7	480 226-5993	888 971-8070	602 272-8141	480 497-0060
Thomasson, J. (Johnny) Operations Manager - Carson, Gaffey Street, Los Angeles Harbor, Watson	124*18197*39	310 930-3243		310 518-7777	562-425-8395
Brown, R. (Rob) Area Manager – Barstow	122*956*23	760 559-4716	760 229-0164	760 254-5472	760 242-3935
Toepfer, Bill Area Manager - Colton-North & South	122*956*360	951-712-8866	909-220-5327	909-873-5152	
Lacro, Vern Area Manager – Las Vegas – Confidential Fax # 303-984-3031		702 280-6128		702 643-9130	
Hosler, T. (Tom) Area Manager – Los Angeles Harbor		310 930-3117		310 547-9655	714 821-6326
Koehn, G. M. (Gary) Area Manager -- Imperial, Niland, Yuma – Confidential Fax #: 714-560-6664	125*21416*2	760 455-6464	888 443-0641	760 312-9598	928 726-7019
Lewis, B. (Brad) Area Manager – Tucson – Confidential Fax #: 714-560-6592	128*17671*25	520 631-2925	888 816-2526	520 514-1065 100	520 749-8796
Luera, F. (Frank) Area Manager – Orange, Mission Valley – Confidential Fax #: 619-285-5706	122*956*369	619 778-5215	858 650-1512	619 285-5703	619-562-0963
Manley, D. S. (Scott) Area Manager – Phoenix - Confidential Fax #: 303-984-3003	128*19951*6	480 797-4673		602 278-8565	602 843-8251
Pigg, J. (James) Area Manager – El Paso - Confidential Fax #: Confidential Fax #: 713-495-7463		915 525-7120	888 446-0159	915 771-8777	432 559-8877
Tilton, Mike Area Manager – Carson	124*18197*3	310 930-3109		310 518-7763	562 866-8979
Vice, M.W. (Marty) Area Manager – Watson	122*956*7636	310 628-7348		310 635-1011	562 421-5772

Pacific Southern Region Facility Address List

<p><u>SOUTHERN REGION ADMINISTRATION</u> 2319 S. RIVERSIDE AVE. BLOOMINGTON, CA 92316 Phone: 909-877-2373</p>	<p><u>BARSTOW TERMINAL</u> Mailing: 34277 DAGGETT/YERMO RD. PO Box 188 BARSTOW, CA 92327 Daggett, CA 92327 Phone: 760-254-2616</p>
<p><u>CARSON TERMINAL</u> 2000 EAST SEPULVEDA BLVD. CARSON, CA 90810-1995 Phone: 310-518-7700</p>	<p><u>COLTON TERMINAL – NORTH / ADMIN</u> 2051 E. SLOVER BLOOMINGTON, CA 92316 Phone: 909-877-2414</p>
<p><u>COLTON CORROSION</u> 2319 S. RIVERSIDE AVE. BLOOMINGTON, CA 92316 Phone: 909-873-5120</p>	<p><u>COLTON PIPELINE MAINTENANCE</u> 2359 S. RIVERSIDE AVE. Mailing: BLOOMINGTON, CA 92316 2319 S. Riverside Ave. Phone: 909-873-5108 Bloomington, CA 92316</p>
<p><u>COLTON TRANSMIX</u> 201 E. SANTA ANA Mailing: BLOOMINGTON, CA 92316 2305 S. Riverside Ave. Phone: 909-874-1998 Bloomington, CA 92316</p>	<p><u>COLTON TERMINAL – SOUTH</u> 2359 S. RIVERSIDE AVE. BLOOMINGTON, CA 92316 Phone: 909-877-2141</p>
<p><u>INDUSTRY STATION</u> 128 S. BREA CANYON ROAD INDUSTRY, CA Phone: 909-594-0410</p>	<p><u>IMPERIAL CORROSION</u> 345 W. ATEN ROAD IMPERIAL, CA 92251 Phone: 760-352-0677</p>
<p><u>IMPERIAL TERMINAL</u> 345 W. ATEN ROAD IMPERIAL, CA 92251 Phone: 760-352-0677</p>	<p><u>MISSION VALLEY TERMINAL</u> 9950 SAN DIEGO MISSION ROAD SAN DIEGO, CA 92108 Phone: 619-283-6511</p>
<p><u>LA HARBOR TERMINAL (LAHT)</u> 1900 WILMINGTON – SAN PEDRO ROAD SAN PEDRO, CA 90733 Mailing: 2000 East Sepulveda Blvd. Carson, CA 90810 Phone: 310-831-6566</p>	<p><u>NORWALK STATION</u> Mailing: 15306 NORWALK BLVD. 20410 S Wilmington Blvd. NORWALK, CA 90650 Long Beach, CA 90810 Phone: 562-921-5779</p>
<p><u>NILAND TERMINAL</u> Mailing: 404 E. NOFFSINGER ROAD 345 W. Aten Road NILAND, CA 92257 Imperial, CA 92251 Phone: 760-359-0641</p>	<p><u>WATSON STATION</u> 20410 S. WILMINGTON BLVD. LONG BEACH, CA 90810 Phone: 310-635-8079</p>
<p><u>ORANGE TERMINAL</u> 1350 N. MAIN STREET ORANGE, CA 92867 Phone: 714-538-5227</p>	<p><u>WATSON QUALITY CONTROL LABORATORY</u> 20410 S. WILMINGTON BLVD. LONG BEACH, CA 90810 Phone: 310-639-4741</p>

Pacific Southern Region CUPAs by Facility - CA only

Staffed Facilities	CUPA	Phone #
Barstow Terminal	San Bernardino County Fire, Hazmat Division	(800) 338-6942
Carson Terminal	Los Angeles County Fire	(323) 890-4045
Colton Terminal - North, South, Transmix	San Bernardino County Fire, Hazmat Division	(800) 338-6942
Imperial Terminal	Department of Toxic Substances Control designated as CUPA by Cal/EPA	(866) 357-3990
LA Harbor Terminal	Los Angeles County Fire	(323) 890-4045
Mission Valley Terminal	San Diego County Dept of Env Health	(619) 338-2284 M-F (858) 565-5255 Eves & Weekends
Orange Terminal	Orange County Environmental Health	(714) 433-6471
Watson Station	Los Angeles County Fire	(323) 890-4045
Remote Facilities	CUPA	Phone #
Adelanto Take-off	San Bernardino County Fire, Hazmat Division*George AFB's CUPA is Victorville City Fire Department, Hazmat Specialist	(800) 338-6942*Victorville FD 760-955-5229
Baker Booster		
BNSF Terminal		
Cajon Booster		
George AFB		
Lenwood Take-off		
Remote Facilities	CUPA	Phone #
Norton AFB	San Bernardino County Fire, Hazmat Division	(800) 338-6942
Ontario Airport		
Valley Wells Booster		
Yermo Station		
March AFB	Riverside City Fire Department	(951) 826-5338
	Riverside County Environmental Health	(951) 358-5055
Edwards AFB	Kern County Environmental Health	(661) 862-8700
El Centro NAS	Department of Toxic Substances Control designated as CUPA by Cal/EPA	(866) 357-3990
Industry Station	Los Angeles County Fire	(323) 890-4045
Niland Terminal	Department of Toxic Substances Control designated as C	(866) 357-3990
Norwalk Station	Los Angeles County Fire	(323) 890-4045
Miramar Terminal	San Diego County Dept of Env Health	(619) 338-2284 M-F (858) 565-5255 Evenings & Weekends
Miramar Jct.		
Point Loma Terminal		
San Diego Harbor		

Pacific Southern Region CUPAs by Pipeline - CA only

Pipeline System	Line Section	CUPA	Phone #
LAHT - Carson 6" (NIS)	GX-110	Los Angeles County Fire	(323) 890-4045
LAHT - Carson 12"	GX-120		
Marine Terminal - Golden Eagle Refinery 8"	GX-130		
Marine Terminal - Carson 10"	GX-140		
Marine Terminal - Willow St 12"	GX-160		
LAHT - Carson 6" (NIS)	GX-170		
LAHT - Carson 8"	GX-180		
Carson - Mobil 10"	GX-190		
Del Amo Vault - Watson 12" (NIS)	101		
Carson - GX-145 10" (leased out)	66		
Watson - Sepulveda Junction 16"	109		
Defense Fuel - Watson 10"	110		
Watson - HWY 52 16"	10, 125, 126	Los Angeles County Fire	(323) 890-4045
		Orange County Environmental Health	(714) 433-6471
		San Diego County Dept of Env Health	(619) 338-2284 M-F (858) 565-5255 Eves & Weekends
Hwy 52 - San Diego 10"	122	San Diego County Dept of Env Health	(619) 338-2284 M-F
Mission Valley - Harbor Junction 10"	123		(858) 565-5255
Harbor Junction - Arco/Chevron 8"	124		Eves & Weekends
Norwalk - Highway 52 10" (NIS)	121, 122	Los Angeles County Fire	(323) 890-4045
		Orange County Environmental Health	(714) 433-6471
		San Diego County Dept of Env Health	(619) 338-2284 M-F (858) 565-5255 Eves & Weekends
Watson - Colton 16"	120, 1	Los Angeles County Fire	(323) 890-4045
		San Bernardino County Fire, Hazmat Division	(800) 338-6942
Watson - Colton 24" / 20"	105, 108	Los Angeles County Fire	(323) 890-4045
		San Bernardino County Fire, Hazmat Division	(800) 338-6942

Pacific Southern Region CUPAs by Pipeline - CA only

Pipeline System	Line Section	CUPA	Phone #
Colton - Phoenix 20"	111, 112, 113, 114	San Bernardino County Fire, Hazmat Division	(800) 338-6942
		Department of Toxic Substances Control designated as CUPA by Cal/EPA	(866) 357-3990
		Riverside City Fire Department	(951) 826-5338
		Riverside County Environmental Health	(951) 358-5055
Colton - March AFB 6"	51	San Bernardino County Fire, Hazmat Division	(800) 338-6942
		Riverside City Fire Department	(951) 826-5338
		Riverside County Environmental Health	(951) 358-5055
Ontario - Ontario Airport 6"	102	San Bernardino County Fire, Hazmat Division*Victorville City FD, Hazmat Specialist is CUPA for portion of ML4-001 within Victorville City limit	(800) 338-6942 Victorville FD 760-955-5229
Colton - Norton AFB 6" (NIS)	67		
Colton North - UPRR (NIS)	98		
Colton - Las Vegas 14"	ML-001		
Colton - Las Vegas 8"	ML1-001		
Adelanto Jct. - George AFB 6", 4"	ML4-001		
George AFB - Edwards AFB 6"	ED-001	San Bernardino County Fire, Hazmat Division	(800) 338-6942
		Los Angeles County Fire	(323) 890-4045
		Kern County Environmental Health	(661) 862-8700
Niland - Imperial 6" / 10"	58, 133	Department of Toxic Substances Control designated as CUPA by Cal/EPA	(866) 357-3990
Imperial - El Centro 4"	59		
Lenwood Take-off - BNSF 12"	BNSF 12"	San Bernardino County Fire, Hazmat Division	(800) 338-6942
Colton South / Colton North	Diesel - 20"		
Colton South / Colton North	Gas - 20"		
Colton South / Colton North	Jet Fuel - 16"		

NIS = Not In Service

Pacific Southern Region CUPAs by PLMP - CA only

Pipeline Segment	Line Section	PLMP	CUPA	Phone #
LAHT - Carson 6" (NIS)	GX-110		Los Angeles County Fire	(323) 890-4045
ARCO Manifold _CT	GX-32	0.00 - 0.04		
LAHT - Carson 12"	GX-120	0.00 - 4.66		
Marine Terminal - Golden Eagle Refinery 8"	GX-130	0.00 - 0.84		
Marine Terminal - Carson 10"	GX-140	0.00 - 4.75		
Marine Terminal - Willow St 12"	GX-160	0.00 - 4.79		
LAHT - Carson (NIS) 6"	GX-170			
LAHT - Carson 8"	GX-180	0.00 - 4.66		
Carson - Mobil 10"	GX-190	0.00 - 8.26		
Del Amo Vault - Watson 12" (NIS)	101			
Carson - GX-145 10" (leased out)	66			
Watson - Sepulveda Junction 16"	109	0.00 - 3.86		
Defense Fuel - Watson 10"	110	0.00 - 2.88		
Watson - HWY 52 16"	10, 125, 126	0.00 - 5.48	Los Angeles County Fire	(323) 890-4045
		5.48 - 55.13	Orange County Environmental Health	(714) 433-6471
		55.13 -114.25	San Diego County Dept of Env Health	(619) 338-2284 M-F (858) 565-5255 Eves & Weekends
Hwy 52 - San Diego 10"	122	114.25 -120.26	San Diego County Dept of Env Health	(619) 338-2284 M-F (858) 565-5255 Eves & Weekends
Mission Valley - Harbor Junction 10"	123	120.26 -128.19		
Harbor Junction - Arco/Chevron 8"	124	128.19 - 128.97		
Norwalk - Highway 52 (NIS)	121, 122		Los Angeles County Fire	(323) 890-4045
			Orange County Environmental Health	(714) 433-6471
			San Diego County Dept of Env Health	(619) 338-2284 M-F (858) 565-5255 Eves & Weekends
Watson - Colton 16"	120, 1	0.00 - 22.22	Los Angeles County Fire	(323) 890-4045
		22.22 - 26.75	Orange County Environmental Health	(714) 433-6471
		26.75 - 43.67	Los Angeles County Fire	(323) 890-4045
		43.67 - 64.57	San Bernardino Co. Fire, Hazmat Division	(800) 338-6942
Watson - Colton 24" / 20"	105, 108	0.00 - 42.36	Los Angeles County Fire	(323) 890-4045
		42.36 - 63.10	San Bernardino Co. Fire, Hazmat Division	(800) 338-6942
Colton - Phoenix 20"	111, 112, 113, 114	0.00 - 13.56	San Bernardino Co. Fire, Hazmat Division	(800) 338-6942
		13.56 -107.19	Riverside City Fire Department & Riverside County Environmental Health	(951) 826-5338 (951) 358-5055
		107.19 -196.66	Department of Toxic Substances Control designated as CUPA by Cal/EPA	(866) 357-3990

Pacific Southern Region CUPAs by PLMP - CA only

Pipeline Segment	Line Section	PLMP	CUPA	Phone #
Ontario - Ontario Airport 6"	102	0.00 - 1.67	San Bernardino Co. Fire, Hazmat Division	(800) 338-6942
Colton - March AFB 6"	51	0.00 - 3.62	San Bernardino Co. Fire, Hazmat Division	(800) 338-6942
		3.62 - 14.69	Riverside City Fire Department & Riverside County Environmental Health	(951) 826-5338 (951) 358-5055
Colton - Norton AFB 6" (NIS)	67		San Bernardino Co. Fire, Hazmat Division *Victorville City FD, Hazmat Specialist is CUPA for portion of ML4-001 within Victorville City Limit	(800) 338-6942 Victorville FD 760- 955-5229
Colton North - UPRR (NIS)	98			
Colton - Las Vegas 14"	ML-001	0.00 - 193.38		
Colton - Las Vegas 8"	ML1-001	0.00 - 193.26		
Adelanto Jct. - George AFB 6", 4"	ML4-001	0.00 - 1.99		
George AFB - Edwards AFB 6"	ED-001	0.00 - 18.84	San Bernardino Co. Fire, Hazmat Division	(800) 338-6942
		18.84 - 48.28	Los Angeles County Fire	(323) 890-4045
		48.28 - 56.73	Kern County Environmental Health	(661) 862-8700
Niland - Imperial 10" / 6"	133, 58	0.00 - 4.39	Department of Toxic Substances Control designated as CUPA by Cal/EPA	(866) 357-3990
		4.39 - 29.56		
Imperial - El Centro 4"	59	0.00 - 6.31	Department of Toxic Substances Control designated as CUPA by Cal/EPA	(866) 357-3990
Colton South / Colton North	Diesel - 20"	0.00 - 0.54	San Bernardino Co. Fire, Hazmat Division	(800) 338-6942
Colton South / Colton North	Gas - 20"	0.00 - 0.52		
Colton South / Colton North	Jet Fuel - 16"	0.00 - 0.53		

NIS = Not In Service