

**Final**

# **Field Sampling Workplan**

## **Appendix B, Health and Safety Plan**

University of California, Berkeley  
Richmond Field Station, Richmond, California

June 2, 2010

*Prepared for*  
Office of Environment, Health & Safety  
University of California, Berkeley  
317 University Hall No. 1150  
Berkeley, California 94720

*Prepared by*





**TETRA TECH EM INC.**

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**REVIEWS AND APPROVALS**  
University of California Berkeley  
Office of Environment, Health & Safety  
**CONTRACT NO.: 103DS1518023**  
**PROJECT NUMBER: 19335A**  
**HEALTH AND SAFETY PLAN**  
**FOR DATA GAPS INVESTIGATION AT**  
**UNIVERSITY OF CALIFORNIA BERKELEY**  
**RICHMOND FIELD STATION**  
**RICHMOND, CALIFORNIA**

We, the undersigned, have read and approve of the health and safety guidelines presented in this health and safety plan for on-site work activities during the data gaps investigation at the University of California, Berkeley, Richmond Field Station site.

Name	Signature	Date
David Brown Tetra Tech EM Inc. Health and Safety Representative		June 2, 2010
Jason Brodersen Tetra Tech EM Inc. Project Manager		June 2, 2010

This certifies that Tetra Tech has assessed the type, risk level, and severity of hazards for the project and has selected appropriate personal protective equipment for site personnel in accordance with Occupational Safety and Health Administration Title 29 of the *Code of Federal Regulations*, Part 1910.120.

Certified by		
David Brown Tetra Tech EM Inc. Technical Reviewer		June 2, 2010

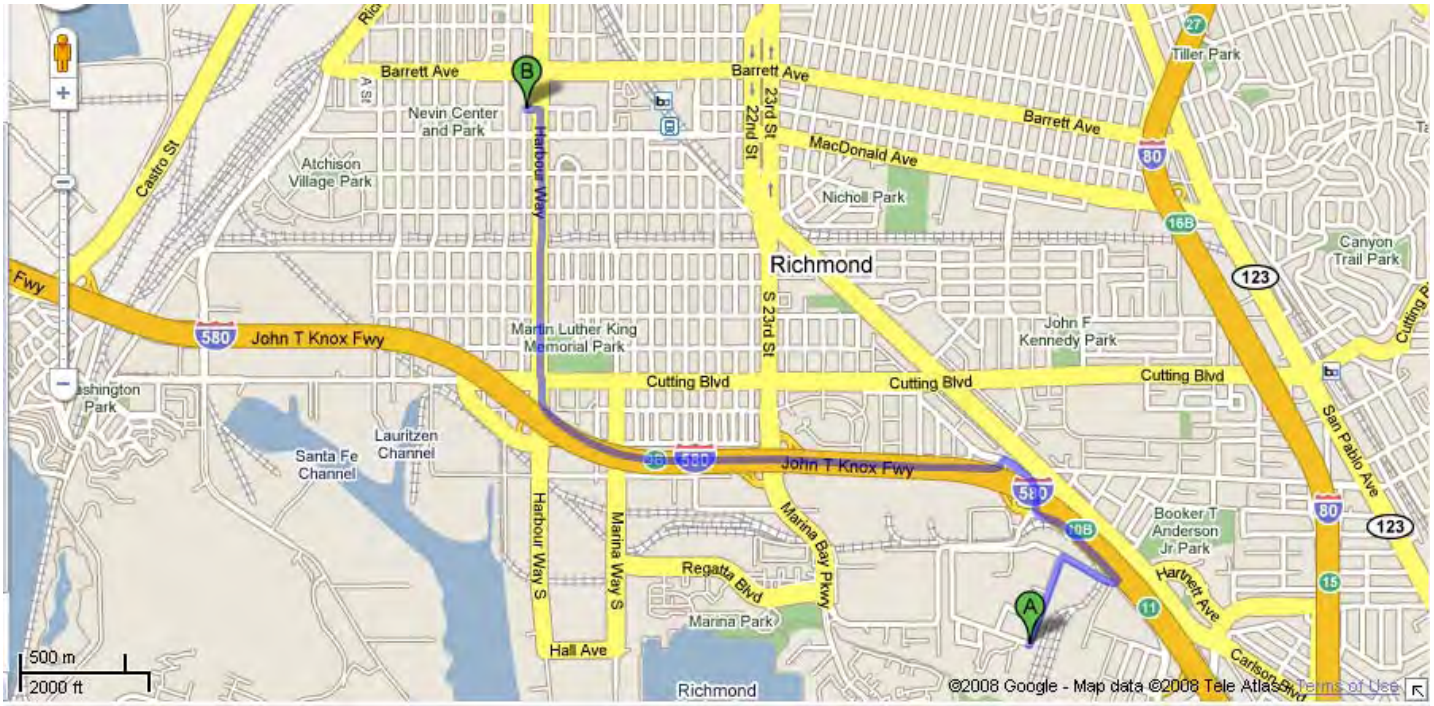
# EMERGENCY INFORMATION

## POST ON SITE

### EMERGENCY CONTACTS AND ROUTE TO HOSPITAL

Emergency Contact		Telephone No.
U.S. Coast Guard National Response Center		(800) 424-8802
InfoTrac Chemical Monitoring System		(800) 535-5053
WorkCare		(800) 455-6155
Fire Department		911 or (510) 307-8031
Police Department		911 or (510) 620-6655
Tetra Tech EM Inc. Personnel:		
Human Resource Development: Amy Clark		(626) 470-2516
Health and Safety Representative: David Brown		(619) 525-7188
Project Manager: Jason Brodersen		(510) 302-6283
Site Safety Coordinator: Sara Woolley		(510) 302-6311
Client Contact:		
Greg Haet, Associate Director, Environmental Protection		
Office of Environment, Health & Safety		(510) 642-4848
Karl Hans, Senior Environmental Scientist,		
Office of Environment, Health & Safety		(510) 643-9574
Medical Emergency		
Hospital Name:	Kaiser Permanente, Richmond	
Hospital Address:	901 Nevin Avenue Richmond, California	
Hospital Telephone No.:	Emergency - (510) 307-1566/(510) 307-1555 General - (510) 307-1520	
Ambulance Telephone No.:	911 or (510) 307-1558	

# EMERGENCY INFORMATION POST ON SITE



**A: Richmond Field Station**

**B: Kaiser Hospital**

## Route to Hospital:

1. Head northeast on S 46th St toward Meade St/Seaver Ave 0.3 mi
2. Turn right at Meade St/Seaver Ave 0.2 mi
3. Slight left at S 47th St 69 ft
4. Turn left at Meade St 0.3 mi
5. Turn right at Erlandson St/Syndicate Ave (signs for I-580 W/San Rafael)
- Continue to follow Erlandson St 0.2 mi
6. Turn left to merge onto I-580 W 1.0 mi
7. Take exit 9B for Harbour Way N 0.4 mi
8. Merge onto S Harbor Way/Harbour Way S (signs for Cutting Blvd/Downtown)
- Continue to follow Harbour Way S 0.9 mi
9. Turn left at Nevin Ave
- Destination will be on the right 230 ft

SOURCE: MODIFIED FROM <http://maps.google.com/>

**Note: This sheet must be posted on site**

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## ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
Bay Trail	East Bay Regional Park District Bay Trail
C	Carcinogen
Ca	California
Cal EPA	California Environmental Protection Agency
CAS	Chemical Abstracts Service
CCR	California Code of Regulations
CFR	Code of Federal Regulation
Cl	Chlorine
dBa	Decibel
DCE	Dichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
ESLI	End-of-service-life indicator
eV	Electron volt
FID	Flame ionization detector
FSW	Field sampling workplan
f/cm <sup>3</sup>	Feet per cubic meter
HSP	Health and Safety Plan
HEPA	High efficiency particulate
Hg	Mercury
HSR	Health and safety representative
IDLH	Immediately dangerous to life and health
IDW	Investigation-derived waste
LEL	Lower explosive limit
mg/kg	Milligram per kilogram
MSDS	Material safety data sheet
NA	Not available
ND	Not detected
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration



## ACRONYMS AND ABBREVIATIONS (continued)

PCB	Polychlorinated biphenyl
PCE	Tetrachloroethylene
PEL	Permissible exposure limit
PID	Photoionization detector
PPE	Personal protective equipment
PPM	Parts per million
QAPP	Quality assurance project plan
QC	Quality control
REL	Recommended exposure limit
REM	Roentgen-equivalent man units
RFS	Richmond Field Station
SCBA	Self-contained breathing apparatus
SSC	Site safety coordinator
SWP	Safe work practices
TBD	To be determined
TCE	Trichloroethylene
Tetra Tech	Tetra Tech EM Inc.
TLD	Thermoluminescence detector
TLV	Threshold limit value
TWA	Time-weighted average
UC	University of California
UC Berkeley	University of California, Berkeley
VOC	Volatile organic compound
Zeneca	Zeneca, Inc.
ug/m <sup>3</sup>	microgram per cubic meter

## 1.0 INTRODUCTION

The University of California, Berkeley (UC Berkeley), prepared a Field Sampling Workplan (FSW) in response to the California Environmental Protection Agency (Cal EPA), Department of Toxic Substances Control (DTSC), Site Investigation and Remediation Order No. IS/E-RAO 06/07-005 (the Order). As required by the Order, UC Berkeley prepared a Current Conditions Report ([Tetra Tech EM Inc. \[Tetra Tech\] 2008](#)) that provides a comprehensive summary of current conditions at the Richmond Field Station (RFS). The Current Conditions Report addresses the 96 acres of upland and 13 acres of tidal marsh and transition habitat as specified in the DTSC Order.

The Current Conditions Report identifies data gaps warranting additional characterization at the RFS. The DTSC Order requires preparation of a FSW—which includes a facility-wide Quality Assurance Project Plan (QAPP), a facility-wide Health and Safety Plan (HSP), and site-specific Field Sampling Plan (FSP) addenda—to conduct site investigations to address these data gaps. The objective of the site investigations are to investigative data gaps to complete a final remediation investigation report and baseline health risk assessment.

Tetra Tech received Work Assignment No.103DS1518023 from the UC Berkeley Office of Environment, Health & Safety under Project No. 19335A to conduct data gaps investigation at the RFS. The facility-specific health and safety provisions in this document have been developed for use during the data gaps investigation at the RFS.

This document addresses items specified under Occupational Safety and Health Administration (OSHA) Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.120 (b), “Final Rule,” and is consistent with California Code of Regulations (CCR), Title 8, Section 5192. This HSP will be available to all on-site personnel who may be exposed to hazardous on-site conditions, including Tetra Tech and subcontractor personnel participating in the data gaps investigation, and all site visitors, including regulatory agency representatives.

The purpose of this HSP is to define requirements and designate protocols to be followed during the data gaps investigation at the UC Berkeley RFS site. All personnel on site, including Tetra Tech and subcontractor employees and site visitors, must be informed of site emergency response procedures and any potential fire, explosion, health, or safety hazards associated with on-site activities. Because the site-specific FSP addenda will include sampling plan details, this HSP summarizes potential hazards and defines protective measures planned for basic site activities. Once specific sampling tasks are developed and approved, HSP addenda will be created to incorporate the site-specific information and to evaluate site- and activity specific hazards and controls for each FSP. The HSP addenda will be included as appendices to this HSP and each HSP addendum will be provided to the DTSC for review and comment.

This plan must be reviewed and approved by the Tetra Tech health and safety representative (HSR) or a designee and the Tetra Tech project manager (see the Reviews and Approvals form that follows the cover of this document). The Compliance Agreement form in [Appendix B-1](#) must be signed by all personnel before they enter the site. Protocols established in this HSP are based on site conditions and health and safety hazards known or anticipated to be present, and on available site data. This plan is intended solely for use during proposed activities described in the corresponding site-specific work plan. Specifications herein are subject to review and revision based on actual conditions encountered in the field during site

activities. Significant revisions to this plan must be approved by the Tetra Tech project manager and the Tetra Tech HSR. Tetra Tech employees must also follow safety requirements taught during safety training and described in the Tetra Tech, Inc., “Health and Safety Manual.”

## 2.0 HEALTH AND SAFETY PERSONNEL AND PLAN ENFORCEMENT

This section describes responsibilities of project personnel, summarizes requirements for subcontractors and visitors who wish to enter the RFS site, and discusses HSP enforcement.

### 2.1 PROJECT PERSONNEL

The following personnel and organizations are associated with planned activities at the site. The organizational structure will be reviewed and updated as necessary during the course of the project.

<u>Name/Title</u>	<u>Responsibility</u>	<u>Telephone No.</u>
-------------------	-----------------------	----------------------

**Client Representative:**

Greg Haet	Associate Director, Environmental Protection Office of Environment, Health & Safety	(510) 642-4848
Karl Hans	Senior Environmental Scientist, Office of Environment, Health & Safety	(510) 643-9574

**Tetra Tech Personnel:**

Jason Brodersen	Project Manager	(510) 302-6283
David Brown	HSR	(619) 525-7188
Sara Woolley	Site Safety Coordinator (SSC)	(510) 302-6311
Carolyn Ferlic	Field Manager	(510) 302-6233

**Subcontractors:**

**Subcontractors will be determined in site-specific FSP addenda prior to each site-specific task, and subcontractor health and safety information will be included in the FSP addenda as appropriate.**

To be Determined (TBD)	TBD	TBD
------------------------	-----	-----

**Subcontractor 2 Company Name:**

TBD	TBD	TBD
-----	-----	-----

The Tetra Tech project manager, field manager, SSC, and HSR will be responsible for implementation and enforcement of the provisions of this HSP. Their duties and the expectations for Tetra Tech employees are described in the following sections.

### **2.1.1 Project Manager and Field Manager**

The Tetra Tech project manager has ultimate responsibility for ensuring implementation of the requirements set forth in this HSP. Some of this responsibility may be achieved through delegation to site-dedicated personnel that report directly to the project manager. The project manager shall regularly confer with site personnel regarding safety and health compliance.

The Tetra Tech field manager will oversee and direct field activities and has day-to-day responsibility for ensuring implementation of the HSP. Subcontractor compliance with the HSP shall be monitored by the field manager. The field manager will report directly to the project manager any health and safety-related issues.

### **2.1.2 Site Safety Coordinator**

The Tetra Tech SSC will be appointed by the project manager and will be responsible for field implementation of tasks and procedures contained in this HSP, including air monitoring, establishing a decontamination protocol, and ensuring the signing of the Daily Tailgate Safety Meeting form (Form HST-2) and the Compliance Agreement (Form HSP-4) (see [Appendix B-1](#)) by all personnel working on site. The SSC will be present at all times during site operations to enforce the HSP and stop operations if personnel or community safety and health may be jeopardized and evaluate monitoring data to make field decisions regarding safety and health. The SSC will have advanced field work experience and be familiar with health and safety requirements specific to the project. The SSC will also maintain the Daily Site Log (Form SSC-1 in [Appendix B-1](#)).

### **2.1.3 Health and Safety Representative**

The Tetra Tech HSR is responsible for administration of the company health and safety program. The HSR will act in an advisory capacity to project managers and site personnel for project-specific health and safety issues. The Tetra Tech project manager will establish a liaison between officers and representatives of the UC Berkeley Office of Environment, Health & Safety and the HSR on matters relating to health and safety.

### **2.1.4 Tetra Tech Employees**

Tetra Tech employees are expected to fully participate in implementing the site HSP by obtaining necessary training, attending site safety meetings, always wearing designated personal protective equipment (PPE), complying with site safety and health rules, and advising the Tetra Tech SSC of health and safety concerns at the site.

## **2.2 SUBCONTRACTORS**

Subcontractor personnel participating in the data gaps investigation will be required to read and comply with all sections of this plan. All subcontractor personnel entering the site must sign the Compliance Agreement form (see [Appendix B-1](#)). Subcontractor personnel must comply with all applicable

29 CFR 1910.120 training, fit testing, and medical surveillance requirements. Subcontractors are responsible for providing PPE required by this plan for their personnel (see [Section 6.1](#), Protective Equipment and Clothing) and are directly responsible for the health and safety of their employees. In the event that this HSP does not cover subcontractor activities, the subcontractor will be responsible for receiving all appropriate regulatory reviews and approvals from DTSC for the subcontractor's site-specific HSP.

### **2.3 VISITORS**

All site visitors will be required to read the HSP and sign the Compliance Agreement form (see [Appendix B-1](#)). Visitors will be expected to comply with relevant OSHA requirements. Visitors will also be expected to provide their own PPE required by the HSP. Visitors who have not met OSHA training, medical surveillance, and PPE requirements are not permitted to enter areas where exposure to hazardous materials is possible.

### **2.4 HEALTH AND SAFETY PLAN ENFORCEMENT**

This HSP applies to all site activities and all personnel working on the RFS site. HSP enforcement shall be rigorous. Violators of the HSP will be verbally notified upon first violation, and the violation will be noted by the Tetra Tech SSC in a field logbook. Upon second violation, the violator will be notified in writing, and the Tetra Tech project manager and the violator's supervisor will be notified. A third violation will result in a written notification and the violator's eviction from the site. The written notification will be sent to Human Resources Development and the HSR.

Personnel will be encouraged to report to the SSC any conditions or practices that they consider to be detrimental to their health or safety or that they believe are in violation of applicable health and safety standards. Such reports may be made orally or in writing. Personnel who believe that an imminent danger threatens human health or the environment will be encouraged to bring the matter to the immediate attention of the SSC for resolution.

At least one copy of this HSP will be available to all site personnel at all times. Minor changes in HSP procedures will be discussed at the beginning of each work day by the SSC at the daily tailgate safety meeting. Significant plan revisions must be discussed with the HSR and project manager.

### 3.0 SITE BACKGROUND

UC Berkeley will conduct additional investigations to address the data gaps identified in the Final Current Conditions Report for the RFS ([Tetra Tech 2008](#)). The following sections describe the RFS site, its history, and activities planned for this project.

#### 3.1 SITE DESCRIPTION

RFS is located at 1301 South 46th Street in Richmond, California, along the eastern shoreline of the Richmond Inner Harbor of the San Francisco Bay and northwest of Point Isabel (see [Figure B-1](#)). It consists of upland areas developed for academic teaching and research activities, an upland remnant coastal terrace prairie, tidal salt marsh, and a transition zone between the upland areas and marsh ([Tetra Tech 2008](#)).

The RFS property covered under the DTSC Order consists of 96 acres of uplands used for academic institutional activities (Upland Area), approximately 7.5 acres of tidal salt marsh (Western Stege Marsh), and 5.5 acres marsh edge habitat and transition area (Transition Area) ([Tetra Tech 2008](#)). The Upland Area is bounded by Meade Street and Hoffman Boulevard to the north, South 46th Street to the east, the Transition Area to the south, and Meeker Slough and Regatta Boulevard to the west. The Transition Area is bounded to the north by the Upland Area at the location of a buried, former seawall that is believed to have been the edge of the historic mudflats and to the south by Western Stege Marsh at the 5 foot elevation upper extent of the marsh (National Geodetic Vertical Datum 29 [NGVD] 29). The Transition Area is believed to consist entirely of artificial fill placed on historic mudflats. Western Stege Marsh is bounded by the Transition Area to the north, the RFS connector trail to the East Bay Regional Park District Trail (Bay Trail) and Eastern Stege Marsh to the east, the Bay Trail to the south, and Meeker Slough and Marina Bay housing development to the west (see [Figure B-2](#)). Western Stege Marsh includes a small isolated area of artificial fill known as the Island that occupies 0.425 acres and is surrounded by tidal marsh (see [Figure B-3](#)).

#### 3.2 SITE HISTORY

From 1897 to 1970, the former Stauffer Chemical Company Inc. (later Zeneca, Inc. [Zeneca]), the previous owner of the property bordering the RFS to the east (referred to in this HSP as the “former Zeneca site”), manufactured sulfuric acid from iron sulfide ore (pyrite) and other industrial chemicals, thereby creating residual pyrite cinder ([Tetra Tech 2008](#)). Large quantities of pyrite cinders were deposited on the UC Berkeley RFS property prior to 1950, as well as on the former Zeneca site. Pesticides were also manufactured at the former Zeneca site until 1997. Between the 1880s and 1948, the California Cap Company, a manufacturer of blasting caps, shells, and explosives; and several other small companies, including the U.S. Briquette Company and the Pacific Cartridge Company, operated explosives manufacturing plants at the RFS ([UC Berkeley 1973](#)). Activities at the former Kaiser Shipyard located at the southwest border of the RFS likely resulted in the deposition of paint-related metals and hydrocarbons into Western Stege Marsh. Activities at other neighboring facilities, including Bio-Rad Laboratories, Pacific Gas and Electric Company, Harbor Front Industries, and Liquid Gold may have historically contaminated portions of the RFS.

In October 1950, The University of California (UC) Regents purchased the California Cap Company property with the agreement that the California Cap Company would remove all hazardous materials from the property ([Tetra Tech 2008](#)). In 1951, UC acquired the adjacent undeveloped property between Avocet Way and Regatta Boulevard in the western portion of the RFS. UC Berkeley initially used the RFS for research for the College of Engineering and, later, other campus departments. Many of the buildings historically housed (and currently house) offices, laboratories, warehouses, and workshops used to support engineering projects ([UC Berkeley 2006](#)). None of the historic records indicate any releases to the environment from the use of laboratory chemicals in buildings at the RFS. One known UC Berkeley academic research and teaching operation resulted in metals releases on a small portion of the upland RFS near the former Forest Products Laboratory at Building 476. A time-critical removal action excavation was performed in 2007 to address this release.

Historical chemical manufacturing operations at the California Cap Company and industrial operations at neighboring properties resulted in chemicals being released or deposited onto the RFS uplands, marsh, and transition areas ([Tetra Tech 2008](#)). The property is currently occupied by UC Berkeley research facilities and non-UC Berkeley tenants including the United States Environmental Protection Agency (EPA) Region IX laboratory, Schlumberger, Inc., The Watershed Project, Stratacor, Inc., and other tenants. Various investigations into the conditions of soil and water occurred between 1981 and 2006. On September 15, 2006, DTSC issued a “Site Investigation and Remediation Order (Docket No. ISE-RAO 06/07-004)” ordering UC Berkeley to conduct response actions to address the release and/or the threatened release of hazardous substances at the RFS. In 2008, UC Berkeley submitted a Final Current Conditions Report ([Tetra Tech 2008](#)) for the RFS according to the DTSC Order. UC Berkeley will conduct additional investigations to address the data gaps identified in the Final Current Conditions Report for the RFS property.





**Richmond Field Station**  
**University of California, Berkeley**

**FIGURE B-1**  
**SITE LOCATION MAP**  
 Appendix B  
 Health and Safety Plan





300 0 300  
Feet

- Property Boundary
- ~ - Approximate Property Boundary

Notes:  
 EBRPD East Bay Regional Parks District  
 EERC Earthquake Engineering Research Center  
 EPA Environmental Protection Agency  
 NRLF Northern Regional Library Facility  
 RFS Richmond Field Station



**Richmond Field Station**  
**University of California, Berkeley**

## FIGURE B-2 SITE MAP

Appendix B  
 Health and Safety Plan





- Property Boundary
- Approximate Property Boundary
- Roads and Other Landscape Features
- Drainage Swale
- Building
- Restoration Plot
- Seasonal Freshwater Wetlands
- Monarch Roosting Area
- Disturbed Coastal Terrace Prairie
- Non Native Dominated Grassland on Fill
- Ornamental Trees
- Eucalyptus
- Cordgrass (*Spartina foliosa*)
- Salty Susan (*Jaumea carnosa*)
- Bulrush (*Scirpus americanus*)
- Saltgrass (*Distichlis spicata*)
- Pickleweed (*Salicornia virginica*)
- Ecotone
- Restored Native Upland
- Non-Native Transitional Upland
- Mud
- Coastal Terrace Prairie
- Surface Water



Richmond Field Station  
University of California, Berkeley

### FIGURE B-3 HABITAT AND WETLANDS MAP

Appedix B  
Health and Safety Plan



### **3.3 PLANNED ACTIVITIES**

General field activities to be performed during the RFS site-wide data gaps investigation include the following tasks:

- Soil sampling
- Sediment sampling
- Groundwater sampling and well installation oversight
- Surface water sampling
- Storm water sampling
- Soil gas sampling
- Air sampling
- Vegetation restoration
- Investigation-derived waste (IDW) sampling and disposal
- Mobilization and demobilization

Addenda to the HSP will be prepared as other site-specific tasks are determined.

## 4.0 SITE-SPECIFIC HAZARD EVALUATION

Field activities and physical features of the site may expose field personnel to a variety of hazards. This section provides information on potential hazards related to site activities and the nature of hazardous material impacts. Potential chemical and physical hazards related to site activities are discussed below.

### 4.1 CHEMICAL HAZARDS

Chemicals that may be present at the site are listed in Table 4-1. These chemicals pose various physical, chemical, and toxicological hazards. Potential routes of exposure include dermal (skin) contact, inhalation, and ingestion. The chemicals may also contaminate equipment, vehicles, instruments, and personnel. The overall health threat from exposure to these chemicals is uncertain because: (1) actual concentrations that personnel could be exposed to cannot be predicted, (2) the actual duration of exposure is unknown, and (3) the effects of low-level exposure to a mixture of chemicals cannot be predicted. However, Tetra Tech believes that the potential for high-level exposure is limited.

Specific information on potential chemical hazards at the site is provided in Table 4-1, including exposure limits, anticipated exposure routes, and toxic characteristics. Table 4-2 provides an activity hazard analysis of the planned field activities listed in [Section 3.3](#).

The Material Safety Data Sheets (MSDS) included in the attachment to this HSP summarize health and safety information for hazardous materials that will be brought to the site, such as laboratory reagents, decontamination solutions, and sample preservatives. These materials are as follows:

- Alconox® for decontamination
- Isobutylene for photoionization detector (PID) calibration
- Nitric acid (preservatives for quality control [QC] samples)
- Hydrochloric acid (preservatives for QC samples)

**Table 4-1: Potential Chemical Hazards at the RFS Site**

**Note:** Potential chemical hazards for tasks involving chemicals not listed in this table will be evaluated in an HSP addendum, as needed.

Chemical and Media	Exposure Limits and IDLH Level	Exposure Routes	Toxic Characteristics
Arsenic, Soil (Upland and Transition Areas), Sediment (Western Stege Marsh)	(as inorganic arsenic CAS 7440-38-2) PEL = TWA 0.010 mg/m <sup>3</sup> REL = Ca C 0.002 mg/m <sup>3</sup> [15-minute] TLV = TWA 0.010 mg/m <sup>3</sup> IDLH = Ca 5 mg/m <sup>3</sup>	Inhalation, skin absorption, skin and/or eye contact, ingestion	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin [potential occupational carcinogen]
Cadmium, Soil (Upland Area), Groundwater (Transition Area)	PEL = TWA 0.005 mg/m <sup>3</sup> REL = Ca TLV = TWA 0.005 mg/m <sup>3</sup> IDLH = Ca 9 mg/m <sup>3</sup>	Inhalation, ingestion	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia [potential occupational carcinogen]
Copper, Sediment (Western Stege Marsh), Surface and Storm Water, Groundwater (Upland and Transition Areas)	PEL = TWA 1 mg/m <sup>3</sup> REL = TWA 1 mg/m <sup>3</sup> TLV = 1 mg/m <sup>3</sup> IDLH = 100 mg/m <sup>3</sup>	inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; cough, dyspnea (breathing difficulty), wheezing
Lead, Soil (Transition Area), Storm Water	PEL = TWA 0.050 mg/m <sup>3</sup> REL = TWA 0.050 mg/m <sup>3</sup> TLV = TWA 0.15 mg/m <sup>3</sup> IDLH = 100 mg/m <sup>3</sup>	Inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension

**Table 4-1: Potential Chemical Hazards at the RFS Site (continued)**

Chemical and Media	Exposure Limits and IDLH Level	Exposure Routes	Toxic Characteristics
Mercury, Soil (Upland Area), Sediment (Western Stege Marsh), Storm Water, Groundwater (Upland and Transition Areas)	PEL = TWA 0.1 mg/m <sup>3</sup> REL = TWA 0.05 mg/m <sup>3</sup> [skin as Hg vapor] TLV = TWA 0.025 mg/m <sup>3</sup> [skin] IDLH = 10 mg/m <sup>3</sup> (as Hg)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria
Nickel, Groundwater (Upland and Transition Areas)	(as nickel metal and other compounds CAS 7440-02-0) PEL = TWA 1 mg/m <sup>3</sup> REL = Ca TWA 0.015 mg/m <sup>3</sup> TLV = TWA 1 mg/m <sup>3</sup> IDLH = Ca 10 mg/m <sup>3</sup>	inhalation, ingestion, skin and/or eye contact	Sensitization dermatitis, allergic asthma, pneumonitis [potential occupational carcinogen]
Silver, Surface and Storm Water	PEL = TWA 0.01 mg/m <sup>3</sup> REL = TWA 0.01 mg/m <sup>3</sup> TLV = 0.1 mg/m <sup>3</sup> (ACGIH 1997) IDLH = 10 mg/m <sup>3</sup>	inhalation, ingestion, skin and/or eye contact	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance
Thallium, Groundwater	PEL = TWA 0.1 mg/m <sup>3</sup> [skin] REL = TWA 0.1 mg/m <sup>3</sup> [skin] TLV = NA IDLH = 15 mg/m <sup>3</sup>	inhalation, skin absorption, ingestion, skin and/or eye contact	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs

**Table 4-1: Potential Chemical Hazards at the RFS Site (continued)**

Chemical and Media	Exposure Limits and IDLH Level	Exposure Routes	Toxic Characteristics
Zinc, Surface and Storm Water, Groundwater (Transition Area)	[as Zinc oxide] PEL = TWA 15 mg/m <sup>3</sup> (total dust) REL = Dust: TWA 5 mg/m <sup>3</sup> TLV = NA IDLH = 500 mg/m <sup>3</sup>	inhalation	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function
Cis-1,2-DCE, Groundwater	PEL = 790 mg/m <sup>3</sup> REL = 790 mg/m <sup>3</sup> TLV = 793 mg/m <sup>3</sup> IDLH = 50 PPM	Inhalation, ingestion, and skin and/or eye contact	The major effect of 1,2-dichloroethylene is narcosis; in high concentrations, exposure to 1,2-dichloroethylene causes central nervous system depression; in milder exposures, it can produce nausea, vomiting, weakness, tremor, epigastric cramps, burning of the eyes and vertigo
PCE, Groundwater	PEL = TWA 678 mg/m <sup>3</sup> REL = Ca Minimize workplace exposure concentrations TLV = 25 ppm as TWA IDLH = Ca [1,017 mg/m <sup>3</sup> ]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage [potential occupational carcinogen]
TCE, Groundwater	PEL = TWA 537 mg/m <sup>3</sup> REL = Ca TLV = 50 ppm as TWA IDLH = Ca [5,370 mg/m <sup>3</sup> ]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury [potential occupational carcinogen]



**Table 4-1: Potential Chemical Hazards at the RFS Site (continued)**

Chemical and Media	Exposure Limits and IDLH Level	Exposure Routes	Toxic Characteristics
Vinyl chloride, Groundwater	PEL = TWA 2.56 mg/m <sup>3</sup> REL = Ca TLV = 1 ppm as TWA A1 (confirmed human carcinogen); (ACGIH 2004) IDLH = Ca [N.D.]	inhalation, skin, and/or eye contact (liquid)	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite [potential occupational carcinogen]
PCBs, Soil (Transition Area), Sediment (Western Stege Marsh), Groundwater (Transition Area) [as Aroclor 1242]	PEL = TWA 1 mg/m <sup>3</sup> [skin] REL = Ca TWA 0.001 mg/m <sup>3</sup> TLV = TWA 1 mg/m <sup>3</sup> [skin] IDLH = Ca [5 mg/m <sup>3</sup> ]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; chloracne; liver damage; reproductive effects [potential occupational carcinogen]
PCBs, Soil (Transition Area), Sediment (Western Stege Marsh), Groundwater (Transition Area) [as Aroclor 1254]	PEL = TWA 0.5 mg/m <sup>3</sup> [skin] REL = Ca TWA 0.001 mg/m <sup>3</sup> TLV = 1 mg/m <sup>3</sup> TWA [skin]; 0.5 mg/m <sup>3</sup> TWA [skin] (54% Cl) IDLH = Ca [5 mg/m <sup>3</sup> ]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, chloracne; liver damage; reproductive effects [potential occupational carcinogen]
Dieldrin, Sediment (Western Stege Marsh)	PEL = TWA 0.25 mg/m <sup>3</sup> [skin] REL = Ca TWA 0.25 mg/m <sup>3</sup> [skin] TLV = TWA 0.25 mg/m <sup>3</sup> [skin] IDLH = Ca 50 mg/m <sup>3</sup>	inhalation, skin absorption, ingestion, skin and/or eye contact	Headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions; coma [potential occupational carcinogen]
Chlordane, Sediment (Western Stege Marsh)	PEL = TWA 0.5 mg/m <sup>3</sup> [skin] REL = Ca TWA 0.5 mg/m <sup>3</sup> [skin] TLV = Ca 0.5 mg/m <sup>3</sup> [skin] IDLH = Ca 100 mg/m <sup>3</sup>	Skin/eye absorption, inhalation, and/or ingestion	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria; in animals: lung, liver, kidney damage [potential occupational carcinogen]

**Table 4-1: Potential Chemical Hazards at the RFS Site (continued)**

Chemical and Media	Exposure Limits and IDLH Level	Exposure Routes	Toxic Characteristics
DDT, Sediment (Western Stege Marsh)	PEL = TWA 1 mg/m <sup>3</sup> [skin] REL = Ca TWA 0.5 mg/m <sup>3</sup> TLV = IDLH = Ca [500 mg/m <sup>3</sup> ]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting [potential occupational carcinogen]

Notes:

ACGIH	American Conference of Governmental Industrial Hygienists
C	Ceiling
Ca	California
CAS	Chemical Abstracts Service
Cl	Chlorine
DCE	Dichloroethylene
DDT	Dichlorodiphenyltrichloroethane
Hg	Mercury
IDLH	Immediately dangerous to life or health
mg/m <sup>3</sup>	Milligram per cubic meter
N.D.	Not Detected
PCB	Polychlorinated biphenyl
PCE	Teterechloroethylene
PEL	Permissible exposure limit
ppm	Part per million
REL	Recommended exposure limit
TCE	Trichloroethylene
TLV	Threshold limit value
TWA	Time weighed average

ACGIH. "Threshold Limit Values and Biological Exposure Indices for 2007." Latest edition.

National Institute for Occupational Safety and Health. 2005. "Pocket Guide to Chemical Hazards." U.S. Department of Health and Human Services. U.S. Government Printing Office. Washington, DC. September. Available online at: <http://www.cdc.gov/niosh/npg/npgd0112.html>

**Table 4-2: Task Hazard Analysis**


 <b>TETRA TECH EM INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Mobilization and Site Setup</b>
<b>Task Description</b>		
Arriving at the site; setting up work zones, equipment and decontamination stations; reviewing truck routes; installing temporary fencing, traffic controls, eyewash stations, etc.; clearing and grubbing for sampling areas.		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
1. Vehicle operation driving to and from job site	Collision with other vehicles, persons, or objects	<ul style="list-style-type: none"> <li>Be alert and exercise defensive driving techniques; do not use cell phones while driving unless a hands-free device is used; drive according to posted speed limits, environment, and road conditions; wear seat belts when driving or riding in vehicle, use headlights and turn signals when applicable.</li> </ul>
	Poor road and weather conditions	<ul style="list-style-type: none"> <li>Adjust driving speed to compensate for road and surface conditions; reduce speed to prevent hydroplaning on wet road surfaces; allow additional driving time or reschedule trips during severe weather.</li> </ul>
2. Establish work zones using barricades, delineators, caution tape, or other similar barriers	Vehicular traffic	<ul style="list-style-type: none"> <li>Wear reflective safety vests when near or in roadways; stay clear of roadways; utilize flagger for traffic control if necessary; use hand signals when necessary.</li> </ul>
	Fire hazards	<ul style="list-style-type: none"> <li>Do not smoke on site.</li> </ul>
	Puncture wounds, pinch points	<ul style="list-style-type: none"> <li>Wear gloves while unrolling fencing; use hand tools according to manufacturer suggestions.</li> </ul>
	Muscle strain, crushing of body parts	<ul style="list-style-type: none"> <li>Use proper lifting techniques when lifting heavy items; use crowbar to assist in lifting heavy parts; wear steel toed shoes.</li> </ul>

Table 4-2: Task Hazard Analysis (continued)


 <b>TETRA TECH EM INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Mobilization and Site Setup</b>
<b>Task Description</b>		
Arriving at the site; setting up work zones, equipment and decontamination stations; reviewing truck routes; installing temporary fencing, traffic controls, eyewash stations, etc.; clearing and grubbing for sampling areas.		
Principle Steps	Potential Hazards	Preventative Actions
2. Establish work zones using barricades, delineators, caution tape, or other similar barriers (Cont'd)	Biological hazards: vermin, bees, ticks, snakes, feral animals, plant (e.g., thistle) thorns	<ul style="list-style-type: none"> <li>Do not approach animals; employees with allergies to bee stings, etc. should have proper medication with them at all times; tuck pant legs into socks; training for recognition of poisonous snakes and spiders for the site area will be obtained prior to site mobilization activities; wear long pants (and long sleeves if possible) and insect repellent. Keep a first aid kit with antihistamines at all times.</li> </ul>
	Trip, slip and fall	<ul style="list-style-type: none"> <li>Look for uneven ground, cracks and potholes while walking; be careful to step around burrowed holes; perform good housekeeping around the site.</li> </ul>
	Heat or cold stress	<ul style="list-style-type: none"> <li>Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather.</li> </ul>
3. Identify equipment and decontamination stations (label and set up related materials and equipment)	See potential hazards for step 2	<ul style="list-style-type: none"> <li>See preventative actions for step 2.</li> </ul>
4. Review/walk on site truck routes	See potential hazards for step 2	<ul style="list-style-type: none"> <li>See preventative actions for step 2.</li> </ul>
5. Install temporary fencing, traffic controls, and eyewash station (if applicable)	See potential hazards for step 2	<ul style="list-style-type: none"> <li>See preventative actions for step 2.</li> </ul>
	Back strains	<ul style="list-style-type: none"> <li>Use proper technique while lifting heavy items, do not lift items greater than 50 pounds, use a buddy to lift oversized items.</li> </ul>

Table 4-2: Task Hazard Analysis (continued)



 TETRA TECH EMI INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Mobilization and Site Setup	
Task Description		
Arriving at the site; setting up work zones, equipment and decontamination stations; reviewing truck routes; installing temporary fencing, traffic controls, eyewash stations, etc.; clearing and grubbing for sampling areas.		
Principle Steps	Potential Hazards	Preventative Actions
6. Clear and grub areas for sampling (cutting and trimming trees and brush)	See potential hazards for step 2	<ul style="list-style-type: none"><li>See preventative actions for step 2.</li></ul>
	Lacerations from equipment use or thorns on trees/shrubs	<ul style="list-style-type: none"><li>Wear leather gloves, wear long sleeved shirts and long pants, use proper cutting tool for the job, wear safety glasses or face shield, wear hard hat and steel-toed shoes, be aware of surroundings before cutting, use safety knives for cutting when appropriate.</li></ul>
	Falling branches	<ul style="list-style-type: none"><li>Wear hard hat, use a buddy to spot cutting activity, do not stand beneath items that are being cut.</li></ul>
	Heavy equipment operation	<ul style="list-style-type: none"><li>Only trained equipment operators should operate equipment, inspect heavy equipment daily, ensure equipment has backup alarms and that they can be heard using hearing protection, always use a spotter, make sure the operator can see you if walking around equipment.</li></ul>

Table 4-2: Task Hazard Analysis (continued)

 TETRA TECH EM INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Mobilization and Site Setup	
Task Description		
Arriving at the site; setting up work zones, equipment and decontamination stations; reviewing truck routes; installing temporary fencing, traffic controls, eyewash stations, etc.; clearing and grubbing for sampling areas.		
Principle Steps	Potential Hazards	Preventative Actions
Personal Protective Equipment:	Safety Equipment:	Training Requirements:
Safety glasses or goggles Hard hat Steel-toed boots Face shield Hearing protection Dust Mask Gloves Safety vest	First Aid Kit Fire Extinguisher Eyewash station (ANSI Standard Z358.1-2004 or later)	<ul style="list-style-type: none"><li>• 40 Hour Hazardous Waste Operations and Emergency Response</li><li>• 8 Hour Refresher Course (once per year)</li><li>• CPR and First Aid Training (at least two people on-site)</li><li>• Heavy equipment operators should be trained on specific equipment.</li></ul>

Approved By/Date:



Date: February 27 2009

David Brown, Health and Safety Representative, Tetra Tech

Table 4-2: Task Hazard Analysis (continued)


 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Utility Clearance and Surveying</b>
<b>Task Description</b>		
This AHA applies to the clearing of utilities before drilling and soil sampling activities. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
1. Call Underground Service Alert (USA) North; review available utility plans; locate sampling locations; investigate utilities in the area	Trip, slip and fall	<ul style="list-style-type: none"> <li>Look for uneven ground, cracks and potholes while walking; be careful to step around burrowed holes; perform good housekeeping around the site.</li> </ul>
	Biological hazards: vermin, bees, ticks, snakes, feral animals, plant (e.g., thistle) thorns	<ul style="list-style-type: none"> <li>Do not approach animals; employees with allergies to bee stings, etc. should have proper medication with them at all times; tuck pant legs into socks; training for recognition of poisonous snakes and spiders for the site area will be obtained prior to site mobilization activities; wear long pants (and long sleeves if possible) and insect repellent. Keep a first aid kit with antihistamines at all times.</li> </ul>
	Fire hazards	<ul style="list-style-type: none"> <li>Do not smoke on site.</li> </ul>
	Muscle strain, crushing of body parts	<ul style="list-style-type: none"> <li>Use proper lifting techniques when lifting heavy items; use crowbar to assist in lifting heavy parts; wear steel toed shoes.</li> </ul>
	Heat or cold stress	<ul style="list-style-type: none"> <li>Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather.</li> </ul>
2. Clear area to be marked	Electrocution, fire hazard	<ul style="list-style-type: none"> <li>Obtain and review all pertinent utility drawings to avoid breaking utility lines; contact USA (811 / 1-800-227-2600) for utility clearance; inspect locating equipment for calibration and proper working order; use industry standard color code for utilities marking; do not smoke on site.</li> </ul>
	Vehicular traffic	<ul style="list-style-type: none"> <li>Wear reflective safety vests when near or in roadways; utilize flagger for traffic control if necessary; use hand signals when necessary.</li> </ul>

Table 4-2: Task Hazard Analysis (continued)



 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Utility Clearance and Surveying</b>
<b>Task Description</b>		
This AHA applies to the clearing of utilities before drilling and soil sampling activities. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
2. Clear area to be marked (Cont'd)	Heat or cold stress	<ul style="list-style-type: none"> <li>Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather.</li> </ul>
3. Mark cleared location with utility marking paints	Exposure to harmful solvents	<ul style="list-style-type: none"> <li>Follow manufacturer's recommended use and safety instructions; follow MSDS instructions for utility paint; never point spray bottles at people; always use down spray nozzle spray cans; wear safety goggles.</li> </ul>
	Fire hazards	<ul style="list-style-type: none"> <li>Do not smoke on site.</li> </ul>
	Vehicular traffic	<ul style="list-style-type: none"> <li>Wear reflective safety vests when near or in roadways; utilize flagger for traffic control if necessary; use hand signals when necessary.</li> </ul>
	Heat or cold stress	<ul style="list-style-type: none"> <li>Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather.</li> </ul>
4. Survey locations for soil excavation	Trip, slip and fall	<ul style="list-style-type: none"> <li>Look for uneven ground, cracks and potholes while walking; be careful to step around burrowed holes; perform good housekeeping around the site.</li> </ul>
	Fire hazards	<ul style="list-style-type: none"> <li>Do not smoke on site.</li> </ul>
	Vehicular traffic	<ul style="list-style-type: none"> <li>Wear reflective safety vests when near or in roadways; utilize flagger for traffic control if necessary; use hand signals when necessary.</li> </ul>



Table 4-2: Task Hazard Analysis (continued)

 TETRA TECH EMI INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Utility Clearance and Surveying	
Task Description		
This AHA applies to the clearing of utilities before drilling and soil sampling activities. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
4. Survey locations for soil excavation (cont.)	Heat or cold stress	<ul style="list-style-type: none"><li>Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather.</li></ul>
Personal Protective Equipment	Safety Equipment	Training Requirements
Hard hat Long pants and shirts with sleeves Steel-toed shoes Leather work gloves Safety glasses First Aid Kit Safety vest	First aid kit Fire extinguisher Eyewash station (ANSI Standard Z358.1-2004 or later)	<ul style="list-style-type: none"><li>40 Hour Hazardous Waste Operations and Emergency Response</li><li>8 Hour Refresher Course (once per year)</li><li>CPR and First Aid Training (at least two people on-site)</li></ul>

Approved By/Date: David Brown Date: February 27 2009  
**David Brown, Health and Safety Representative, Tetra Tech**

Table 4-2: Task Hazard Analysis (continued)


 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Soil Sampling</b>
Task Description		
Transport to and from the site; collection of soil samples.		
Principle Steps	Potential Hazards	Preventative Actions
1. Loading coolers and equipment onto truck	Pinch Points	<ul style="list-style-type: none"> <li>Use caution when loading equipment and be careful to remove all extremities before closing the truck bed door.</li> </ul>
	Muscle Strain	<ul style="list-style-type: none"> <li>Use proper lifting techniques; including bending at the knees and bringing the load close to the body prior to lifting. Use two people if necessary and hand trucks and other lifting aids when possible.</li> </ul>
2. Vehicle operation driving to and from job site	Collision with other vehicles	<ul style="list-style-type: none"> <li>Be alert and exercise defensive driving techniques; do not use cell phones while driving unless a hands-free device is also used; drive according to posted speed limits, environment, and road conditions; wear seat belts when driving or riding in vehicle.</li> </ul>
	Poor road conditions and weather conditions	<ul style="list-style-type: none"> <li>Adjust driving speed to compensate for road and surface conditions; reduce speed to prevent hydroplaning on wet road surfaces; allow additional driving time or reschedule trips during severe weather.</li> </ul>
3. Parking at site	Truck roll or truck runaway	<ul style="list-style-type: none"> <li>Put truck in park and secure parking brake.</li> </ul>
	Pinch points	<ul style="list-style-type: none"> <li>Ensure the doorway is clear before closing; close the vehicle doors slowly.</li> </ul>
4. Walk to sampling location	Trip, slip and fall	<ul style="list-style-type: none"> <li>Look for uneven ground, cracks, and potholes while walking; be careful to step around burrowed holes; step around debris on site; check for unstable surfaces to prevent falling in.</li> </ul>
	Biological hazards: vermin, bees, ticks, snakes, feral animals, plant (e.g., thistle) thorns	<ul style="list-style-type: none"> <li>Do not approach animals; employees with allergies to bee stings, etc. should have proper medication with them at all times; tuck pant legs into socks; training for recognition of poisonous snakes and spiders for the site area will be obtained prior to site mobilization activities; wear long pants (and long sleeves if possible) and insect repellent. Keep a first aid kit with antihistamines at all times.</li> </ul>
	Fire hazards from dry grass	<ul style="list-style-type: none"> <li>Do not smoke on site.</li> </ul>

Table 4-2: Task Hazard Analysis (continued)


 TETRA TECH EMI INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Soil Sampling	
Task Description		
Transport to and from the site; collection of soil samples.		
Principle Steps	Potential Hazards	Preventative Actions
5. Collect soil sample using a disposable scoop and a pick ax if necessary.	Exposure to chemicals	<ul style="list-style-type: none"><li>Wear proper PPE (site-specific PPE for this principle step is listed in 6.1).</li></ul>
	Struck by equipment or tools e.g., pick ax	<ul style="list-style-type: none"><li>Do not collect samples until operator has stopped using equipment/tool e.g., pick ax and area is clear for sampling. Stay at a safe distance from operator using equipment/tool. Place equipment/tool away from people when not in use and notify them of its location.</li></ul>
	Back strain	<ul style="list-style-type: none"><li>Use correct posture and bending techniques.</li></ul>
	Repetitive motion	<ul style="list-style-type: none"><li>Take adequate breaks; do stretches</li></ul>
	Cuts, puncture wounds, pinch points	<ul style="list-style-type: none"><li>Use work gloves while operating equipment/tool. Be aware of moving and sharp parts.</li></ul>
	Heat or cold stress	<ul style="list-style-type: none"><li>Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather.</li></ul>
	Dust getting into eyes	<ul style="list-style-type: none"><li>Wear eye protection; do not put face close to source.</li></ul>
	Broken sample jar	<ul style="list-style-type: none"><li>Handle glass jar carefully; dispose of broken glass using a scoop while wearing puncture-resistant gloves. Place broken glass in puncture-resistant container and dispose in proper bin.</li></ul>

Table 4-2: Task Hazard Analysis (continued)



 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Soil Sampling</b>
<b>Task Description</b>		
Transport to and from the site; collection of soil samples.		
Principle Steps	Potential Hazards	Preventative Actions
6. Label jar, place sample in cooler	Pinch Points	<ul style="list-style-type: none"> <li>Be careful to remove hands before closing cooler lid.</li> </ul>
	Broken sample jar	<ul style="list-style-type: none"> <li>Handle glass jar carefully; dispose of broken glass using a scoop while wearing puncture-resistant gloves. Place broken glass in puncture-resistant container and dispose in proper bin.</li> </ul>
	Cuts, puncture wounds, laceration	<ul style="list-style-type: none"> <li>Use a tape cutter with protective guard; cut (e.g., tape) away from body</li> </ul>
7. Walk to next sampling location; collect samples	See potential hazards steps 5	<ul style="list-style-type: none"> <li>See preventative actions step 5.</li> </ul>
8. Repeat task steps 5 through 8 until sampling is finished	See potential hazards steps 5-8	<ul style="list-style-type: none"> <li>See preventative actions step 5 through 8.</li> </ul>
	Heat exhaustion	<ul style="list-style-type: none"> <li>Monitor own and partner's energy levels, drink water, take regular breaks, and seek shady resting spots.</li> </ul>
9. Walk back to truck	See potential hazards step 5	<ul style="list-style-type: none"> <li>See preventative actions step 5.</li> </ul>
10. Dispose of disposable equipment in garbage bag	Exposure to chemicals	<ul style="list-style-type: none"> <li>Wear proper PPE (site-specific PPE for this principle step is listed in Section 6.1).</li> </ul>
11. Cut tape and tape up cooler	Puncture, cuts	<ul style="list-style-type: none"> <li>Use safety scissors if possible; do not run with scissors; use tape dispensers with safety guards; cut tape carefully.</li> </ul>

Table 4-2: Task Hazard Analysis (continued)

 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Soil Sampling</b>
<b>Task Description</b>		
Transport to and from the site; collection of soil samples.		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
12. Load cooler onto truck	Pinch Points	<ul style="list-style-type: none"> <li>Be careful to remove hands before closing truck bed.</li> </ul>
	Muscle Strain	<ul style="list-style-type: none"> <li>Use proper lifting techniques; including bending at the knees and bringing the load close to the body prior to lifting. Use two people if necessary and hand trucks and other lifting aids when possible.</li> </ul>
13. Drive samples to shipping location and unload coolers	See potential hazards steps 1, 2 and 3	<ul style="list-style-type: none"> <li>See preventative actions steps 1, 2 and 3.</li> </ul>
<b>Personal Protective Equipment</b>	<b>Safety Equipment</b>	<b>Training Requirements</b>
Steel-toed boots Work gloves (e.g., leather) Chemical-resistant gloves Long-sleeved shirt and pants Safety glasses	First Aid Kit Eyewash (ANSI Standard Z358.1-2004 or later)	<ul style="list-style-type: none"> <li>40-Hour Hazardous Waste Operations and Emergency Response</li> <li>8-Hour Refresher Course (once per year)</li> <li>CPR and First Aid Training (at least two people on-site)</li> <li>MSDS</li> <li>Dangerous goods shipping</li> </ul>


Approved By/Date:




Date: February 27 2009

**David Brown, Health and Safety Representative, Tetra Tech**


**Table 4-2: Task Hazard Analysis (continued)**

 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		<b>Analyzed by: Tetra Tech 01/26/09</b>
		<b>Sediment Sampling</b>
<b>Task Description</b>		
<p>This Activity Hazard Analysis (AHA) applies to sediment sample collection at the marsh site at UCB-RFS. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.</p>		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
1. Loading coolers and equipment onto truck	Pinch Points	<ul style="list-style-type: none"> <li>Use caution when loading equipment and be careful to remove all extremities before closing the truck bed door.</li> </ul>
	Muscle Strain	<ul style="list-style-type: none"> <li>Use proper lifting techniques; including bending at the knees and bringing the load close to the body prior to lifting. Use two people if necessary and hand trucks and other lifting aids when possible.</li> </ul>
2. Vehicle operation driving to and from job site	Collision with Other Vehicles	<ul style="list-style-type: none"> <li>Be alert and exercise defensive driving techniques; do not use cell phones while driving unless a hands-free device is also used; drive according to posted speed limits, environment, and road conditions; wear seat belts when driving or riding in vehicle.</li> </ul>
	Poor Road Conditions and Weather Conditions	<ul style="list-style-type: none"> <li>Adjust driving speed to compensate for road and surface conditions; reduce speed to prevent hydroplaning on wet road surfaces; allow additional driving time or reschedule trips during severe weather.</li> </ul>
3. Parking at site	Truck Roll or Truck Runaway	<ul style="list-style-type: none"> <li>Put truck in park and secure parking brake.</li> </ul>
	Pinch Points	<ul style="list-style-type: none"> <li>Ensure the doorway is clear before closing; close the vehicle doors slowly.</li> </ul>

**Table 4-2: Task Hazard Analysis (continued)**

 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		<b>Analyzed by: Tetra Tech 01/26/09</b>
		<b>Sediment Sampling</b>
<b>Task Description</b>		
<p>This Activity Hazard Analysis (AHA) applies to sediment sample collection at the marsh site at UCB-RFS. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.</p>		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
4. Walk to sampling location with sampling gear	Slip, Trip, Fall	<ul style="list-style-type: none"> <li>• Wear appropriate footwear</li> <li>• Scan the area ahead before proceeding</li> <li>• Carry only necessary items to minimize any difficulty balancing</li> <li>• Make multiple trips if gear cannot be carried safely in one trip</li> </ul>
	Getting Stuck in Mud	<ul style="list-style-type: none"> <li>• Wear appropriate footwear (rubber safety boots or waders if necessary)</li> <li>• Test stability of terrain before taking a step</li> <li>• Walk with a buddy in close proximity</li> <li>• Take a long walking pole for support</li> </ul>
	Biological hazards: vermin, bees, ticks, snakes, feral animals, plant (e.g., thistle) thorns	<ul style="list-style-type: none"> <li>• Do not approach animals; employees with allergies to bee stings, etc. should have proper medication with them at all times; tuck pant legs into socks; training for recognition of poisonous snakes and spiders for the site area will be obtained prior to site mobilization activities; wear long pants (and long sleeves if possible) and insect repellent. Keep a first aid kit with antihistamines at all times.</li> </ul>
	Fire hazards from dry grass (surface water sampling only)	<ul style="list-style-type: none"> <li>• Do not smoke on site.</li> </ul>

**Table 4-2: Task Hazard Analysis (continued)**

 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		<b>Analyzed by: Tetra Tech 01/26/09</b>
		<b>Sediment Sampling</b>
<b>Task Description</b>		
<p>This Activity Hazard Analysis (AHA) applies to sediment sample collection at the marsh site at UCB-RFS. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.</p>		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
5. Collect sediment core samples with push corer, hand auger, split-spoon sampler, or trowel	Back/Muscle Strain	<ul style="list-style-type: none"> <li>Practice proper lifting and bending techniques (lift with the legs)</li> <li>Wear appropriate personal protective equipment (PPE)</li> </ul>
	Pinch Points	<ul style="list-style-type: none"> <li>Wear leather work gloves when handling equipment</li> <li>Avoid putting hands near pinch points</li> </ul>
	Exposure to Chemicals	<ul style="list-style-type: none"> <li>Wear proper PPE (site-specific PPE for this principle step is listed in 6.1).</li> </ul>
	Drowning	<ul style="list-style-type: none"> <li>Check tide chart prior to mobilization</li> <li>See SWP 6-22</li> </ul>
	Heat or Cold Stress	<ul style="list-style-type: none"> <li>Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather.</li> </ul>



**Table 4-2: Task Hazard Analysis (continued)**



 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		<b>Analyzed by: Tetra Tech 01/26/09</b>
		<b>Sediment Sampling</b>
<b>Task Description</b>		
<p>This Activity Hazard Analysis (AHA) applies to sediment sample collection at the marsh site at UCB-RFS. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.</p>		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
6. Process samples (cut and label samples)	Sample Dropped on Foot	<ul style="list-style-type: none"> <li>Wear safety shoes</li> <li>Stabilize sample before cutting</li> </ul>
	Puncture, Cuts	<ul style="list-style-type: none"> <li>Use safety scissors if possible; do not run with scissors; use tape dispensers with safety guards; cut tape carefully.</li> </ul>
	Exposure to Chemicals	<ul style="list-style-type: none"> <li>Wear proper PPE (site-specific PPE for this principle step is listed in 6.1).</li> </ul>
7. Decontaminate equipment	Exposure to Chemicals and Decontamination Chemical Solution	<ul style="list-style-type: none"> <li>Wear proper PPE (site-specific PPE for this principle step is listed in Section 6.1).</li> </ul>
	Liquid Spills	<ul style="list-style-type: none"> <li>Line areas with 6 mil polyethylene sheeting prior to draining. Berm the area using straw wattles, sand bags, or other similar supplies. Containerize drained liquids in bermed area. Let dry or transfer into a drum or poly tank until proper disposal can be arranged.</li> </ul>
8. Load cooler onto truck	Pinch Points	<ul style="list-style-type: none"> <li>Be careful to remove hands before closing truck bed.</li> </ul>
	Muscle Strain	<ul style="list-style-type: none"> <li>Use proper lifting techniques; including bending at the knees and bringing the load close to the body prior to lifting. Use two people if necessary and hand trucks and other lifting aids when possible.</li> </ul>

Table 4-2: Task Hazard Analysis (continued)

 <b>TETRA TECH EMI INC.</b>	<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>	
	Analyzed by: Tetra Tech 01/26/09	
	<b>Sediment Sampling</b>	
<b>Task Description</b>		
<p>This Activity Hazard Analysis (AHA) applies to sediment sample collection at the marsh site at UCB-RFS. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.</p>		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
9. Drive samples to shipping location and unload coolers	See potential hazards steps 1, 2 and 3	<ul style="list-style-type: none"> <li>• See preventative actions steps 1, 2 and 3.</li> </ul>
<b>Equipment to be Used</b>	<b>Safety Equipment</b>	<b>Training Requirements</b>
Steel-toed boots, rubber boots, or waders, as appropriate for site conditions Long-sleeved shirt and pants (non-cotton recommended) Safety Glasses Latex or nitrile gloves Leather gloves Personal flotation device (PFD) Support pole	First Aid Kit Eyewash (ANSI Standard Z358.1-2004 or later)	<ul style="list-style-type: none"> <li>• 40-Hour Hazardous Waste Operations and Emergency Response</li> <li>• 8-Hour Refresher Course (once per year)</li> <li>• CPR and First Aid Training (at least two people on-site)</li> <li>• MSDS</li> <li>• Dangerous goods shipping</li> </ul>

Approved By/Date:

  
**David Brown, Health and Safety Representative, Tetra Tech**

Date: February 27 2009

Table 4-2: Task Hazard Analysis (continued)


 <b>TETRA TECH INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Storm and Surface Water Sampling</b>
<b>Task Description</b>		
Transport to and from the site; collection of storm water samples.		
Principle Steps	Potential Hazards	Preventative Actions
1. Loading coolers and equipment onto truck	Pinch points	<ul style="list-style-type: none"> <li>Use caution when loading equipment and be careful to remove all extremities before closing the truck bed door.</li> </ul>
	Muscle strain	<ul style="list-style-type: none"> <li>Use proper lifting techniques; including bending at the knees and bringing the load close to the body prior to lifting. Use two people if necessary and hand trucks and other lifting aids when possible.</li> </ul>
2. Vehicle operation driving to and from job site	Collision with other vehicles	<ul style="list-style-type: none"> <li>Be alert and exercise defensive driving techniques; do not use cell phones while driving unless a hands-free device is also used; drive according to posted speed limits, environment, and road conditions; wear seat belts when driving or riding in vehicle.</li> </ul>
	Poor road conditions and weather conditions	<ul style="list-style-type: none"> <li>Adjust driving speed to compensate for road and surface conditions; reduce speed to prevent hydroplaning on wet road surfaces; allow additional driving time or reschedule trips during severe weather.</li> </ul>
3. Parking at site	Truck roll or truck runaway	<ul style="list-style-type: none"> <li>Put truck in park and secure parking brake.</li> </ul>
	Pinch points	<ul style="list-style-type: none"> <li>Ensure the doorway is clear before closing; close the vehicle doors slowly.</li> </ul>
4. Walk to sampling location	Slip, trip, fall	<ul style="list-style-type: none"> <li>Look for uneven ground, cracks, and potholes while walking; be careful to step around burrowed holes; step around debris on site; check for unstable surfaces to prevent falling in.</li> </ul>
	Wet conditions	<ul style="list-style-type: none"> <li>Use slip-resistant footwear and rain gear with reflectors. Stay away from lightning-conducting materials. Be careful when walking on wet surfaces.</li> </ul>
	Biological hazards: vermin, bees, ticks, snakes, feral animals, plant (e.g., thistle) thorns	<ul style="list-style-type: none"> <li>Do not approach animals; employees with allergies to bee stings, etc. should have proper medication with them at all times; tuck pant legs into socks; training for recognition of poisonous snakes and spiders for the site area will be obtained prior to site mobilization activities; wear long pants (and long sleeves if possible) and insect repellent. Keep a first aid kit with antihistamines at all times.</li> </ul>

Table 4-2: Task Hazard Analysis (continued)



 <b>TETRA TECH INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Storm and Surface Water Sampling</b>
<b>Task Description</b>		
Transport to and from the site; collection of storm water samples.		
Principle Steps	Potential Hazards	Preventative Actions
4. Walk to sampling location (Con't)	Fire hazards from dry grass (surface water sampling only)	<ul style="list-style-type: none"> <li>Do not smoke on site.</li> </ul>
5. Collect water samples using a disposable sampler	Back strain	<ul style="list-style-type: none"> <li>Use correct posture and bending techniques.</li> </ul>
	Exposure to chemicals	<ul style="list-style-type: none"> <li>Wear proper PPE (site-specific PPE for this principal step is listed in Section 6.1).</li> </ul>
	Cuts, puncture wounds, pinch points	<ul style="list-style-type: none"> <li>Use work gloves while operating equipment/tools. Be aware of moving and sharp points.</li> </ul>
	Heat or cold stress	<ul style="list-style-type: none"> <li>Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather. During storm water sampling, change to dry clothes as soon as possible.</li> </ul>
	Falling into body of water	<ul style="list-style-type: none"> <li>Stay away from steep, unstable, or wet surfaces. See SWP 6-22.</li> </ul>
6. Label jar, place sample in cooler	Broken sample jar	<ul style="list-style-type: none"> <li>Handle glass jar carefully; dispose of broken glass using a scoop while wearing puncture-resistant gloves. Place broken glass in puncture-resistant container and dispose in proper bin.</li> </ul>
	Pinch points	<ul style="list-style-type: none"> <li>Be careful to remove hands before closing cooler lid.</li> </ul>
	Broken sample jar	<ul style="list-style-type: none"> <li>Handle glass jar carefully; dispose of broken glass using a scoop while wearing puncture-resistant gloves. Place broken glass in puncture-resistant container and dispose in proper bin.</li> </ul>
7. Proceed to next sampling location; collect samples	Cuts, puncture wounds, laceration	<ul style="list-style-type: none"> <li>Use a tape cutter with protective guard; cut (e.g., tape) away from body.</li> </ul>
	See potential hazards steps 1-5	<ul style="list-style-type: none"> <li>See preventative actions steps 1-5.</li> </ul>
8. Repeat task steps 5 through 8 until	See potential hazards steps 5-8	<ul style="list-style-type: none"> <li>See preventative actions step 5 through 8.</li> </ul>

Table 4-2: Task Hazard Analysis (continued)

 <b>TETRA TECH INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Storm and Surface Water Sampling</b>
<b>Task Description</b>		
Transport to and from the site; collection of storm water samples.		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
sampling is finished	Heat exhaustion	<ul style="list-style-type: none"> <li>Monitor own and partner's energy levels, drink water, take regular breaks, ventilate or remove extra layers of clothing, seek shady resting spots.</li> </ul>
9. Dispose of disposable equipment in garbage bag	Exposure to chemicals	<ul style="list-style-type: none"> <li>Wear proper PPE (site-specific PPE for this principle step is listed in Section 6.1).</li> </ul>
10. Cut tape and tape up cooler	Puncture, cuts	<ul style="list-style-type: none"> <li>Use safety scissors if possible; do not run with scissors; use tape dispensers with safety guards; cut tape carefully.</li> </ul>
11. Load cooler onto truck	Pinch points	<ul style="list-style-type: none"> <li>Be careful to remove hands before closing truck bed.</li> </ul>
	Muscle strain	<ul style="list-style-type: none"> <li>Use proper lifting techniques; including bending at the knees and bringing the load close to the body prior to lifting. Use two people if necessary and hand trucks and other lifting aids when possible.</li> </ul>
12. Drive samples to shipping location and unload coolers	See potential hazards steps 1, 2 and 3	<ul style="list-style-type: none"> <li>See preventative actions steps 1, 2 and 3.</li> </ul>
<b>Equipment to be Used</b>	<b>Safety Equipment</b>	<b>Training Requirements</b>
Steel-toed boots, rubber boots, or waders, as appropriate for site conditions Long-sleeved shirt and pants (non-cotton recommended) Safety Glasses Latex or nitrile gloves Leather gloves Personal flotation device (PFD) Support pole	First Aid Kit Eyewash (ANSI Standard Z358.1-2004 or later)	<ul style="list-style-type: none"> <li>40-Hour Hazardous Waste Operations and Emergency Response</li> <li>8-Hour Refresher Course (once per year)</li> <li>CPR and First Aid Training (at least two people on-site)</li> <li>MSDS</li> <li>Dangerous goods shipping</li> </ul>


Approved By/Date:



Date: February 27 2009

**Table 4-2: Task Hazard Analysis (continued)**

**David Brown, Health and Safety Representative, Tetra Tech**

 TETRA TECH EMI INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Groundwater Sampling	
Task Description		
This Activity Hazard Analysis (AHA) applies to collection of grab groundwater samples. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
1. Set up equipment at piezometer or well	Slip/trip/fall	<ul style="list-style-type: none"><li>Visually inspect the area for slippery spots or debris and correct if found</li><li>Wear steel-toed, non-skid boots in accordance with Tetra Tech EMI policy</li></ul>
	Back strain/sprain	<ul style="list-style-type: none"><li>Use proper lifting techniques (lift with legs not back)</li></ul>
2. Measure depth to water	Chemical exposure	<ul style="list-style-type: none"><li>Use PID or FID as indicated in the site-specific APP/HASP to monitor well head and ambient air</li><li>Wear safety glasses and nitrile gloves to protect against splash</li></ul>
3. Measure and insert tube into well	Laceration	<ul style="list-style-type: none"><li>Only use retractable safety blade to cut tubing</li><li>Cut in a direction away from the face/body</li></ul>
4. Begin extracting water from well	Employee exposure	<ul style="list-style-type: none"><li>Use PID or FID as indicated in the site-specific APP/HASP to monitor well head and ambient air</li><li>Wear safety glasses and nitrile gloves</li></ul>

**Table 4-2: Task Hazard Analysis (continued)**



 TETRA TECH EMI INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Groundwater Sampling	
Task Description		
This Activity Hazard Analysis (AHA) applies to collection of grab groundwater samples. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
5. Fill sample bottles with sample material, load coolers and IDW (if appropriate) into vehicle	Laceration	<ul style="list-style-type: none"><li>• Handle all glass containers carefully</li><li>• Have a first aid kit on-site available for small cuts</li><li>• Dispose of all broken shards immediately</li></ul>

Table 4-2: Task Hazard Analysis (continued)

 TETRA TECH EMI INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Groundwater Sampling	
Task Description		
This Activity Hazard Analysis (AHA) applies to collection of grab groundwater samples. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
6. Store sample containers in coolers and load onto vehicles	Slip/trip/fall	<ul style="list-style-type: none"><li>Visually inspect the area for slippery spots or debris and correct if found</li><li>Wear steel-toed, non-skid boots in accordance with Tetra Tech EMI policy</li></ul>
	Back strain/sprain	<ul style="list-style-type: none"><li>Use proper lifting techniques (lift with legs not back)</li></ul>
Equipment to be Used	Inspection Requirements	Training Requirements
Level D PPE (steel-toed boots, safety glasses, nitrile gloves) Reflective safety vest if in areas of vehicle traffic Retractable safety blade First Aid Kit PID or FID	None	<ul style="list-style-type: none"><li>Safe Lifting Procedures</li><li>Personal Protective Equipment</li><li>Hazardous Waste Operations and Emergency Response (40-hour and current 8-hour update)</li><li>CPR/First Aid (one employee on-site must have current CPR/First Aid training)</li></ul>

Approved By/Date:




Date: February 27 2009

David Brown, Health and Safety Representative, Tetra Tech



Table 4-2: Task Hazard Analysis (continued)

 TETRA TECH EMI INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Monitoring Well Installation Oversight	
Task Description		
This Activity Hazard Analysis (AHA) applies to collection of grab groundwater samples. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
1. Identify location for temporary monitoring well	Loss of Lives, Health, and Property	<ul style="list-style-type: none"><li>• Install temporary well only where borehold has been previously drilled by the subcontractor</li><li>• Ensure that utility clearances have been conducted by independent utility clearance subcontractor</li></ul>
2. Assemble well casing and lower into existing borehole	Pinch Points / Crushing Damage	<ul style="list-style-type: none"><li>• Remain alert while assembling the temporary well casing</li><li>• Wear leather work gloves</li></ul>
Equipment to be Used	Inspection Requirements	Training Requirements
<b>Personal Protective Equipment:</b>  Steel Toed Boots  Nitrile Gloves  Safety Glasses  Summa Canister and Pressure Regulator  Safety/Utility Knife  PID or FID	Daily housekeeping inspections (slips, trips, falls; spills; leaks)	<ul style="list-style-type: none"><li>• 40-Hour Hazardous Waste Operations and Emergency Response</li><li>• 8-Hour Refresher Course (once per year)</li><li>• 10-Hour Construction Training</li></ul>

Approved By/Date:

  
**David Brown, Health and Safety Representative, Tetra Tech**

Date: February 27 2009

**Table 4-2: Task Hazard Analysis (continued)**



 TETRA TECH EM INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Active Soil Gas Sampling	
Task Description		
This AHA applies to sampling of soil gas from active soil gas sample boreholes installed by a subcontractor. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
1. Set up sampling equipment at temporary active soil gas borehole	Slips, Trips, and Falls	<ul style="list-style-type: none"><li>• Visually inspect for slick footing</li><li>• Ensure all debris has been removed</li></ul>
	Back Sprains	<ul style="list-style-type: none"><li>• Lift with knees and use proper lifting technique</li><li>• Get help with heavy or awkwardly-shaped loads</li><li>• Limit each lift to no more than 50 pounds per person</li><li>• Use hand trucks and other lifting aids whenever possible</li></ul>
2. Connect all necessary tubing for sample train	Vapors Inhalation	<ul style="list-style-type: none"><li>• Use PID or FID to monitor well head and breathing zone</li></ul>
3. Conduct purge volume calculation and purge test	Vapors Inhalation	<ul style="list-style-type: none"><li>• Use PID or FID to monitor well head and breathing zone</li><li>• Wear Nitrile gloves and safety glasses</li></ul>
4. Place small amount of tracer gas on paper towel and place near drill rod and connections of the sample train	Vapors Inhalation	<ul style="list-style-type: none"><li>• Use PID or FID to monitor well head and breathing zone</li><li>• Wear Nitrile gloves and safety glasses</li></ul>
5. Collect active soil gas sample using a Summa canister. Slowly open Summa canister valve.	Debris in Eyes	
	Vapors Inhalation	
6. Close Summa canister valve when pressure gauge reaches zero. Disconnect Swagelok fitting.	Debris in Eyes	
	Vapors Inhalation	
	Improperly Closed Containers	


Table 4-2: Task Hazard Analysis (continued)

 <b>TETRA TECH EM INC.</b>	<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>	
	<b>Analyzed by: Tetra Tech 01/26/09</b>	
	<b>Active Soil Gas Sampling</b>	
<b>Task Description</b>		
<p>This AHA applies to sampling of soil gas from active soil gas sample boreholes installed by a subcontractor. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.</p>		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
7. Dispose of tubing and other items that cannot be decontaminated properly for use at the next sample location	Slice or Stab Wounds from Cutting Tubing	
<b>Equipment to be Used</b>	<b>Inspection Requirements</b>	<b>Training Requirements</b>
<b>Personal Protective Equipment:</b> Steel Toed Boots Nitrile Gloves Safety Glasses Summa Canister and Pressure Regulator Safety/Utility Knife PID or FID	Daily housekeeping inspections (slips, trips, falls; spills; leaks)	<ul style="list-style-type: none"> <li>• 40-Hour Hazardous Waste Operations and Emergency Response</li> <li>• 8-Hour Refresher Course (once per year)</li> <li>• 10 –Hour Construction Training</li> <li>• Familiarity with Standard Operating Procedures for soil gas sampling</li> </ul>

Approved By/Date:

  
 Date: February 27 2009  
 David Brown, Health and Safety Representative, Tetra Tech

Table 4-2: Task Hazard Analysis (continued)

 TETRA TECH EM INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Active Soil Gas Sampling Borehole Installation Oversight	
Task Description		
This AHA applies to oversight of installation of boreholes that will be used to support active soil gas sample collection. Direct-push drilling will be conducted by the subcontractor to install the rods and tubing necessary to collect a soil gas sample with a Summa canister. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
1. Identify location for active soil gas sample borehole installation	Loss of Lives, Health, and Property	<ul style="list-style-type: none"><li>• Ensure that utility clearances have been conducted by independent utility clearance subcontractor.</li></ul>
2. Subcontracted driller will drive rods into the ground; tubing installed at that time will be used to collect a soil vapor sample	Pinch Points / Crushing Damage	<ul style="list-style-type: none"><li>• Remain alert while assembling the permanent well casing</li><li>• Wear leather work gloves</li></ul>
	Lifting Rod Sections / Crushing and Back Strain	<ul style="list-style-type: none"><li>• Lift with the knees and in pairs</li><li>• Wear steel toe boots</li></ul>
3. Subcontractor will set up appropriate tubing and regulated valve system	Pinch Points	<ul style="list-style-type: none"><li>• Remain alert while assembling the regulator and valve system</li><li>• Wear leather work gloves</li></ul>
4. ChaduxTt will assemble Summa canister to end of valve system (see “Active Soil Gas Sampling” AHA)	Pinch Points	<ul style="list-style-type: none"><li>• Remain alert while assembling the Summa canister to end of valve system</li><li>• Wear leather work gloves, if needed</li></ul>
5. Pull rods from ground and decontaminate rods after soil gas sample is collected	Lifting Rod Sections / Crushing and Back Strain	<ul style="list-style-type: none"><li>• Lift with the knees and in pairs</li><li>• Wear steel toe boots</li></ul>
Equipment to be Used	Inspection Requirements	Training Requirements
<b>Personal Protective Equipment:</b> Steel-toed boots Safety vest Safety glasses Leather work gloves	Daily housekeeping inspections (slips, trips, falls; spills; leaks)	<ul style="list-style-type: none"><li>• 40-Hour Hazardous Waste Operations and Emergency Response</li><li>• 8-Hour Refresher Course (once per year)</li><li>• 10-Hour Construction Training</li></ul>

Approved By/Date:

  
**David Brown, Health and Safety Representative, Tetra Tech**

Date: February 27 2009

Table 4-2: Task Hazard Analysis (continued)


 TETRA TECH EM INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Passive Soil Gas Sampler Installation/Retrieval	
Task Description		
This AHA applies to the installation and retrieval of passive soil gas (PSG) samplers. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
1. Identify borehole location where PSG sampler will be installed	Slips, Trips, and Falls	<ul style="list-style-type: none"><li>Visually inspect open borehole and sampling area for obstructions</li><li>Ensure all debris has been removed</li></ul>
2. Unwind the retrieval wire wrapped around the PSG sampler	Slice Wounds from wire	<ul style="list-style-type: none"><li>Use caution and slowly unwrap wire to avoid cutting fingers</li></ul>
	Debris in Eyes	<ul style="list-style-type: none"><li>Wear Nitrile gloves and safety glasses</li></ul>
3. Remove white solid cap from PSG sampler and replace with black sampling cap (mesh top)	Slice Wounds from Wire	<ul style="list-style-type: none"><li>Use caution when working with vial and extended wire to avoid cutting fingers</li></ul>
4. Lower the PSG sampler with cap-end down into the 1" borehole approximately 8 inches	Pinch Fingers	<ul style="list-style-type: none"><li>Wear Nitrile gloves and safety glasses</li></ul>
5. Tightly place wad of aluminum foil ½-inch below surface and bend wire over the foil to prevent the sampler from falling deep into borehole	Slice Wounds from Wire	<ul style="list-style-type: none"><li>Use caution when bending wire on top of aluminum foil</li></ul>
6. Cover aluminum plug with soils for samplers installed in vegetated or bare soil areas. Cover aluminum plug to grade with ¼-inch concrete patch (no thicker) for PSG samplers installed beneath asphalt or concrete.	Debris in Eyes	<ul style="list-style-type: none"><li>Wear Nitrile gloves and safety glasses</li></ul>
	Dermal Exposure	<ul style="list-style-type: none"><li>Wear Nitrile gloves and safety glasses when working with concrete patch materials</li></ul>
7. Retrieve PSG sampler after exposure of 7 to 14 days below ground surface by removing soils and aluminum plug from borehole.	Slice Wounds from Wire	<ul style="list-style-type: none"><li>Use caution when bending wire on top of aluminum foil</li></ul>
	Debris in Eyes	<ul style="list-style-type: none"><li>Wear Nitrile gloves and safety glasses</li></ul>

Table 4-2: Task Hazard Analysis (continued)



 TETRA TECH EMI INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Passive Soil Gas Sampler Installation/Retrieval	
Task Description		
This AHA applies to the installation and retrieval of passive soil gas (PSG) samplers. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
8. Use chisel and hammer to remove concrete patch to expose aluminum plug, if needed	Pinch Points / Crushing Damage	<ul style="list-style-type: none"><li>• Remain alert while hammering chisel to remove concrete patch</li><li>• Wear leather work gloves and steel toed boots</li></ul>
9. Pull retrieval wire upward to remove PSG sampler from borehole	Broken Glass Wounds from Vials	<ul style="list-style-type: none"><li>• Dispose of all broken shards immediately</li></ul>
	Slice Wounds from Wire	<ul style="list-style-type: none"><li>• Use caution when removing sampler and retrieval wire</li></ul>
10. Using provided wire cutters, cut the retrieval wire completely from the sampler vial	Slice Wounds from Cutting wire	<ul style="list-style-type: none"><li>• Ensure fingers are positioned as far as possible from where wire will be cut</li><li>• Gently use vise grip to hold vial while cutting wire, if necessary</li></ul>
	Broken Glass Wounds from Vials	<ul style="list-style-type: none"><li>• Dispose of all broken shards immediately</li></ul>
11. Replace black sampling cap with white solid cap and prepare for shipment to laboratory.	Broken Glass Wounds from Vials	<ul style="list-style-type: none"><li>• Dispose of all broken shards immediately</li></ul>
12. Backfill open borehole with grout	Slips, Trips, and Falls	<ul style="list-style-type: none"><li>• Ensure all debris has been removed</li></ul>
	Back strains	<ul style="list-style-type: none"><li>• Lift with knees and use proper lifting technique</li><li>• Get help with heavy or awkwardly-shaped loads</li><li>• Limit each lift to no more than 50 pounds per person</li><li>• Use hand trucks and other lifting aids whenever possible</li></ul>

Table 4-2: Task Hazard Analysis (continued)

 TETRA TECH EM INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Passive Soil Gas Sampler Installation/Retrieval	
Task Description		
This AHA applies to the installation and retrieval of passive soil gas (PSG) samplers. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.		
Principle Steps	Potential Hazards	Preventative Actions
Equipment to be Used	Inspection Requirements	Training Requirements
<b>Personal Protective Equipment:</b> Steel-toed boots Nitrile gloves Safety glasses Wire cutters Chisel and hammer PSG samplers	Daily housekeeping inspections (slips, trips, falls; spills; leaks)	<ul style="list-style-type: none"><li>• 40-Hour Hazardous Waste Operations and Emergency Response</li><li>• 8-Hour Refresher Course (once per year)</li><li>• Familiarity with Beacon Standard Operating Procedure for Passive Soil Gas Investigations</li></ul>

Approved By/Date:

  
David Brown, Health and Safety Representative, Tetra Tech

Date: February 27 2009

Table 4-2: Task Hazard Analysis (continued)


 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Indoor Air Sampling</b>
<b>Task Description</b>		
Transport to and from the site; collection of indoor air samples.		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
1. Loading coolers and equipment onto truck	Pinch Points	<ul style="list-style-type: none"> <li>Use caution when loading equipment and be careful to remove all extremities before closing the truck bed door.</li> </ul>
	Muscle Strain	<ul style="list-style-type: none"> <li>Use proper lifting techniques; including bending at the knees and bringing the load close to the body prior to lifting. Use two people if necessary and hand trucks and other lifting aids when possible.</li> </ul>
2. Vehicle operation driving to and from job site	Collision with other vehicles	<ul style="list-style-type: none"> <li>Be alert and exercise defensive driving techniques; do not use cell phones while driving unless a hands-free device is also used; drive according to posted speed limits, environment, and road conditions; wear seat belts when driving or riding in vehicle.</li> </ul>
	Poor road conditions and weather conditions	<ul style="list-style-type: none"> <li>Adjust driving speed to compensate for road and surface conditions; reduce speed to prevent hydroplaning on wet road surfaces; allow additional driving time or reschedule trips during severe weather.</li> </ul>
3. Parking at site	Truck roll or truck runaway	<ul style="list-style-type: none"> <li>Put truck in park and secure parking brake.</li> </ul>
	Vehicle traffic	<ul style="list-style-type: none"> <li>Park in designated parking area or at safe distance from roads. Use traffic cones if parking on road or shoulder. Check oncoming traffic before opening door and getting in/out from vehicle; use door away from vehicle traffic if possible. Do not congregate on roads.</li> </ul>
	Pinch points	<ul style="list-style-type: none"> <li>Ensure the doorway is clear before closing; close the vehicle doors slowly.</li> </ul>



Table 4-2: Task Hazard Analysis (continued)


 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		<b>Analyzed by: Tetra Tech 01/26/09</b>
		<b>Indoor Air Sampling</b>
<b>Task Description</b>		
Transport to and from the site; collection of indoor air samples.		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
4. Walk to sampling location	Trip, slip and fall	<ul style="list-style-type: none"> <li>Look for uneven ground, cracks, and potholes while walking; be careful to step around burrowed holes; step around debris on site; check for unstable surfaces to prevent falling in.</li> </ul>
	Biological hazards: vermin, bees, ticks, snakes, feral animals, plant (e.g., thistle) thorns	<ul style="list-style-type: none"> <li>Do not approach animals; employees with allergies to bee stings, etc. should have proper medication with them at all times; tuck pant legs into socks; training for recognition of poisonous snakes and spiders for the site area will be obtained prior to site mobilization activities; wear long pants (and long sleeves if possible) and insect repellent. Keep a first aid kit with antihistamines at all times.</li> </ul>
	Fire hazards from dry grass	<ul style="list-style-type: none"> <li>Do not smoke on site.</li> </ul>
	Unoccupied buildings	<ul style="list-style-type: none"> <li>Check with RFS maintenance prior to accessing unoccupied buildings. Always use buddy system. Request RFS staff for escort if possible. Inspect for hazards (rodents, criminal activity, friable asbestos etc.). Familiarize with exit points. See SWP 6-7.</li> </ul>
	Elevated surfaces	<ul style="list-style-type: none"> <li>Assess fall protection requirement. See SWP-6-9</li> </ul>
	Vehicle traffic	<ul style="list-style-type: none"> <li>Be aware of vehicles; cross roads carefully. Wear safety vests.</li> </ul>
	Inclement weather	<ul style="list-style-type: none"> <li>Check weather conditions prior to mobilization. Wear proper PPE and implement AHA for working under poor weather conditions.</li> </ul>
5. Collect air samples.	Exposure to chemicals	<ul style="list-style-type: none"> <li>Wear proper PPE (site-specific PPE for this principle step is listed in 6.1). Clearly mark filled and empty sampling containers to avoid accidentally opening samples.</li> </ul>
	Struck by equipment or tools	<ul style="list-style-type: none"> <li>Stay at a safe distance from operator using equipment/tool. Place equipment/tool away from people when not in use and notify them of its location. Clearly mark and secure sampling equipment in occupied spaces. Use safety boots.</li> </ul>
	Back strain	<ul style="list-style-type: none"> <li>Use correct posture, bending techniques, and proper lifting procedures.</li> </ul>

Table 4-2: Task Hazard Analysis (continued)



 TETRA TECH EMI INC.		UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
		Analyzed by: Tetra Tech 01/26/09	
		Indoor Air Sampling	
Task Description			
Transport to and from the site; collection of indoor air samples.			
Principle Steps	Potential Hazards	Preventative Actions	
5. Collect air samples (Con't)	Cuts, puncture wounds, pinch points	<ul style="list-style-type: none"><li>Use work gloves while operating equipment/tool. Be aware of moving and sharp parts.</li></ul>	
	Heat or cold stress	<ul style="list-style-type: none"><li>Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather.</li></ul>	
	Electrocution	<ul style="list-style-type: none"><li>Read voltage requirements for equipment to be used. Inspect electrical outlets, extension cords, equipment and electrical cords and plugs prior to using. Use safety precautions when working with electrical equipment.</li></ul>	
6. Label containers, place sample in cooler	Pinch Points	<ul style="list-style-type: none"><li>Be careful to remove hands before closing sampling ports, pelican cases and cooler lid.</li></ul>	
	Air pressure	<ul style="list-style-type: none"><li>Monitor pressure gauge; slowly open and close ports/vents; do not overtighten sampling ports</li></ul>	
	Cuts, puncture wounds, laceration	<ul style="list-style-type: none"><li>Use a tape cutter with protective guard; cut (e.g., tape) away from body. Use safety scissors if possible; do not run with scissors; cut tape carefully.</li></ul>	
7. Walk to next sampling location; collect samples	See potential hazards steps 5	<ul style="list-style-type: none"><li>See preventative actions step 5.</li></ul>	
8. Repeat task steps 5 through 8 until sampling is finished	See potential hazards steps 5-8	<ul style="list-style-type: none"><li>See preventative actions step 5 through 8.</li></ul>	
	Heat exhaustion	<ul style="list-style-type: none"><li>Monitor own and partner's energy levels, drink water, take regular breaks, and seek shady resting spots.</li></ul>	
9. Walk back to truck	See potential hazards step 5	<ul style="list-style-type: none"><li>See preventative actions step 5.</li></ul>	

Table 4-2: Task Hazard Analysis (continued)

 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		Analyzed by: Tetra Tech 01/26/09
		<b>Indoor Air Sampling</b>
<b>Task Description</b>		
Transport to and from the site; collection of indoor air samples.		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
10. Dispose of disposable equipment in garbage bag	Exposure to chemicals	<ul style="list-style-type: none"> <li>Wear proper PPE (site-specific PPE for this principle step is listed in Section 6.1).</li> </ul>
11. Load sample containers, equipment and cooler onto truck	Pinch Points	<ul style="list-style-type: none"> <li>Be careful to remove hands before closing truck bed.</li> </ul>
	Muscle Strain	<ul style="list-style-type: none"> <li>Use proper lifting techniques; including bending at the knees and bringing the load close to the body prior to lifting. Use two people if necessary and hand trucks and other lifting aids when possible.</li> </ul>
12. Drive samples to shipping location and unload coolers	See potential hazards steps 1, 2 and 3	<ul style="list-style-type: none"> <li>See preventative actions steps 1, 2 and 3.</li> </ul>
<b>Equipment to be Used</b>	<b>Safety Equipment</b>	<b>Training Requirements</b>
<b>Personal Protective Equipment</b> Steel-toed boots Work gloves (e.g., leather) Chemical-resistant gloves Long-sleeved shirt and pants Safety glasses	First Aid Kit Eyewash (ANSI Standard Z358.1-2004 or later)	<ul style="list-style-type: none"> <li>40-Hour Hazardous Waste Operations and Emergency Response</li> <li>8-Hour Refresher Course (once per year)</li> <li>CPR and First Aid Training (at least two people on-site)</li> <li>MSDS</li> <li>Dangerous goods shipping</li> </ul>

Approved By/Date:

  
**David Brown, Health and Safety Representative, Tetra Tech**

Date: February 27 2009

**Table 4-2: Task Hazard Analysis (continued)**



 <b>TETRA TECH EMI INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		<b>Analyzed by: Tetra Tech 01/26/09</b>
		<b>Vegetation Restoration</b>
<b>Task Description</b>		
<p>This Activity Hazard Analysis (AHA) applies to vegetation restoration. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.</p>		
<b>Task Steps</b>	<b>Potential Hazards</b>	<b>Critical Safety Procedures and Controls</b>
1. Collect seeds from native plants	Exposure to Poison Oak	<ul style="list-style-type: none"> <li>Visually inspect the area for poison oak and avoid the area if growing nearby</li> <li>Immediately wash exposed skin with Technu brand poison oak wash</li> </ul>
	Insect Stings	<ul style="list-style-type: none"> <li>Visually inspect the area for yellow jackets or other stinging insects and avoid the area if any are nearby</li> </ul>
2. Propagate native plants in the nursery	Back Strain/Sprain	<ul style="list-style-type: none"> <li>Use proper lifting techniques when moving nursery flats</li> </ul>
	Slip/Trip/Fall	<ul style="list-style-type: none"> <li>Wear non-skid boots in accordance with Tetra Tech EMI policy</li> <li>Use caution when greenhouse floor is wet</li> </ul>
3. Control weeds on nursery grounds		<ul style="list-style-type: none"> <li>Wear nitrile gloves and safety glasses when spraying herbicide on weeds</li> </ul>
4. Planting or hand weeding in upland soils	Back Strain/ Repetitive Motion Strain	<ul style="list-style-type: none"> <li>Take breaks and stretch.</li> <li>Use hand tools in an ergonomic manner.</li> </ul>
	Slip/Trip/Fall	<ul style="list-style-type: none"> <li>Wear non-skid boots in accordance with Tetra Tech EMI policy</li> <li>Visually inspect the area for slippery spots or debris and correct if found</li> </ul>
5. Planting or hand weeding in tidal marsh sediments	Employee Exposure	<ul style="list-style-type: none"> <li>Wear nitrile gloves and rubber boots when working in tidal sediments</li> <li>Avoid touching exposed skin with muddy tools or gloves</li> <li>Dispose of gloves in the trash and wash boots and tools when finished</li> </ul>

Table 4-2: Task Hazard Analysis (continued)

 TETRA TECH EMI INC.		UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
		Analyzed by: Tetra Tech 01/26/09	
		Vegetation Restoration	
Task Description			
This Activity Hazard Analysis (AHA) applies to vegetation restoration. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.			
Task Steps	Potential Hazards	Critical Safety Procedures and Controls	
6. Mulching restoration plots with straw	Laceration	<ul style="list-style-type: none"><li>Only use retractable safety blade to cut rope binding straw bales</li><li>Cut in a direction away from the face/body</li></ul>	
	Back Strain/Sprain	<ul style="list-style-type: none"><li>Use proper lifting techniques and obtain help when moving straw bales</li></ul>	
7. Controlling weeds with a flame produced by a propane torch (a.k.a Blanching or Flaming)	Burns	<ul style="list-style-type: none"><li>Wear safety glasses, leather boots, and leather gloves</li></ul>	
	Fire	<ul style="list-style-type: none"><li>Use procedure only when raining or when the ground is very wet and when winds do not exceed 15 mph</li><li>Always have hose ready to put out a fire</li></ul>	
Equipment to be Used	Inspection Requirements	Training Requirements	
Level D PPE (non-skid boots, safety glasses, nitrile gloves, leather gloves) Retractable safety blade First Aid Kit	None	<ul style="list-style-type: none"><li>Safe Lifting Procedures</li><li>Personal Protective Equipment</li><li>Hazardous Waste Operations and Emergency Response (40-hour and current 8-hour update)</li><li>CPR/First Aid (one employee on-site must have current CPR/First Aid training)</li></ul>	

Approved By/Date:

  
**David Brown, Health and Safety Representative, Tetra Tech**

Date: February 27 2009

Table 4-2: Task Hazard Analysis (continued)


 <b>TETRA TECH EM INC.</b>	<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>	
	<b>Analyzed by: Tetra Tech 01/26/09</b>	
	<b>Waste Management, Decontamination and Disposal</b>	
<b>Task Description</b>		
Disposal of investigation derived waste offsite at an appropriate disposal facility.		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
1. Loading debris or contaminated soil into trucks for off haul to an appropriate offsite waste facility	Heavy equipment operation	Only trained equipment operators should operate equipment, inspect heavy equipment daily, ensure equipment has backup alarms and that they can be heard using hearing protection, always use a spotter, make sure the operator can see you if walking around equipment.
	Vehicular traffic	Wear reflective safety vests when near or in roadways; utilize flagger for traffic control if necessary; use hand signals when necessary; always use a spotter to guide the truck and avoid hitting stationary objects; keep clear of loading area.
	Dust	Minimize dust generation by keeping drop heights to a minimum; utilize dust suppression (spraying water) as needed; cover stockpiles with 6 mil polyethylene sheeting; monitor with a mini-Ram upwind and downwind for fugitive dust. Use respirators if action level (50 micrograms per cubic meter) is exceeded.
	Exposure to chemicals	Wear proper PPE (site-specific PPE for this principle step is listed in Section 6.1).
	Pinch points	Wear gloves while operating equipment; use the proper tool to complete the job. Keep clear of moving parts.
	Heat/cold stress	Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather; use the buddy system to monitor co-workers with verbal verifications.

Table 4-2: Task Hazard Analysis (continued)


 TETRA TECH EM INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Waste Management, Decontamination and Disposal	
Task Description		
Disposal of investigation derived waste offsite at an appropriate disposal facility.		
Principle Steps	Potential Hazards	Preventative Actions
1. Loading debris or contaminated soil into trucks for off haul to an appropriate offsite waste facility (Con't)	Trip, slip and fall	Look for uneven ground and potholes while walking; be careful to step around burrowed holes; perform good housekeeping daily to remove slip, trip and fall hazards.
	Biological hazards: vermin, bees, ticks, snakes, feral animals, plant (e.g., thistle) thorns	Do not approach animals; employees with allergies to bee stings, etc. should have proper medication with them at all times; tuck pant legs into socks; training for recognition of poisonous snakes and spiders for the site area will be obtained prior to site mobilization activities; wear long pants (and long sleeves if possible) and insect repellent. Keep a first aid kit with antihistamines at all times.
	Noise	Use hearing protection if noise exceeds 85 dBA.
2. Decontaminate trucks and equipment	Exposure to chemicals and decontamination chemical solution	Wear proper PPE (site-specific PPE for this principle step is listed in Section 6.1).
	Dust generation (dry decontamination)	Minimize dust generation by keeping drop heights to a minimum; utilize dust suppression (spraying water) as needed; cover stockpiles with 6 mil polyethylene sheeting; monitor with a mini-Ram upwind and downwind for fugitive dust. Use respirators if action level (50 micrograms per cubic meter) is exceeded.
	Liquid spills	Line areas with 6 mil polyethylene sheeting prior to draining. Berm the area using straw wattles, sand bags, or other similar supplies. Containerize drained liquids in bermed area. Let dry or transfer into a drum or poly tank until proper disposal can be arranged.

Table 4-2: Task Hazard Analysis (continued)

 TETRA TECH EM INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Waste Management, Decontamination and Disposal	
Task Description		
Disposal of investigation derived waste offsite at an appropriate disposal facility.		
Principle Steps	Potential Hazards	Preventative Actions
<u>Personal Protective Equipment:</u> Steel Toed Boots Chemical-Resistant Gloves Long-sleeved shirt and pants Safety Glasses Hard hat Safety vest Half-face respirator (as needed) Hearing protection (e.g., ear plugs)	<u>Safety Equipment:</u> Fire Extinguisher Eyewash Station (ANSI Standard Z358.1-2004 or later) First Aid Kit Mini-Ram dust monitor (calibrate daily)	<u>Training Requirements:</u> 40 Hour Hazardous Waste Operations and Emergency Response 8 Hour Refresher Course (once per year) CPR and First Aid Training (at least two people on-site) Respirator fit test & training (if applicable) DOT's HM-126F regulations Title 40 CFR § 265.16 Equipment operator training/license

Approved By/Date:

  
David Brown, Health and Safety Representative, Tetra Tech

Date: February 27 2009



Table 4-2: Task Hazard Analysis (continued)


 TETRA TECH EM INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Demobilization	
Task Description		
Demobilize equipment, supplies, material and personnel from the site.		
Principle Steps	Potential Hazards	Preventative Actions
1. Break down equipment stations, temporary fencing, traffic controls, and work zones (if applicable)	Pinch points	Wear gloves while operating equipment; use the proper tool to complete the job. Keep clear of moving parts.
	Heat/cold stress	Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather; use the buddy system to monitor co-workers with verbal verifications.
	Trip, slip and fall	Look for uneven ground, cracks, and potholes while walking; be careful to step around burrowed holes; perform good housekeeping daily to remove slip, trip and fall hazards.
	Vehicular traffic	Wear reflective safety vests when near or in roadways; utilize flagger for traffic control if necessary; use hand signals when necessary; always use a spotter to guide the truck and avoid hitting stationary objects; keep clear of loading area.
2. Clean-up materials and sweep areas	See potential hazards for step 1.	See preventative actions for step 1.
	Vehicular traffic	Wear reflective safety vests when near or in roadways; utilize flagger for traffic control if necessary; use hand signals when necessary; always use a spotter to guide the truck and avoid hitting stationary objects; keep clear of loading area.
2. Clean-up materials and sweep areas (Con't)	Exposure to chemicals	Wear proper PPE (site-specific PPE for this principle step is listed in Section 6.1).

Table 4-2: Task Hazard Analysis (continued)



 <b>TETRA TECH EM INC.</b>		<b>UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)</b>
		<b>Analyzed by: Tetra Tech 01/26/09</b>
		<b>Demobilization</b>
<b>Task Description</b>		
Demobilize equipment, supplies, material and personnel from the site.		
<b>Principle Steps</b>	<b>Potential Hazards</b>	<b>Preventative Actions</b>
3. Loading equipment and supplies into trucks	Pinch points	Be careful to remove hands before closing truck bed or doors; use the proper tool to complete the job. Keep clear of moving parts.
	Heat/cold stress	Follow proper procedures for minimizing heat stress, such as drinking adequate amounts of water, reducing outerwear and taking appropriate breaks in a shaded area. For cold stress, don additional layers of clothing and seek shelter from wind and weather; use the buddy system to monitor co-workers with verbal verifications.
	Trip, slip and fall	Look for uneven ground, cracks, and potholes while walking; be careful to step around burrowed holes; perform good housekeeping daily to remove slip, trip and fall hazards.
	Biological hazards: vermin, bees, ticks, snakes, feral animals, plant (e.g., thistle) thorns	Do not approach animals; employees with allergies to bee stings, etc. should have proper medication with them at all times; tuck pant legs into socks; training for recognition of poisonous snakes and spiders for the site area will be obtained prior to site mobilization activities; wear long pants (and long sleeves if possible) and insect repellant. Keep a first aid kit with antihistamines at all times.
	Noise	Use hearing protection if noise exceeds 85 dBA.

Table 4-2: Task Hazard Analysis (continued)

 TETRA TECH EM INC.	UCB-RFS ACTIVITY HAZARD ANALYSIS (AHA)	
	Analyzed by: Tetra Tech 01/26/09	
	Demobilization	
Task Description		
Demobilize equipment, supplies, material and personnel from the site.		
Principle Steps	Potential Hazards	Preventative Actions
<u>Personal Protective Equipment:</u> Steel Toed Boots Chemical-Resistant Gloves Long-sleeved shirt and pants Safety Glasses Hard hat Safety vest Hearing protection (e.g., ear plugs)	<u>Safety Equipment:</u> Fire Extinguisher Eyewash Station (ANSI Standard Z358.1-2004 or later) First Aid Kit	<u>Training Requirements:</u> 40 Hour Hazardous Waste Operations and Emergency Response 8 Hour Refresher Course (once per year) CPR and First Aid Training (at least two people on-site)

Approved By/Date:

  
**David Brown, Health and Safety Representative, Tetra Tech**

Date: February 27 2009

## 4.2 PHYSICAL HAZARDS

Physical hazards associated with site activities present a potential threat to on-site personnel. Dangers are posed by heavy equipment, utility and power lines, slippery surfaces, unseen obstacles, noise, heat, cold, and poor illumination.

Injuries may result, for example, from the following:

- Accidents caused by slipping, tripping, or falling
- Use of improper lifting techniques
- Moving or rotating equipment
- Equipment mobilization and operation (such as electrocution from contact with overhead or underground power lines)
- Improperly maintained equipment

Injuries resulting from physical hazards can be avoided by using safe work practices (SWP) and employing caution when working with machinery (SWP 6-26). Specific SWPs applicable to the RFS site are listed in [Section 9.5](#) and are provided in [Appendix B-2](#) of this HSP. To ensure a safe workplace, the SSC will conduct and document regular safety inspections and will make sure that all Tetra Tech workers and visitors are informed of any potential physical hazards related to the site. Physical hazards that have been identified at this site include the following:

- Slip/trip/fall
- Terrain (marsh, slopes, potholes, etc.)
- Inclement weather
- Wet, steep, or uneven surfaces
- Falling into body of water/drowning
- Temperature (heat/cold)
- Animal/insect bites
- Equipment and tools
- Vehicles
- Utility and power lines

- Poor illumination (although all activities will be conducted during daylight hours, and when conducted within buildings, proper illumination will be provided in accordance with the requirements of 8 CCR 51 92(m))

## 5.0 TRAINING REQUIREMENTS

All on-site personnel who may be exposed to hazardous conditions, including Tetra Tech and subcontractor personnel and site visitors who will participate in on-site activities, will be required to meet training requirements outlined in 29 CFR 1910.120, “Hazardous Waste Operations and Emergency Response,” and compliant with the 8 CCR 51 92(e). All personnel and visitors entering the site will be required to review this HSP and sign the Compliance Agreement form (Form HSP-4), and site workers will be required to sign the Daily Tailgate Safety Meeting form (Form HST-2) (see [Appendix B-1](#)).

Before on-site activities begin, the Tetra Tech SSC will present a briefing for all personnel who will participate in on-site activities. The following topics will be addressed during the prework briefing:

- Names of the SSC and the designated alternate
- Site history
- Work tasks
- Hazardous chemicals that may be encountered on site
- Physical hazards that may be encountered on site
- PPE, including type or types of respiratory protection to be used for work tasks
- Training requirements
- Environmental surveillance (air monitoring) equipment use and maintenance
- Action levels and situations requiring upgrade or downgrade of level of protection
- Site control measures, including site communications, control zones, and SWPs
- Decontamination procedures
- Emergency communication signals and codes
- Environmental accident emergency procedures (in case contamination spreads outside the exclusion zone)
- Personnel exposure and accident emergency procedures (in case of falls, exposure to hazardous substances, and other hazardous situations)
- Fire and explosion emergency procedures
- Emergency telephone numbers
- Emergency routes



Any other health and safety-related issues that may arise before on-site activities begin will also be discussed during the prework briefing.

Issues that arise during implementation of on-site activities will be addressed during tailgate safety meetings to be held daily before the workday or shift begins and will be documented in the Daily Tailgate Safety Meeting form (Form HST-2 in [Appendix B-1](#)). Any changes in procedures or site-specific health and safety-related matters will be addressed during these meetings.

## **6.0 PERSONAL PROTECTION REQUIREMENTS**

The levels of personal protection to be used for work tasks at the RFS site have been selected based on known or anticipated physical hazards; types and concentrations of contaminants that may be encountered on site; and contaminant properties, toxicity, exposure routes, and matrices. The following sections describe protective equipment and clothing; reassessment of protection levels; limitations of protective clothing; and respirator selection, use, and maintenance.

### **6.1 PROTECTIVE EQUIPMENT AND CLOTHING**

Personnel will wear protective equipment when: (1) site activities involve known or suspected atmospheric contamination; (2) site activities may generate vapors, gases, or particulates; or (3) direct contact with hazardous materials may occur. The anticipated levels of protection selected for use by field personnel during site activities are listed in Table 4-2, Activity Hazard Analysis. Based on the anticipated hazard level, personnel will initially perform field tasks in Level D protection. If site conditions or the results of air monitoring performed during on-site activities warrant a higher level of protection, all field personnel will withdraw from the site, immediately notify the Tetra Tech SSC, and wait for further instructions. This PPE program is in accordance with 8 CCR 5192(g). Descriptions of equipment and clothing required for Level D, Level C, and Level B protection are provided below.

- Level D
  - Coveralls or work clothes, if applicable
  - Chemical-resistant clothing (such as Tyvek® or Saranex® coveralls)(optional)
  - Outer gloves (neoprene, nitrile, or other), if applicable
  - Disposable inner gloves (such as latex or vinyl)(optional)
  - Boots with steel-toe protection and steel shanks
  - Disposable boot covers or chemical-resistant outer boots (optional)
  - Safety glasses or goggles
  - Hard hat (face shield optional)
  - Hearing protection (for areas with a noise level exceeding 85 decibels on the A-weighted scale)
- Level C
  - Coveralls or work clothes, if applicable
  - Chemical-resistant clothing (such as Tyvek® or Saranex® coveralls)

- Outer gloves (neoprene, nitrile, or other), if applicable
  - Disposable inner gloves (latex or vinyl)
  - Boots with steel-toe protection and steel shanks
  - Disposable boot covers or chemical-resistant outer boots
  - Full- or half-face, air-purifying respirator with National Institute for Occupational Safety and Health (NIOSH)-approved cartridges to protect against organic vapors, dust, fumes, and mists (cartridges used for gas and vapors must be replaced in accordance with the change-out schedule described in the Respiratory Hazard Assessment form [Form RP-2] in [Appendix B-3](#))
  - Safety glasses or goggles (with a half-face respirator only)
  - Hard hat (face shield optional)
  - Hearing protection (for areas with a noise level exceeding 85 decibels on the A-weighted scale)
- Level B
    - Chemical-resistant clothing (such as Tyvek® or Saranex® coveralls)
    - Outer gloves (neoprene, nitrile, or other)
    - Disposable inner gloves (latex or vinyl)
    - Boots with steel-toe protection and steel shanks
    - Disposable boot covers or chemical-resistant outer boots
    - NIOSH-approved, pressure-demand airline respirator with a 5-minute escape cylinder or self-contained breathing apparatus (SCBA)
    - Hard hat (face shield optional)
    - Hearing protection (for areas with a noise level exceeding 85 decibels on the A-weighted scale)

## 6.2 REASSESSMENT OF PROTECTION LEVELS

PPE levels shall be upgraded or downgraded based on a change in site conditions or investigation findings. When a significant change in site conditions occurs, hazards will be reassessed. Some indicators of the need for reassessment are as follows:

- Commencement of a new work phase, such as the start of a significantly different sampling activity or work that begins on a different portion of the site
- A change in job tasks during a work phase
- A change of season or weather
- Temperature extremes or individual medical considerations limiting the effectiveness of PPE
- Discovery of contaminants other than those previously identified
- A change in ambient levels of airborne contaminants (see the action levels listed in Table 8-1)
- A change in work scope that affects the degree of contact with contaminated media

### **6.3 LIMITATIONS OF PROTECTIVE CLOTHING**

PPE clothing ensembles designated for use during site activities have been selected to provide protection against contaminants at known or anticipated on-site concentrations and physical states. However, no protective garment, glove, or boot is entirely chemical-resistant, nor does any protective clothing provide protection against all types of chemicals. Permeation of a given chemical through PPE depends on the contaminant concentration, environmental conditions, physical condition of the protective garment, and resistance of the garment to the specific contaminant. Chemical permeation may continue even after the source of contamination has been removed from the garment.

All site personnel will use the procedures presented below to obtain optimum performance from PPE.

- When chemical-protective coveralls become contaminated, don a new, clean garment after each rest break or at the beginning of each shift.
- Inspect all clothing, gloves, and boots both before and during use for the following:
  - Imperfect seams
  - Nonuniform coatings
  - Tears
  - Poorly functioning closures
- Inspect reusable garments, boots, and gloves both before and during use for visible signs of chemical permeation, such as the following:
  - Swelling

- Discoloration
- Stiffness
- Brittleness
- Cracks
- Any sign of puncture
- Any sign of abrasion

Reusable gloves, boots, or coveralls exhibiting any of the characteristics listed above must be discarded. Reusable PPE will be decontaminated in accordance with procedures described in [Section 10.0](#) and will be neatly stored in the support zone away from work zones.

#### **6.4 RESPIRATOR SELECTION, USE, AND MAINTENANCE**

Tetra Tech and subcontractor personnel will be informed of the proper use, maintenance, and limitations of respirators during annual health and safety refresher training and the prework briefing. Any on-site personnel who will use a tight-fitting respirator must pass a qualitative fit test for the respirator that follows the fit testing protocol provided in [Appendix B-1](#) of the OSHA respirator standard (29 CFR 1910.134). Fit testing must be repeated annually or when a new type of respirator is used.

Respirator selection is based on the assessment of the nature and extent of hazardous atmospheres anticipated during field activities. This assessment includes a reasonable estimate of employee exposure to respiratory hazards and identification of each contaminant's anticipated chemical form and physical state.

For each work task requiring respirator use at the RFS site, a respiratory hazard assessment will be conducted. The results of this assessment are documented in the Respiratory Hazard Assessment form (Form RP-2), which has been approved by the HSR. The completed Form RP-2 is included in [Appendix B-3](#) and defines respiratory protection requirements for the project. Amendments to this HSP and to Form RP-2 will be discussed during daily tailgate safety meetings.

When the atmospheric contaminant is an identified gas or vapor and its concentration is known or can be reasonably estimated, respiratory protection options include the following:

- An atmosphere-supplying respirator (air-line or SCBA)
- An air-purifying respirator equipped with a NIOSH-certified, end-of-service-life indicator (ESLI) for the identified contaminant. If no ESLI is available, a change-out schedule for cartridges must be developed based on objective data or information. Respirator cartridge selection and change-out schedules will be evaluated by the HSR at the time of the respiratory hazard assessment. The Respiratory Hazard Assessment,

Form RP-2, will describe the information and data used as the basis for the cartridge change-out schedule and the proposed change schedule.

For protection against particulate contaminants, approved respirators can include the following:

- An atmosphere-supplying respirator
- A respirator equipped with a filter certified by NIOSH under 32 CFR Part 11 or 42 CFR Part 84 as a P100 filter (formerly known as a high-efficiency particulate [HEPA] air filter)

For any tasks performed in Level C PPE, a full- or half-face, air-purifying respirator equipped with NIOSH-approved cartridges or filters will be selected to protect against vapors, gases, and aerosols.

Air-purifying respirators will be used only in conjunction with breathing-space air monitoring, which must be conducted in adherence to the action levels outlined in Table 8-1. Air-purifying respirators will be used only when they can provide protection against the substances encountered on site.

Factors precluding use of Level C and air-purifying respirators are as follows:

- Oxygen-deficient atmosphere (less than 19.5 percent oxygen)
- Concentrations of substances that may be immediately dangerous to life and health
- Confined or unventilated areas that may contain airborne contaminants not yet characterized
- Unknown contaminant concentrations or concentrations that may exceed the maximum use levels for designated cartridges documented in the selected cartridge manufacturer's instructions
- Unidentified contaminants
- High relative humidity (more than 85 percent), which reduces the sorbent life of the cartridges
- Respirator cartridges with an undetermined service life

Use, cleaning, and maintenance of respirators are described in SWP 6-27, Respirator Cleaning Procedures, and SWP 6-28, Safe Work Practices for Use of Respirators. These SWPs are included in [Appendix B-2](#).

## **7.0 MEDICAL SURVEILLANCE**

The following sections describe Tetra Tech's medical surveillance program, including health monitoring requirements, site-specific medical monitoring, and medical support and follow-up requirements. Procedures documented in these sections will be followed for all activities at the RFS site. Additional requirements are defined in the Tetra Tech, Inc., "Health and Safety Manual."

### **7.1 HEALTH MONITORING REQUIREMENTS**

All Tetra Tech and subcontractor personnel involved in on-site activities at the RFS site must participate in a health monitoring program as required by 29 CFR 1910.120(f) and compliant with 8 CCR 51 92(f). Tetra Tech has established a health monitoring program with WorkCare, Inc., of Orange, California. Under this program, Tetra Tech personnel receive baseline and annual or biennial physical examinations consisting of the following:

- Complete medical and work history
- Physical examination
- Vision screening
- Audiometric screening
- Pulmonary function test
- Resting electrocardiogram
- Chest x-ray (required once every 3 years)
- Blood chemistry, including hematology and serum
- Urinalysis

For each employee, Tetra Tech receives a copy of the examining physician's written opinion after post-examination laboratory tests have been completed; the Tetra Tech employee also receives a copy of the written opinion. This opinion includes the following information (in accordance with 29 CFR 1910.120[f][7]):

- The results of the medical examination and tests
- The physician's opinion as to whether the employee has any medical conditions that would place the employee at an increased risk of health impairment from work involving hazardous waste operations or during an emergency response



- The physician's recommended limitations, if any, on the employee's assigned work; special emphasis is placed on fitness for duty, including the ability to wear any required PPE under conditions expected on site (for example, temperature extremes)
- A statement that the employee has been informed by the physician of the medical examination results and of any medical conditions that require further examination or treatment

All subcontractors must have health monitoring programs conducted by their own clinics in compliance with 29 CFR 1910.120(f). Any visitor or observer at the site will be required to provide records in compliance with 29 CFR 1910.120(f) before entering the site.

## **7.2 SITE-SPECIFIC MEDICAL MONITORING**

Site-specific medical monitoring is not required for tasks at RFS.

## **7.3 MEDICAL SUPPORT AND FOLLOW-UP REQUIREMENTS**

As a follow-up to an injury requiring care beyond basic first aid or to possible exposure above established exposure limits, all employees are entitled to and encouraged to seek medical attention and physical testing. Such injuries and exposures must be reported to the HSR. Depending on the type of injury or exposure, follow-up testing, if required, must be performed within 24 to 48 hours of the incident. It will be the responsibility of the employer's medical consultant to advise the type of test required to accurately monitor for exposure effects. The Accident and Illness Investigation Report (Form AR-1 in [Appendix B-1](#)) must be completed by the Tetra Tech SSC in the event of an accident, illness, or injury. A copy of this form must be forwarded to the HSR for use in determining the recordability of the incident and for inclusion in Tetra Tech's medical surveillance records.

## **8.0 ENVIRONMENTAL MONITORING AND SAMPLING**

Environmental monitoring or sampling will be conducted to assess personnel exposure levels as well as site or ambient conditions and to determine appropriate levels of PPE for work tasks. The following sections discuss initial and background air monitoring, personal monitoring, ambient air monitoring, monitoring parameters and devices, use and maintenance of survey equipment, thermal stress monitoring, and noise monitoring. General air monitoring requirements and action levels are provided in Table 8-1. HSP addendum will include site-specific action levels and chemicals of concern as well as specifications for monitoring instruments selected for the projects.

### **8.1 INITIAL AND BACKGROUND AIR MONITORING**

Initial air monitoring of the work area will be performed before a work task begins. This monitoring will be performed using real-time field survey instrumentation. Air will also be monitored at the beginning of each workday to identify any potentially hazardous situation that might have developed during off-shift periods.

Operations at the site may result in variable background levels of airborne compounds. Airborne compounds may be released from vehicles, blowing dust, material transfers, and so on. These sources can complicate evaluation of contaminant emissions during project tasks. Therefore, several upwind and prework measurements will be taken to assess contributions to airborne contamination by other potential sources.

### **8.2 PERSONAL MONITORING**

The employees working closest to a source of contamination have the highest likelihood of exposure to airborne contaminant concentrations that may exceed established exposure limits. Therefore, selective monitoring of the workers who are closest to a source of contaminant generation will be conducted during site activities. Personal monitoring shall be conducted in the breathing zone and, if a worker is wearing respiratory protective equipment, outside the face piece.

**Table 8-1 Site-Specific Air Monitoring Requirements and Action Levels**

Chemical or Hazard	Task	Monitoring Device	Action Level	Monitoring Frequency	Action
Organic vapors	Collection of soil samples	PID model: <input type="checkbox"/> 11.7 eV <input checked="" type="checkbox"/> 10.6 eV <input type="checkbox"/> 10.2 eV <input type="checkbox"/> 9.8 eV <input type="checkbox"/> _____ eV	Background to 5 ppm	Every 30 to 60 minutes	Use Level D PPE
			5 to 100 ppm	Every 30 minutes <sup>1</sup>	Use Level C PPE (unless chlordane is detected and evaluated using personal air sampling)
			> 100 ppm	NA	Stop work, evacuate area, and evaluate source and upgrade of PPE
Chlordane	Collection of soil samples	Personal air sampling pump with filter and solid sorbent tube (0.8-micrometer cellulose ester membrane; Chromosorb 102, 100/50 milligram) (NIOSH 5510)	<one-half of PEL or TLV	Every workday	Use modified Level D PPE
			=>one-half of PEL or TLV	Every workday	Stop work, evacuate area, and evaluate source and upgrade of PPE
Particulates	Soil excavation, sampling, backfill, and loadout	Fibrous aerosol monitor	<5 f/cm <sup>3</sup>	As necessary	Use modified Level D PPE
			<0.05 to 0.1 f/cm <sup>3</sup>	As necessary	Use Level C PPE and implement dust suppression activities
			0.1 f/cm <sup>3</sup>	As necessary	Stop work and implement dust suppression activities

**Table 8-1: Site-Specific Air Monitoring Requirements and Action Levels (continued)**

<b>Chemical or Hazard</b>	<b>Task</b>	<b>Monitoring Device</b>	<b>Action Level</b>	<b>Monitoring Frequency</b>	<b>Action</b>
Noise	Oversight of excavation and use of heavy equipment activities	Sound level meter, personal dosimeter, or be able to speak to someone at arm's length distance without having to raise voice	< 85 dBA	Initial startup, when necessary	Ear plugs are required at all times
Dust	Oversight of soil excavation, backfill and loadout activities	MiniRAM	50 µg/m <sup>3</sup> of air, measured as the difference between the upwind and downwind measurements <sup>2,3</sup>	Initially and on an hourly basis during work activities	Implement dust suppression measures. If dust suppression is unsuccessful, stop work until conditions improve.

Notes: Level C may be acceptable for certain tasks in some situations. If you are uncertain whether Level C is appropriate, consult the Regional Safety Officer. Additionally, when working with unknown respiratory hazards, Level C cartridge must provide protection for organic vapors, acid gases, ammonia, amines, formaldehyde, hydrogen fluoride, and particulate aerosols.

1 Increase monitoring frequency as site conditions require.

2 Based on 24-hour exposure duration for particulate matter (PM<sub>10</sub>) identified in the Table of Standards, Section 70200, California Ambient Air Quality Standards, Title 17 of the California Code of Regulations (02-22-2007 update).

3 Wind speed and direction will be monitored using a portable calibrated wind sock.

µg/m<sup>3</sup> Microgram per cubic meter

dBA Decibel as measured on the A-weighted scale

eV Electron volt

f/cm<sup>3</sup> Feet per cubic meter

NA Not applicable

NIOSH National Institute of Occupational Safety and Health

PEL Permissible Exposure Limit

PID Photoionization detector

PPE Personal protective equipment

ppm Part per million

TLV Threshold limit value

### **8.3 AMBIENT AIR MONITORING**

Most tasks will require monitoring of the general work area or ambient site conditions. Ambient monitoring will generally be conducted using direct-reading survey instrumentation or compound-specific instruments or detector tubes.

Initial ambient air monitoring will be performed as a minimum requirement when any of the situations listed below arise.

- Work begins on a different portion of the site.
- Contaminants other than those previously identified are encountered.
- A different type of operation is initiated (for example, well installation is initiated after drilling activities).
- Workers handle leaking containers or work in areas with obvious liquid contamination (for example, spill or lagoon areas).
- Obvious lithologic changes are noticed during drilling activities.
- Workers experience physical difficulties.

Periodic ambient air monitoring will be performed at the frequency listed in Table 8-1. Monitoring locations and instruments will be included in HSP addenda.

### **8.4 MONITORING PARAMETERS AND DEVICES**

The following sections briefly describe the use and limitations of instruments used to monitor for organic vapors, chlordane, dust, noise and particulates. Site-specific air monitoring requirements and action levels are listed in Table 8-1 and will be elaborated if necessary in individual HSP addenda.

All monitors will be calibrated in accordance with manufacturer recommendations at the beginning of every workday, if possible. Calibration results along with air monitoring data will be recorded in the field logbook.

#### **8.4.1 Organic Vapors**

A direct-reading organic vapor monitor, such as a flame ionization detector (FID) or photoionization detector (PID), will be used to determine the presence of volatile organic compounds (VOC). Table 8-1 specifies the instrument that will be used for the project. The concentrations of individual VOCs of concern cannot usually be determined using the instrument because the detector responds to the total VOC mixture.

Acute inhalation of chlordane vapor is unlikely because of chlordane's low vapor pressure at ordinary temperatures; however, chlordane is semivolatile and may volatilize in hot environments. A PID will be used to monitor general organic vapors during work at the site. Draeger tubes will be used to screen for chlordane vapor.

#### **8.4.2 Other Chemicals**

Engineering controls such as site and dust control and use of PPE will be implemented to address metals (such as mercury vapors), PCBs, and pesticides at the RFS. No additional chemicals have been identified at the RFS that require air monitoring, thus air monitoring for other chemicals will not be conducted.

#### **8.4.3 Combustible Atmospheres**

When a flammable compound reaches a certain concentration in air, it can become explosive when exposed to an ignition source. The lowest concentration able to support combustion is known as the lower explosive limit (LEL). Each flammable compound has its own LEL. Monitoring indicates how close to this limit the airborne concentration of a flammable compound is. Site activities will cease when the airborne concentration of any flammable vapor or gas reaches 25 percent of its LEL.

Due to the nature of the work at the RFS, no areas exist where Tetra Tech employees are expected to be exposed to combustible atmospheres, thus no air monitoring for combustible atmospheres will be conducted.

#### **8.4.4 Percent Oxygen**

Hazardous conditions exist whenever the oxygen level is too high or too low. Monitoring for percent oxygen will be conducted to verify that a safe oxygen level is present for site activities. Workers must never enter or remain in low-oxygen atmospheres unless they are wearing supplied air respirators (air-line or SCBA). An oxygen-enriched atmosphere is hazardous because it causes an increased risk of fire.

Due to the nature of the work at the RFS, no areas exist where Tetra Tech employees are expected to be exposed to oxygen-deficient atmospheres, thus no air monitoring for percent oxygen will be conducted.

#### **8.4.5 External Exposure to Radiation**

If the potential for external exposure to radiation exists, all personnel will be required to wear radiation exposure monitoring devices while working on site (SWP 6-21). Personal exposure monitoring devices may include a thermoluminescence detector (TLD), a standard film badge, or a pocket dosimeter. Monitoring devices are to be left at the site at the end of each working day in a location removed from any source material. An outside vendor will supply the TLDs, badges, or dosimeters and will perform laboratory analyses on TLDs and film badges. The external radiation exposure limit for site personnel will be 1.25 Roentgen-equivalent man units (Rem) per 3 months with a 5-Rem maximum per year.

If necessary, radiation detectors will be used to determine the types and levels of radiation present. Appropriate instrumentation, such as alpha or gamma meters and Geiger counters, will be used. If external exposure to radiation is identified at a site, the monitoring device, monitoring frequency, and action levels for external exposure to radiation during site activities will be included in an addendum to this HSP.

#### **8.4.6            Particulates**

Aerosols are a group of airborne materials that include particulates, fumes, mists, and smoke. Particulates are the primary aerosol of concern at hazardous waste sites. If climatic conditions, surface soil conditions, or site operations (such as excavation activities) adversely impact ambient air quality by increasing particulate matter for extended periods of time, air monitoring using a direct-reading instrument for particulates may become necessary. If elevated (visible) particulate matter conditions persist for 5 minutes or longer, the Tetra Tech SSC is responsible for sampling the breathing zone with a particulate monitor.

Generally, particulate monitors are capable of measuring both solid and liquid particulates within the size range of 0.1 to 10 micrometers (the respirable range). A monitor indicates the concentration of these particulates in units of milligrams per cubic meter of air.

Action levels for particulates will be based on the type of dust and hazardous materials that may contribute to the composition of the particulates and will be determined with the assistance of the Tetra Tech HSR or designee. Table 8-1 lists the monitoring device, monitoring frequency, and general action levels expected to be used during site activities.

### **8.5                USE AND MAINTENANCE OF SURVEY EQUIPMENT**

All personnel using field survey equipment must have training in its operation, limitations, and maintenance. Maintenance and internal or electronic calibration will be performed in accordance with manufacturer recommendations by individuals familiar with the devices before their use on site. Repairs, maintenance, and internal or electronic calibration of these devices will be recorded in an equipment maintenance logbook. The equipment maintenance logbook for each instrument will be kept in that instrument's case. For rented monitoring equipment, repairs and maintenance will be conducted by the rental company. Results of routine calibration will be recorded in the field logbook.

Air monitoring equipment (such as combustible gas indicators, oxygen meters, and PIDs) will be calibrated before work begins. Only basic maintenance (such as changing batteries) will be performed by on-site personnel. Any additional maintenance or repairs will be performed by a trained service technician.

### **8.6                THERMAL STRESS MONITORING**

Heat stress and cold stress are common and serious threats at hazardous waste sites. SWPs 6-15 and 6-16 discuss heat and cold stress, respectively, and include monitoring methods appropriate for the season and location of work (see [Appendix B-2](#)).



## **8.7 NOISE MONITORING**

In most cases, high noise levels at a work site are caused by heavy equipment, such as drill rigs and backhoes, or sources associated with the work site, such as factory equipment and vehicles. When noise levels at the RFS are suspected to equal or exceed an 8-hour time-weighted average (TWA) of 85 decibels on an A-weighted scale in slow response mode (85 dBA), the Tetra Tech SSC will evaluate the work area to characterize the noise source and exposure levels. A sound level meter may be used for the evaluation, but a noise dosimeter is recommended for documenting full-shift noise exposures. If neither instrument is available, the SSC may use a simple rule-of-thumb test to determine whether noise levels exceed 85 dBA. The test requires the SSC to determine how loud he or she must speak to be heard at an arm's length from another person. If the SSC must raise his or her voice to be heard, the average noise level likely exceeds 85 dBA.

If employees are exposed to noise levels that exceed the action level of 85 dBA, hearing protection must be worn. The protectors will be ear plugs or muffs that must provide sufficient attenuation to limit noise exposure to less than 85 dBA. The SSC will supervise use of hearing protectors at the work site as necessary. Table 8-1 lists the monitoring device and action levels to be used.

## 9.0 SITE CONTROL

Site control is an essential component in HSP implementation. The following sections discuss measures and procedures for site control, such as on-site communications, site control zones, site access control, site safety inspections, and SWPs. These site control measures are in accordance with 8 CCR 51 92(d).

### 9.1 ON-SITE COMMUNICATIONS

Successful communication between field teams and personnel in the support zone is essential. The following communication systems will be available during site activities:

- Cellular telephones

The hand signals listed below will be used by site personnel in emergency situations or when verbal communication is difficult.

<u>Signal</u>	<u>Definition</u>
Hands clutching throat	Out of air or cannot breathe
Hands on top of head	Need assistance
Thumbs up	Okay, I am all right, or I understand
Thumbs down	No or negative
Arms waving upright	Send backup support
Gripping partner's wrist	Exit area immediately

### 9.2 SITE CONTROL ZONES

To control the spread of contamination and employee exposures to chemical and physical hazards, on-site work areas may be divided into an exclusion zone, a decontamination zone, and a support zone. Access to the exclusion and decontamination zones will be restricted to authorized personnel. Any visitors to these areas must present proper identification and be authorized to be on site. The Tetra Tech SSC will identify work areas that visitors or personnel are authorized to enter and will enforce site control measures.

The following sections describe the exclusion zone, the decontamination zone, and the support zone as well as procedures to be followed in each.

### **9.2.1            Zone 1: Exclusion Zone**

An exclusion zone includes areas where contamination is either known or likely to be present or, because of work activity, has the potential to cause harm to personnel. The perimeter of the exclusion zone and an appropriate radius around work task areas will be demarcated by a physical barrier, such as barricade tape or traffic cones, to restrict access. A daily roster with the date of each person's entrance into the exclusion zone; the person's name, signature, and organization; and the time of entry and exit will be kept for all personnel working in the zone. Visitors will not be permitted to enter the exclusion zone without proper qualifications, equipment, and Tetra Tech SSC authorization. Work tasks that may require establishment of an exclusion zone include the following:

- Soil sampling
- Soil gas sampling
- Sediment sampling
- Groundwater sampling
- Surface water sampling
- Storm water sampling
- Air sampling
- Vegetation restoration
- IDW sampling

### **9.2.2            Zone 2: Decontamination Zone**

The decontamination zone will contain facilities to decontaminate personnel and portable equipment. A steam-cleaning area for decontamination of heavy equipment and vehicles may be established at a location readily accessible from work areas. Equipment decontamination procedures are described in [Section 10.0](#). Visitors will not be permitted to enter the decontamination zone without proper qualifications and Tetra Tech SSC authorization.

A decontamination zone for each task will be established upwind from the exclusion zone.

### **9.2.3            Zone 3: Support Zone**

A support zone may consist of any uncontaminated and nonhazardous part of the site. The support zone should be situated in an area generally upwind of any exclusion zone whenever possible. Site visitors not meeting training, medical surveillance, and PPE requirements must stay in the support zone.

### **9.3 SITE ACCESS CONTROL**

The UC Berkeley RFS site is located at 1301 South 46th Street, Richmond, California, along the eastern shoreline of the Richmond Inner Harbor of the San Francisco Bay and northwest of Point Isabel. Access to the site is controlled by a security gate.

### **9.4 SITE FACILITIES ACCESS**

Access to sanitation facilities will be available to all on-site workers, including subcontractors, at Building 162. Building 162 is not locked; toilets, water, and soap will be accessible during all work hours.

### **9.5 SITE SAFETY INSPECTIONS**

Periodic site safety inspections shall be conducted by the Tetra Tech SSC to ensure safe work areas and compliance with this HSP. Results of the site safety inspections will be recorded in the field logbook or on a Field Audit Checklist (Form AF-1 in [Appendix B-1](#)).

### **9.6 SAFE WORK PRACTICES**

Various SWPs are applicable to the RFS site. These SWPs are included in [Appendix B-2](#) to this HSP. The following SWPs apply to the site:

- ☒ SWP 6-1 General Safe Work Practices
- ☐ SWP 6-2 Control of Hazardous Energy Sources (Lockout/Tagout)
- ☐ SWP 6-3 Safe Drilling Practices
- ☐ SWP 6-4 Excavation Practices
- ☒ SWP 6-5 Working Over or Near Water
- ☐ SWP-6-6 Hot Work Practices
- ☐ SWP 6-7 Special Site Hazards
- ☐ SWP 6-8 Safe Electrical Work Practices
- ☒ SWP 6-9 Fall Protection Practices
- ☐ SWP 6-10 Portable Ladder Safety
- ☒ SWP 6-11 Drum and Container Handling Practices
- ☐ SWP 6-12 Shipping Dangerous Goods
- ☐ SWP 6-13 Flammable Hazards and Ignition Sources
- ☒ SWP 6-14 Spill and Discharge Control Practices
- ☒ SWP 6-15 Heat Stress

- ☒ SWP 6-16 Cold Stress
- ☒ SWP 6-17 Biohazards
- ☐ SWP 6-18 Underground Storage Tank Removal Practices
- ☐ SWP 6-19 Working Safely with Hydrazine
- ☐ SWP 6-20 Working Safely with Benzene
- ☒ SWP 6-21 Radiation Safety Practices
- ☒ SWP 6-22 Hydrographic Data Collection
- ☐ SWP 6-23 Permit-Required Confined Space
- ☐ SWP 6-24 Non-Permit-Required Confined Space
- ☐ SWP 6-25 Oil and Petroleum Distillate Fuel Product Hazards
- ☒ SWP 6-26 Working Near Heavy Equipment
- ☒ SWP 6-27 Respirator Cleaning Procedures
- ☒ SWP 6-28 Safe Work Practices for Use of Air Purifying Respirators
- ☐ SWP 6-29 Respirator Qualitative Fit Testing Procedures
- ☐ SWP 6-32 Safe Work Practice for Sampling Anthrax Contamination in Buildings

## 10.0 DECONTAMINATION

Decontamination is the process of removing or neutralizing contaminants on personnel or equipment. When properly conducted, decontamination procedures protect workers from contaminants that may have accumulated on PPE, tools, and other equipment. Proper decontamination also prevents transport of potentially harmful materials to uncontaminated areas. Personnel and equipment decontamination procedures are described in the following sections.

### 10.1 PERSONNEL DECONTAMINATION

Personnel decontamination at the site will be limited by using disposable PPE whenever possible. Any personnel decontamination procedures will follow guidance in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH and others 1985). Personnel and PPE will be decontaminated with potable water or a mixture of detergent and water. Liquid and solid wastes generated during decontamination will be collected and drummed.

The decontamination procedures listed below will be conducted if personnel decontamination is required.

- Wash neoprene boots or disposable booties with a Liquinox<sup>®</sup> or Alconox<sup>®</sup> solution, and rinse them with water. Remove and retain neoprene boots for reuse, if possible. Place disposable booties in plastic bags for disposal.
- Wash outer gloves in a Liquinox<sup>®</sup> or Alconox<sup>®</sup> solution, and rinse them in water. Remove outer gloves and place them in a plastic bag for disposal.
- Remove chemical-resistant clothing, and place it in a plastic bag for disposal.
- Remove the air-purifying respirator, if used, and place the spent filter in a plastic bag for disposal. The filter must be changed in accordance with the Respiratory Hazard Assessment form (Form RP-2 in [Appendix B-3](#)). Clean and disinfect the respirator in accordance with SWP 6-27, and place it in a plastic bag for storage.
- Remove inner gloves and place them in a plastic bag for disposal.
- Thoroughly wash the hands and face with water and soap.

Used, disposable PPE will be collected in sealable containers. Personnel decontamination procedures may be modified as necessary while on site.

### 10.2 EQUIPMENT DECONTAMINATION

Decontamination of all drilling, sampling, and field monitoring equipment used during site activities will be required. Decontamination of on-site heavy equipment and sampling equipment will follow procedures defined in the site's individual field sampling plan addenda. Equipment decontamination procedures described in the following sections are based on guidelines appropriate for low-level

contamination. Additional procedures may be found in EPA SOP No. 2006, titled “Sampling Equipment Decontamination” dated August 11, 1994. Wastewater from equipment decontamination activities will be stored in 55-gallon drums until proper disposal is possible.

### **10.2.1 Heavy Equipment**

Heavy equipment, such as drilling and excavating vehicles, will be decontaminated at a designated location in the decontamination zone. Gross decontamination will be performed using a cleaning brush to loosen debris, and steam-cleaning with a high-pressure steam spray. If equipment still has soil on it after steam-cleaning, an appropriate cleaning brush will be used to further loosen debris, and the equipment will be steam-cleaned again. All wastewater generated from decontamination activities will be collected and stored in 55-gallon drums until proper disposal is arranged. Wastewater may also be discharged to either the municipal sanitary sewer system, with the City of Richmond’s approval, or the site sanitary sewer system, as applicable.

Heavy equipment will not be used during the field activities covered by this HSP.

### **10.2.2 Sampling Equipment**

Sampling equipment, such as split spoons, will be decontaminated before and after each use as described below.

- Scrub the equipment with a brush in a bucket containing Liquinox® or Alconox® solution and distilled water.
- Triple-rinse the equipment with distilled water, and allow it to air-dry.
- Reassemble the equipment, and place it on plastic or aluminum foil in a clean area. If aluminum foil is used, wrap the equipment with the dull side of the aluminum foil toward the equipment.



## **11.0 EMERGENCY RESPONSE PLANNING**

This section describes emergency response planning procedures to be implemented for the site. This section is consistent with local, state, and federal disaster and emergency management plans. The following sections discuss pre-emergency planning, personnel roles and lines of authority, emergency recognition and prevention, evacuation routes and procedures, emergency contacts and notifications, hospital route directions, emergency medical treatment procedures, protective equipment failure, fire or explosion, weather-related emergencies, spills or leaks, emergency equipment and facilities, and reporting.

### **11.1 PRE-EMERGENCY PLANNING**

During the prework briefing and daily tailgate safety meetings, all on-site employees will be trained in and reminded of the provisions of [Section 11.0](#), site communication systems, and site evacuation routes. The emergency response provisions will be reviewed on a regular basis by the Tetra Tech SSC and will be revised, if necessary, to ensure that they are adequate and consistent with prevailing site conditions.

### **11.2 PERSONNEL ROLES AND LINES OF AUTHORITY**

The Tetra Tech SSC has primary responsibility for responding to and correcting emergency situations and for taking appropriate measures to ensure the safety of site personnel and the public. Possible actions may include evacuation of personnel from the site area. The SSC is also responsible for ensuring that corrective measures have been implemented, appropriate authorities have been notified, and follow-up reports have been completed.

Individual subcontractors are required to cooperate with the SSC, within the parameters of their scopes of work.

Personnel are required to report all injuries, illnesses, spills, fires, and property damage to the SSC. The SSC must be notified of any on-site emergencies and is responsible for ensuring that the appropriate emergency procedures described in this section are followed. The local fire or emergency response department will be supplied with a copy of this HSP before site work begins.

### **11.3 EMERGENCY RECOGNITION AND PREVENTION**

Table 4-1 lists potential on-site chemical hazards, and accident hazard analyses provide information on the hazards associated with the different tasks planned for the site. On-site personnel will be made familiar with this information and with techniques of hazard recognition through prework training and site-specific briefings.

### **11.4 EVACUATION ROUTES AND PROCEDURES**

In the event of an emergency that necessitates evacuation of a work task area or the site, the Tetra Tech SSC shall contact all nearby personnel using the on-site communications discussed in [Section 9.1](#) to

advise the personnel of the emergency. The personnel will proceed along site roads to a safe distance upwind from the hazard source. The personnel will remain in that area until the SSC or an authorized individual provides further instructions. The safe meeting place will on 46<sup>th</sup> Street near the guard shack at the entrance to the RFS property.

UC Berkeley's Office of Environment, Health & Safety has established evacuation procedures for the RFS. All personnel working at the RFS shall familiarize themselves with these procedures.

## **11.5 EMERGENCY CONTACTS AND NOTIFICATIONS**

The emergency information before Section 1.0 of this HSP provides names and telephone numbers of emergency contact personnel. **THIS PAGE MUST BE POSTED ON SITE OR MUST BE READILY AVAILABLE AT ALL TIMES.** In the event of a medical emergency, personnel will notify the appropriate emergency organization and will take direction from the Tetra Tech SSC. In the event of a fire, explosion, or spill at the site, the SSC will notify the appropriate local, state, and federal agencies and will follow procedures discussed in [Section 11.9](#) or [11.11](#).

## **11.6 HOSPITAL DIRECTIONS**

Before performing any site activities, Tetra Tech personnel will conduct a pre-emergency hospital run to familiarize themselves with the route to the local hospital. A map showing the hospital route is provided in the emergency information before Section 1.0 of this HSP.

## **11.7 EMERGENCY MEDICAL TREATMENT PROCEDURES**

A person who becomes ill or injured during work tasks may require decontamination. If the illness or injury is minor, any decontamination necessary will be completed and first aid should be administered prior to patient transport. If the patient's condition is serious, partial decontamination will be completed (such as complete disrobing of the person and redressing the person in clean coveralls or wrapping in a blanket). First aid should be administered until an ambulance or paramedics arrive. All injuries and illnesses must be reported immediately to the Tetra Tech project manager and HSR.

Any person transported to a clinic or hospital for chemical exposure treatment will be accompanied by information on the chemical he or she has been exposed to at the site, if possible. Table 4-1 contains this information.

## **11.8 PROTECTIVE EQUIPMENT FAILURE**

If any worker in the exclusion zone experiences a failure of protective equipment (either engineering controls or PPE) that affects his or her personal protection, the worker and all coworkers will immediately leave the exclusion zone. Re-entry to the exclusion zone will not be permitted until (1) the protective equipment has been repaired or replaced, (2) the cause of the equipment failure has been determined, and (3) the equipment failure is no longer considered to be a threat.

## **11.9 FIRE OR EXPLOSION**

In the event of a fire or explosion on site, the local fire department will be immediately summoned. The Tetra Tech SSC or a site representative will advise the fire department of the location and nature of any hazardous materials involved. Appropriate provisions of Section 11.0 will be implemented by site personnel.

## **11.10 WEATHER-RELATED EMERGENCIES**

Site work shall not be conducted during severe weather conditions, including high-speed winds or lightning. In the event of severe weather, field personnel will stop work, secure and lower all equipment (for example, drilling masts), and leave the site.

Thermal stress caused by excessive heat or cold may occur as a result of extreme temperatures, workload, or the PPE used. Heat and cold stress treatment will be administered as described in SWPs 6-15 and 6-16, respectively.

## **11.11 SPILLS OR LEAKS**

In the event of a severe spill or a leak, site personnel will follow the procedures listed below.

- Evacuate the affected area and relocate personnel to an upwind location.
- Inform the Tetra Tech SSC, a Tetra Tech office, and a site representative immediately.
- Locate the source of the spill or leak, and stop the flow if it is safe to do so.
- Begin containment and recovery of spilled or leaked materials.
- Notify appropriate local, state, and federal agencies.

Based on planned sampling activities, the only source for potential spills is IDW. This includes drums of purge water and spoils generated by drilling for soil samples. All drums containing IDW will be handled in accordance with 8 CCR 5192(j); information is presented in SWP 6-11. Additional information on spill and leak control is presented in SWP 6-14.

## **11.12 EMERGENCY EQUIPMENT AND FACILITIES**

The following emergency equipment will be available on site:

- First aid kit
- Fixed eye wash (available at certain locations)

- Fire extinguisher
- Mobile telephone
- Sorbent material
- Drums
- Spill kits
- Berm material

### **11.13        REPORTING**

All emergency situations require follow-up and reporting. [Appendix B-1](#) includes the Tetra Tech Accident and Illness Investigation Report (Form AR-1). This report must be completed and submitted to the Tetra Tech project manager within 24 hours of an emergency situation. The project manager will review the report and then forward it to the Tetra Tech HSR for review. The report must include proposed actions to prevent similar incidents from occurring. The HSR must be fully informed of the corrective action process so that she may implement applicable elements of the process at other sites.

## 12.0 REFERENCES

- American Conference of Governmental Industrial Hygienists (ACGIH). “Threshold Limit Values and Biological Exposure Indices for 1998.” Latest edition.
- National Institute for Occupational Safety and Health (NIOSH) and others. 1985. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*. October.
- NIOSH. 1997. “Pocket Guide to Chemical Hazards.” U.S. Department of Health and Human Services. U.S. Government Printing Office. Washington, DC. June.
- Tetra Tech, Inc. 1999. “Health and Safety Manual.”
- Tetra Tech EM Inc. 2008. “Final Current Conditions Report, University of California, Berkeley, Richmond Field Station, Richmond, California.” November 21.
- University of California, Berkeley (UCB). 1973. Sanitary Engineering Research Laboratory News Quarterly. Volume XXIII, No. 2. Richmond, California. April.
- UCB. 2006. Interview regarding RFS Operational History. Between Scott Shackleton, Karl Hans, Larry Bell, and Greg Haet, UC Berkeley; and Julia Vetromile and Leslie Lundgren, Tetra Tech EM Inc. November 14.

## **APPENDIX B-1**

### **TETRA TECH FORMS**

(Eight Sheets)

- Compliance Agreement (Form HSP-4)
- Daily Tailgate Safety Meeting (Form HST-2)
- Daily Site Log (Form SSC-1)
- Accident and Illness Investigation Report (Form IR)
- Field Audit Checklist (Form AF-1)



**TETRA TECH, INC.**

**HEALTH AND SAFETY PLAN COMPLIANCE AGREEMENT**

Project Name: \_\_\_\_\_

Project Number: \_\_\_\_\_

I have read and understand the health and safety plan indicated above and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the safety requirements specified in the plan. I understand that ChaduxTt assumes no liability for the health and safety of any person on this jobsite other than ChaduxTt employees.

<b>Name</b>	<b>Signature</b>	<b>Employer</b>	<b>Date</b>
_____	_____	_____	_____
_____	_____	_____	_____
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**TETRA TECH, INC.**  
**DAILY TAILGATE SAFETY MEETING FORM**

Date: \_\_\_\_\_ Time: \_\_\_\_\_ Project No.: \_\_\_\_\_

Client: \_\_\_\_\_ Site Location: \_\_\_\_\_

Site Activities Planned for Today: \_\_\_\_\_

\_\_\_\_\_

Safety Topics Discussed
<b>Protective clothing and equipment:</b>
<b>Chemical hazards:</b>
<b>Physical hazards:</b>
<b>Environmental and biohazards:</b>
<b>Equipment hazards:</b>
<b>Decontamination procedures:</b>
<b>Other:</b>
<b>Review of emergency procedures:</b>
<b>Employee Questions or Comments:</b>



**TETRA TECH, INC.**  
**DAILY TAILGATE SAFETY MEETING FORM (Continued)**

<b>Attendees</b>	
<b>Printed Name</b>	<b>Signature</b>

**Meeting Conducted by:**

\_\_\_\_\_  
Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Signature



**TETRA TECH, INC.**  
**DAILY SITE LOG**

Site Name: \_\_\_\_\_ Date: \_\_\_\_\_

Name (print)	Company	Time	
		In	Out

Comments:

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Report Date	Report Prepared By	Incident Report Number
<b>INSTRUCTIONS:</b> All incidents (including those involving subcontractors under direct supervision of Tetra Tech personnel) must be documented on the IR Form. Complete any additional parts to this form as indicated below for the type of incident selected.		
<b>TYPE OF INCIDENT (Check all that apply)</b>		<b>Additional Form(s) Required for this type of incident</b>
Near Miss (No losses, but could have resulted in injury, illness, or damage)	<input type="checkbox"/>	Complete IR Form Only
Injury or Illness	<input type="checkbox"/>	Complete Form IR-A; Injury or Illness
Property or Equipment Damage, Fire, Spill or Release	<input type="checkbox"/>	Complete Form IR-B; Damage, Fire, Spill or Release
Motor Vehicle	<input type="checkbox"/>	Complete Form IR-C; Motor Vehicle
<b>INFORMATION ABOUT THE INCIDENT</b>		
<b>Description of Incident</b>		
<hr/> <hr/> <hr/> <hr/>		
<b>Date of Incident</b>	<b>Time of Incident</b>	
	_____ AM <input type="checkbox"/> PM <input type="checkbox"/> OR Cannot be determined <input type="checkbox"/>	
<b>Weather conditions at the time of the incident</b>	<b>Was there adequate lighting?</b>	
	_____ Yes <input type="checkbox"/> No <input type="checkbox"/>	
<b>Location of Incident</b>		
_____ Was location of incident within the employer's work environment? Yes <input type="checkbox"/> No <input type="checkbox"/>		
<b>Street Address</b>	<b>City, State, Zip Code and Country</b>	
<b>Project Name</b>	<b>Client:</b>	
<b>Tt Supervisor or Project Manager</b>	<b>Was supervisor on the scene?</b>	
	Yes <input type="checkbox"/> No <input type="checkbox"/>	
<b>WITNESS INFORMATION (attach additional sheets if necessary)</b>		
<b>Name</b>	<b>Company</b>	
<b>Street Address</b>	<b>City, State and Zip Code</b>	
<b>Telephone Number(s)</b>		



## CORRECTIVE ACTIONS

Corrective action(s) immediately taken by unit reporting the incident:

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Corrective action(s) still to be taken (by whom and when):

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## ROOT CAUSE ANALYSIS LEVEL REQUIRED

Root Cause Analysis Level Required: Level - 1 ☐ Level - 2 ☐ None ☐

## Root Cause Analysis Level Definitions

Level - 1	<p><b>Definition:</b> A Level 1 RCA is conducted by an individual(s) with experience or training in root cause analysis techniques and will conduct or direct documentation reviews, site investigation, witness and affected employee interviews, and identify corrective actions. Activating a Level 1 RCA and identifying RCA team members will be at the discretion of the Corporate Administration office.</p> <p>The following events may trigger a Level 1 RCA:</p> <ul style="list-style-type: none"><li>▪ Work related fatality</li><li>▪ Hospitalization of one or more employee where injuries result in total or partial permanent disability</li><li>▪ Property damage in excess of \$75,000</li><li>▪ When requested by senior management</li></ul>
Level - 2	<p><b>Definition:</b> A Level 2 RCA is self performed within the operating unit by supervisory personnel with assistance of the operating unit HSR. Level 2 RCA will utilize the 5 Why RCA methodology and document the findings on the tools provided.</p> <p>The following events will require a Level 2 RCA:</p> <ul style="list-style-type: none"><li>▪ OSHA recordable lost time incident</li><li>▪ Near miss incident that could have triggered a Level 1 RCA</li><li>▪ When requested by senior management</li></ul>

Complete the Root Cause Analysis Worksheet and Corrective Action form. Identify a corrective action(s) for each root cause identified within each area of inquiry.

## NOTIFICATIONS

Title	Printed Name	Signature	Telephone Number	Date
Project Manager or Supervisor				
Site Safety Coordinator or Office H&S Representative				
Operating Unit H&S Representative				
Other: _____				

The signatures provided above indicate that appropriate personnel have been notified of the incident.

**INSTRUCTIONS:**

Complete all sections below for incidents involving injury or illness.

Do NOT leave any blanks.

Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)

**EMPLOYEE INFORMATION****Company Affiliation**Tetra Tech Employee? ☐TetraTech subcontractor employee (directly supervised by Tt personnel)? ☐**Full Name****Company (if not Tt employee)****Street Address, City, State and Zip Code****Address Type**Home address (for Tt employees) ☐Business address (for subcontractors) ☐**Telephone Numbers**

Work: \_\_\_\_\_

Home: \_\_\_\_\_

Cell: \_\_\_\_\_

**Occupation (regular job title)****Department****Was the individual performing regular job duties?**Yes ☐ No ☐**Time individual began work**\_\_\_\_\_ AM ☐ PM ☐ OR Cannot be determined ☐**Safety equipment**Provided? Yes ☐ No ☐

Type(s) provided:

☐ Hard hat☐ Protective clothing☐ Gloves☐ High visibility vest☐ Eye protection☐ Fall protection☐ Safety shoes☐ Machine guarding☐ Respirator☐ Other (list) \_\_\_\_\_Used? Yes ☐ No ☐ If no, explain why \_\_\_\_\_**NOTIFICATIONS****Name of Tt employee to whom the injury or illness was first reported****Was H&S notified within one hour of injury or illness?**Yes ☐ No ☐**Date of report****H&S Personnel Notified****Time of report****Time of Report****If subcontractor injury, did subcontractor's firm perform their own incident investigation?**Yes ☐ No ☐ If yes, request a copy of their completed investigation form/report and attach it to this report.



## INJURY / ILLNESS DETAILS

**What was the individual doing just before the incident occurred?** Describe the activity as well as the tools, equipment, or material the individual was using. Be specific. Examples: "Climbing a ladder while carrying roofing materials"; "Spraying chlorine from a hand sprayer"; "Daily computer key-entry"

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**What Happened?** Describe how the injury occurred. Examples: "When ladder slipped on wet floor and worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; Worker developed soreness in wrist over time"

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**Describe the object or substance that directly harmed the individual:** Examples: "Concrete floor"; "Chlorine"; "Radial Arm Saw". If this question does not apply to the incident, write "Not Applicable".

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## MEDICAL CARE PROVIDED

Was first aid provided at the site: Yes ☐ No ☐ If yes, describe the type of first aid administered and by whom?

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Was treatment provided away from the site: Yes ☐ No ☐ If yes, provide the information below.

Name of physician or health care professional

Facility Name

Street Address, City State and Zip Code

Type of Care?

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Was individual treated in emergency room? Yes ☐ No ☐

Was individual hospitalized overnight as an in-patient? Yes ☐ No ☐

Telephone Number

Did the individual die? Yes ☐ No ☐ If yes, date: \_\_\_\_\_

Will a worker's compensation claim be filed? Yes ☐ No ☐

**NOTE: Attach any police reports or related diagrams to this report.**

## SIGNATURES

I have reviewed this report and agree that all the supplied information is accurate

Affected individual (print)

Affected individual (signature)

Telephone Number

Date

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This form contains information relating to employee health and must be used in a manner that protects the confidentiality of the employee to the extent possible while the information is being used for occupational safety and health purposes.

**INSTRUCTIONS:**

Complete all sections below for incidents involving property/equipment damage, fire, spill or release.

Do NOT leave any blanks.

Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)

**TYPE OF INCIDENT (Check all that apply)**Property Damage ☐Equipment Damage ☐Fire or Explosion ☐Spill or Release ☐**INCIDENT DETAILS****Results of Incident:** Fully describe damages, losses, etc.

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**Response Actions Taken:**


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Responding Agency(s) (i.e. police, fire department, etc.)

Agency(s) Contact Name(s)

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**DAMAGED ITEMS (List all damaged items, extent of damage and estimated repair cost)**

Item:	Extent of damage:	Estimated repair cost

**SPILLS / RELEASES (Provide information for spilled/released materials)**

Substance	Estimated quantity and duration	Specify Reportable Quantity (RQ)
		_____ Exceeded? Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>

**FIRES / EXPLOSIONS (Provide information related to fires/explosions)**Fire fighting equipment used? Yes ☐ No ☐ If yes, type of equipment: \_\_\_\_\_**NOTIFICATIONS**

Required notifications	Name of person notified	By whom	Date / Time
Client: _____ Yes <input type="checkbox"/> No <input type="checkbox"/>			
Agency: _____ Yes <input type="checkbox"/> No <input type="checkbox"/>			
Other: _____ Yes <input type="checkbox"/> No <input type="checkbox"/>			

Who is responsible for reporting incident to outside agency(s)? Tt ☐ Client ☐ Other ☐ Name: \_\_\_\_\_Was an additional written report on this incident generated? Yes ☐ No ☐ If yes, place in project file.



**INSTRUCTIONS:**

Complete all sections below for incidents involving motor vehicle accidents. Do NOT leave any blanks.  
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)							
<b>INCIDENT DETAILS</b>							
Name of road, street, highway or location where accident occurred				Name of intersecting road, street or highway if applicable			
County		City			State		
Did police respond to the accident?				Did ambulance respond to the accident?			
Yes <input type="checkbox"/> No <input type="checkbox"/>				Yes <input type="checkbox"/> No <input type="checkbox"/>			
Name and location of responding police department				Ambulance company name and location			
Officer's name/badge #							
Did police complete an incident report? Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, police report number: _____ Request a copy of completed investigation report and attach to this form.							
<b>VEHICLE INFORMATION</b>							
How many vehicles were involved in the accident? _____ (Attach additional sheets as applicable for accidents involving more than 2 vehicles.)							
Vehicle Number 1 – Tetra Tech Vehicle				Vehicle Number 2 – Other Vehicle			
Vehicle Owner / Contact Information				Vehicle Owner / Contact Information			
Color				Color			
Make				Make			
Model				Model			
Year				Year			
License Plate #				License Plate #			
Identification #				Identification #			
Describe damage to vehicle number 1				Describe damage to vehicle number 2			
Insurance Company Name and Address				Insurance Company Name and Address			
Agent Name				Agent Name			
Agent Phone No.				Agent Phone No.			
Policy Number				Policy Number			



DRIVER INFORMATION							
Vehicle Number 1 – Tetra Tech Vehicle				Vehicle Number 2 – Other Vehicle			
Driver's Name				Driver's Name			
Driver's Address				Driver's Address			
Phone Number				Phone Number			
Date of Birth				Date of Birth			
Driver's License #				Driver's License #			
Licensing State				Licensing State			
Gender		Male <input type="checkbox"/> Female <input type="checkbox"/>		Gender		Male <input type="checkbox"/> Female <input type="checkbox"/>	
Was traffic citation issued to Tetra Tech driver? Yes <input type="checkbox"/> No <input type="checkbox"/>				Was traffic citation issued to driver of other vehicle? Yes <input type="checkbox"/> No <input type="checkbox"/>			
Citation #				Citation #			
Citation Description				Citation Description			
PASSENGERS IN VEHICLES (NON-INJURED)							
<p align="center">List all non-injured passengers (excluding driver) in each vehicle.            Driver information is captured in the preceding section.            Information related to persons injured in the accident (non-Tt employees) is captured in the section below on this form.            Injured Tt employee information is captured on FORM IR-A</p>							
Vehicle Number 1 – Tetra Tech Vehicle				Vehicle Number 2 – Other Vehicle			
How many passengers (excluding driver) in the vehicle? _____				How many passengers (excluding driver) in the vehicle? _____			
Non-Injured Passenger Name and Address				Non-Injured Passenger Name and Address			
Non-Injured Passenger Name and Address				Non-Injured Passenger Name and Address			
Non-Injured Passenger Name and Address				Non-Injured Passenger Name and Address			
INJURIES TO NON-TETRATECH EMPLOYEES							
Name of injured person 1				Address of injured person 1			
Age	Gender	Car No.	Location in Car	Seat Belt Used?	Ejected from car?	Injury or Fatality?	
	Male <input type="checkbox"/> Female <input type="checkbox"/>			Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>	Injured <input type="checkbox"/> Died <input type="checkbox"/>	
Name of injured person 2				Address of injured person 2			
Age	Gender	Car No.	Location in Car	Seat Belt Used?	Ejected from car?	Injury or Fatality?	
	Male <input type="checkbox"/> Female <input type="checkbox"/>			Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>	Injured <input type="checkbox"/> Died <input type="checkbox"/>	
OTHER PROPERTY DAMAGE							
Describe damage to property other than motor vehicles							
Property Owner's Name				Property Owner's Address			



**COMPLETE AND SUBMIT DIAGRAM DEPICTING WHAT HAPPENED**



**TETRA TECH, INC.**  
**FIELD AUDIT CHECKLIST**

Project Name: \_\_\_\_\_ Project No.: \_\_\_\_\_

Field Location: \_\_\_\_\_ Completed by: \_\_\_\_\_

Project Manager: \_\_\_\_\_ Site Safety Coordinator: \_\_\_\_\_

General Items		In Compliance?		
Health and Safety Plan Requirements		Yes	No	NA
1	Approved health and safety plan (HASP) on site or available			
2	Names of on-site personnel recorded in field logbook or daily log			
3	HASP compliance agreement form signed by all on-site personnel			
4	Material Safety Data Sheets on site or available			
5	Designated site safety coordinator present			
6	Daily tailgate safety meetings conducted and documented			
7	On-site personnel meet HASP requirements for medical examinations, fit testing, and training (including subcontractors)			
8	Compliance with specified safe work practices			
9	Documentation of training, medical examinations, and fit tests available from employer			
10	Exclusion, decontamination, and support zones delineated and enforced			
11	Windsock or ribbons in place to indicate wind direction			
12	Illness and injury prevention program reports completed (California only)			
Emergency Planning				
13	Emergency telephone numbers posted			
14	Emergency route to hospital posted			
15	Local emergency providers notified of site activities			
16	Adequate safety equipment inventory available			
17	First aid provider and supplies available			
18	Eyewash stations in place			
Air Monitoring				
19	Monitoring equipment specified in HASP available and in working order			
20	Monitoring equipment calibrated and calibration records available			
21	Personnel know how to operate monitoring equipment and equipment manuals available on site			
23	Environmental and personnel monitoring performed as specified in HASP			



**TETRA TECH, INC.**  
**FIELD AUDIT CHECKLIST (Continued)**

Safety Items		In Compliance?		
		Yes	No	NA
<b>Personal Protection</b>				
1	Splash suit			
2	Chemical protective clothing			
3	Safety glasses or goggles			
4	Gloves			
5	Overboots			
6	Hard hat			
7	Dust mask			
8	Hearing protection			
9	Respirator			
<b>Instrumentation</b>				
10	Combustible gas meter			
11	Oxygen meter			
12	Organic vapor analyzer			
<b>Supplies</b>				
13	Decontamination equipment and supplies			
14	Fire extinguishers			
15	Spill cleanup supplies			
Corrective Action Taken During Audit:				
Corrective Action Still Needed:				

Note: NA = Not applicable

\_\_\_\_\_  
Auditor's Signature

\_\_\_\_\_  
Site Safety Coordinator's Signature

\_\_\_\_\_  
Date

## **APPENDIX B-2**

### **SAFE WORK PRACTICES**

- SWP 6-1 General Safe Work Practices
- SWP 6-5 Working Over or Near Water
- SWP 6-9 Fall Protection Practices
- SWP 6-11 Drum and Container Handling Practices
- SWP 6-14 Spill and Discharge Control Practices
- SWP 6-15 Heat Stress
- SWP 6-16 Cold Stress
- SWP 6-17 Biohazards
- SWP 6-21 Radiation Safety Practices
- SWP 6-22 Hydrographic Data Collection
- SWP 6-26 Working Near Heavy Equipment
- SWP 6-27 Respirator Cleaning
- SWP 6-28 Respirator Use



**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**GENERAL SAFE WORK PRACTICES**

**SWP NO.: 6-1**  
**ISSUE DATE: JULY 1998**  
**REVISION NO.: 1**

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## GENERAL SAFE WORK PRACTICES

To prevent injuries and adverse health effects, the following general safe work practices (SWP) are to be followed when conducting work involving known and unknown site hazards. These SWPs establish a pattern of general precautions and measures for reducing risks associated with hazardous site operations. This list is not inclusive and may be amended as necessary.

- Do not eat, drink, chew gum or tobacco, take medication, or smoke in contaminated or potentially contaminated areas or where the possibility for the transfer of contamination exists.
- Wash hands and face thoroughly upon leaving a contaminated or suspected contaminated area. A thorough shower and washing must be conducted as soon as possible if excessive skin contamination occurs.
- Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, or other such areas. Avoid, whenever possible, kneeling on the ground or leaning or sitting on drums, equipment, or the ground. Do not place monitoring equipment on potentially contaminated surfaces.
- Remove beards or facial hair that interfere with a satisfactory qualitative respirator fit test or routine pre-entry positive and negative pressure checks.
- Be familiar with and knowledgeable of and adhere to all instructions in the site-specific health and safety plan (HASP). At a minimum, a safety meeting will be held at the start of each project to discuss the HASP. Additional meetings will be held, as necessary, to address new or continuing safety and health concerns.
- Be aware of the location of the nearest telephone and all emergency telephone numbers.
- Attend a briefing on the anticipated hazards, equipment requirements, SWPs, emergency procedures, and communication methods before going on site.
- Plan and delineate entrance, exit, and emergency escape routes.
- Rehearse unfamiliar operations prior to implementation.
- Use the “buddy system” whenever respiratory protection equipment is in use. Buddies should establish hand signals or other means of emergency communication in case radios break down or are unavailable.
- Buddies should maintain visual contact with each other and with other on-site team members by remaining in close proximity in order to assist each other in case of emergency.

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- Minimize the number of personnel and equipment in contaminated areas (such as the exclusion zone). Nonessential vehicles and equipment should remain within the support zone.
- Establish appropriate support, contamination reduction, and exclusion zones.
- Establish appropriate decontamination procedures for leaving the site.
- Immediately report all injuries, illnesses, and unsafe conditions, practices, and equipment to the site safety coordinator (SSC).
- Maintain a portion of the site field logbook as a project safety log. The project safety log will be used to record the names, entry and exit dates, and times on site of all Tetra Tech, subcontractor, and project site visitor personnel; air quality and personal exposure monitoring data; and other information related to safety matters. Form SSC-1, Daily Site Log, may be used to record names of on-site personnel.
- A portable eyewash station should be located in the support zone if chemical splashes to eyes are possible.
- Do not bring matches and lighters in the exclusion zone or contamination reduction zone.
- Observe coworkers for signs of toxic exposure and heat or cold stress.
- Inform coworkers of nonvisual effects of illness if you experience them, such as headaches, dizziness, nausea, or blurred vision.

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**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**WORKING OVER OR NEAR WATER**

**SWP NO.: 6-5**  
**ISSUE DATE: JULY 1998**  
**REVISION NO.: 1**

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## WORKING OVER OR NEAR WATER

This safe work practice (SWP) provides guidelines for working over or near bodies of water 3 or more feet deep or swiftly moving water. Workers will observe the requirements of the Occupational Safety and Health Administration (OSHA) specified in Title 29 of the *Code of Federal Regulations* (CFR), Part 1926.106, “Working Over or Near Water.” The following sections discuss general procedures, underwater work, and cold water procedures.

### 1.0 GENERAL PROCEDURES

When working over or near water, the following precautions will be taken:

- All staff and team members must wear a personal flotation device (PFD) within 15 feet of a water body. Personnel will be provided with U.S. Coast Guard (USCG)-approved life jackets or work vests. The PFD should be Class III, which will support the head of an unconscious person above water.
- Life jackets and work vests will be inspected before each use.
- A USCG-approved life-saving skiff will be available.
- Under no circumstances will team members enter water bodies without protective clothing such as rubber boots or waders.
- At least one person will remain on shore as a look-out.

If a team member falls into the water, under no circumstances should another team member enter the water to rescue the person in the water. If possible, a branch, paddle, pole, or similar object should be extended to the person in the water. When the person in the water grabs the extended item, they should be pulled toward the shore or boat. If the person is unconscious, the PFD, clothing, or hair should be hooked to pull the person toward the shore or boat. Once the person has been safely retrieved, necessary emergency medical procedures should be performed by qualified personnel. If none are necessary, the retrieved team member should change into dry clothing as soon as possible after any necessary personal decontamination.

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## **2.0 UNDERWATER WORK**

Underwater work should be performed in accordance with the procedures and guidelines of the Diving Safety Program (Document Control No. 2-15 in Volume I).

## **3.0 COLD WATER PROCEDURES**

When the water temperature is below 45 °F, hypothermia is a serious risk. A person can lose feeling in the extremities within 5 minutes. All field staff members should be familiar with cold water survival techniques or should receive training from an American Red Cross-certified swimming instructor in cold water survival techniques when site conditions warrant such knowledge.

After a person has been rescued from cold water, he or she should change into dry clothes as soon as possible. If the person who has fallen into the water displays hypothermia symptoms, he or she should be treated immediately and taken to a medical facility. Under no circumstances should the hypothermia victim be given hot liquids because this could accelerate shock. Drinks no warmer than normal body temperature are acceptable. If symptoms are severe and evacuation to a medical facility cannot be quickly conducted, any wet clothing should be removed, the victim should be placed in blankets or sleeping bags in a sheltered location, and the rescuer should climb into the blankets or sleeping bag with victim to provide additional warmth. The victim should also be treated continuously for shock, elevating feet and monitoring the victim's pulse and breathing rate.

If a team member falls into cold water, he or she should not remove any clothing while in the water because clothing provides additional insulation. Although clothing creates an added drag while swimming, the insulation outweighs the disadvantage of the additional drag. Each team member should carry a wool hat to place on his or her head in case he or she falls into the water. A wool hat, even when wet, provides good insulation for the head, where a large amount of body heat is lost.

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**FALL PROTECTION PRACTICES**

**SWP NO.: 6-9**  
**ISSUE DATE: JULY 1998**  
**REVISION NO.: 1**

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## FALL PROTECTION PRACTICES

This safe work practice (SWP) presents general guidelines for basic fall protection when working in elevated areas. Continuous elevated work or elevated construction work will require detailed procedures included in a site-specific health and safety plan. SWP No. 6-10, "Portable Ladder Safety," should also be consulted. During elevated work, the precautions below must be taken.

- All fall hazards should be identified at work sites with the potential for elevated work. Once an elevated fall hazard has been recognized, an appropriate control measure must be selected. Priority should be given to elimination of the fall hazard over the use of fall protection equipment.
- Approved safety harnesses and lanyards shall be worn by employees whose work exposes them to falls of greater than 6 feet.
- Lanyards should be anchored at a level no lower than the employee's waist to limit the fall distance to a maximum of 4 feet and to not allow the employee to contact the next lower work level, where practical.
- All fall protection devices should be used only in accordance with manufacturer's recommendations.
- All fall protection devices shall be inspected daily before use.
- Any lifeline, harness, or lanyard actually subjected to in-service loading (a fall) should be immediately removed from service and not used again for employee fall protection.
- Anchor points and lanyards capable of supporting a minimum dead weight of 5,400 pounds should be used.
- Employees who are required to wear fall protection should be trained in the use of the equipment, as well as in fall protection work practices.

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**DRUM AND CONTAINER HANDLING PRACTICES**

**SWP NO.: 6-11**  
**ISSUE DATE: JULY 1998**  
**REVISION NO.: 1**

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## **DRUM AND CONTAINER HANDLING PRACTICES**

This safe work practice (SWP) establishes procedures to protect field personnel and the public from exposure to hazardous materials resulting from the handling, opening, sampling, transferring, overpacking, and shipping of drums.

Regional health and safety representatives (RHSR) and subsidiary health and safety representatives (SHSR) are responsible for providing technical guidance to project managers and site safety coordinators (SSC) on drum and container handling procedures. Project managers are responsible for ensuring implementation of this SWP, when warranted, on their projects. SSCs are responsible for enforcement of this SWP at the work site. Field personnel are required to adhere to drum and container handling guidelines and procedures.

All drum and container handling operations must adhere to all applicable federal, state, local, contractual, and company requirements. Preparation and shipping of containers of hazardous materials must comply with applicable U.S. Environmental Protection Agency (EPA) and U.S. Department of Transportation (DOT) regulations. All drums and containers used during hazardous waste operations must meet appropriate DOT regulations for the materials they contain.

Drum and container handling should be approached in a systematic, stepwise manner, especially when the contents are unknown or containers are in poor condition. Inspection, opening, sampling, overpacking, and staging requirements for drums and containers are described below.

### **1.0 INSPECTION**

Drums or containers should be visually inspected before any work is conducted to gain as much information as possible about their contents. Field personnel should document in the field logbook the following information:

- Any labels or other markings indicating possible contents
- Drum or container condition (such as rusted, leaking, or dented)
- Signs of pressure (such as bulging or swelling)

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- Drum or container size, construction, and type
- Configuration of drum or container head (open or closed top)

After observations are documented in the field logbook, each drum or container should be labeled with an identification code for future tracking.

## **2.0 OPENING**

For efficient and safe drum or container opening, personnel must adhere to the guidelines below.

- If available, remote-controlled drum or container opening equipment should be used.
- In order to protect the employee, a suitable shield shall be placed between the employee and the drum being opened.
- Only spark-proof tools should be used to open drums and containers.
- Drums or containers containing unknown materials should be opened using Level B personal protection, including splash protection.
- Drums or containers containing radioactive material should not be opened or handled until the appropriate personnel with expertise in this area have been consulted.
- Air monitoring equipment should be available near the drum or container being opened, such as combination oxygen and combustible gas meters, colorimetric tubes, and photoionization detectors.
- Tools used for drum or container opening should be decontaminated after each use to avoid mixing incompatible wastes.
- Drums or containers should be resealed as soon as possible to minimize vapor generation.
- If possible, drums or containers exhibiting signs of pressure should not be opened.

## **3.0 SAMPLING**

Drum and container sampling poses a variety of potential hazards to worker health and safety, including direct contact with hazardous materials, inhalation of hazardous vapors, and the possibility of drum or container explosion or rupture. The guidelines below should be used to properly sample drums and containers.

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- Prior to sampling, a sample plan must be developed that includes the following information:
  - Background information on the waste
  - Which drums or containers will be sampled
  - Appropriate sampling devices
  - Sample containers to be used
- Sampling personnel should not stand on drums or containers or lean over other drums or containers to obtain samples.
- All phases in the vertical cross section of each drum or container should be sampled.
- Disposable glass tubing or other disposable sampling devices should be used to sample liquid.
- When sampling liquids, absorbent pads should be placed on drum tops to collect spillage that may occur while transferring samples into containers.
- Sampling personnel should document container number, any container labeling, sampling date and time, and number and color of different phases.

#### 4.0 OVERPACKING

During an emergency, drums and containers should be handled as detailed below.

- Leaks should be plugged or patched immediately if this can be done without risk.
- Damaged drums and containers should be placed in an overpack container with absorbent pads to collect any spilled material or the contents transferred into a clean, compatible drum or container.
- Absorbent material should be used to collect any leakage that may occur during shipment.

During remedial actions, the procedures below apply to drum and container handling.

- Drums or containers should be placed in overpack containers, and any identification number assigned to the drum or container should be placed on the outside of the overpack container.

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- If drum or container contents are to be bulked with other drum or container contents, the compatibility of the contents should be verified by a field characterization study prior to bulking.

## 5.0 STAGING

Staging refers to moving drums or containers in an organized manner to predesignated areas. Drums or containers may be staged to facilitate characterization and remedial action and also to protect drums or containers from potentially hazardous site conditions (such as high temperatures and proximity to ignition sources or heavy equipment). To ensure that staging is conducted in a safe and efficient manner, the guidelines below should be followed.

- Staging activities should be kept to a minimum to prevent hazards associated with increased handling of drums or containers.
- The staging area should be as close as possible to the site exit.
- The staging area should be level and covered with plastic sheeting or absorbent material.
- The staging area should be diked to contain possible spills.
- Drums or containers should be secured on pallets whenever possible to aid in the safe movement of drums or containers and to isolate the drums or containers from the soil surface.
- Drums or containers should not be stacked on top of each other.
- Drums or containers should be staged according to chemical composition of the contents. Drums or containers containing incompatible materials should be kept segregated.
- Drums and containers should be staged far enough apart to allow for the movement of equipment and personnel.

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**SPILL AND DISCHARGE CONTROL PRACTICES**

**SWP NO.: 6-14**  
**ISSUE DATE: JULY 1998**  
**REVISION NO.: 1**

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## **SPILL AND DISCHARGE CONTROL PRACTICES**

This safe work practice (SWP) provides contingency measures for spills and unintentional discharges from handling and transporting hazardous materials. Spill and discharge control practices should follow specific procedures to ensure the safety of responders and bystanders and to limit environmental impacts.

### **1.0 GENERAL PROCEDURES**

Immediate action should be taken to control and contain any spill following the general guidelines below:

- Unnecessary people should be kept away from the spill or discharge.
- The hazardous area should be isolated.
- If the spill or discharge creates a hazardous situation or results in injury or an environmental release, the emergency procedures of the HASP should be implemented. Emergency response telephone numbers, designated contacts, and special reporting procedures are presented in the HASP.
- Personnel should stay on the upwind side of the spill or discharge.
- Entry into a confined space or low area where liquids or vapors may accumulate should be avoided.
- Sources of ignition should be eliminated if the spill or discharge involves combustible materials.
- Drains, manholes, waterways, sewers, and the like should be identified and covered or protected.
- The spill should be controlled or absorbed using appropriate media or devices.
- When the spill or discharge is fully contained and under control, spill or discharge material should be collected.
- Following cleanup, the spill area should be evaluated by collecting soil samples and screening the area with air monitoring instruments.

### **2.0 SOLIDS**

If the spill or discharge material is solid and nonreactive, the material should be scooped up and placed in a suitable and compatible container until the disposal method has been determined.

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### 3.0 LIQUIDS

If liquid is discharged, the following general procedures apply:

- The point of discharge should be immediately identified and measures taken to eliminate further discharges by uprighting or patching containers, transferring contents, or other appropriate methods.
- Any discharged liquids or sludge should be removed or retrieved.
- Discharged materials should be cleaned up with absorbent materials or devices.
- Spent absorbent material should be placed into storage or disposal containers.

### 4.0 REPORTING

In some instances, a release may require reporting to government agencies. If a reportable quantity is released (this quantity is stated on the Material Safety Data Sheet) or human health or the environment is threatened, appropriate national, state, and local administering agency personnel should be notified. The timeframe for notification may vary from agency to agency. Notification may be required immediately or within 24 hours, depending on the type, location, and amount of released material. The appropriate agency to report spills to should be determined during HASP development.

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**HEAT STRESS**

**SWP NO.: 6-15**

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## HEAT STRESS

This safe work practice (SWP) describes situations where heat stress is likely to occur and provides procedures for the prevention and treatment of heat-related injuries and illnesses. Wearing personal protective equipment (PPE), especially during warm weather, puts employees at considerable risk of developing heat-related illness. Health effects from heat stress may range from transient heat fatigue or rashes to serious illness or death.

Many factors contribute to heat stress, including PPE, ambient temperature and humidity, workload, and the physical condition of the employee, as well as predisposing medical conditions. However, the primary factors are elevated ambient temperatures in combination with fluid loss. Because heat stress is one of the more common health concerns that may be encountered during field activities, employees must be familiar with the signs, symptoms, and various treatment methods of each form of heat stress. Heat stroke is the most serious heat-related illness—it is a threat to life and has a 20 percent mortality rate. Direct exposure to sun, poor air circulation, poor physical condition, and advanced age directly affect the tendency to heat stroke. Table 1 lists the most serious heat conditions, their causes, signs and symptoms, and treatment.

Training is an important component of heat stress prevention. Employees are instructed to recognize and treat heat-related illnesses during 8-hour health and safety refresher and first aid training courses. When working in hot environments, specific steps should be taken to lessen the chances of heat-related illnesses. These include the following:

- Ensuring that all employees drink plenty of fluids (Gatorade® or its equivalent)
- Ensuring that frequent breaks are scheduled so overheating does not occur
- Revising work schedules, when necessary, to take advantage of the cooler parts of the day (such as working from 5:00 a.m. to 11:00 a.m. and 6:00 p.m. to nightfall).

When PPE must be worn (especially Levels A and B), suggested guidelines relating to ambient temperature and maximum wearing time per excursion are as shown in Table 2.

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**TABLE 1**  
**HEAT STRESS CONDITIONS**

Condition	Causes	Signs and Symptoms	Treatment
Heat cramps	Fluid loss and electrolyte imbalance from dehydration	<ul style="list-style-type: none"><li>• Painful muscle cramps, especially in legs and abdomen</li><li>• Faintness</li><li>• Profuse perspiration</li></ul>	<ul style="list-style-type: none"><li>• Move affected worker to cool location</li><li>• Provide sips of liquid such as Gatorade®</li><li>• Stretch cramped muscles</li><li>• Transport affected worker to hospital if condition worsens</li></ul>
Heat Exhaustion	Blood transport to skin to dissipate excessive body heat, resulting in blood pooling in the skin with inadequate return to the heart	<ul style="list-style-type: none"><li>• Weak pulse</li><li>• Rapid and shallow breathing</li><li>• General weakness</li><li>• Pale, clammy skin</li><li>• Profuse perspiration</li><li>• Dizziness</li><li>• Unconsciousness</li></ul>	<ul style="list-style-type: none"><li>• Move affected worker to cool area</li><li>• Remove as much clothing as possible</li><li>• Provide sips of cool liquid or Gatorade® (only if conscious)</li><li>• Fan the person but do not overcool or chill</li><li>• Treat for shock</li><li>• Transport to hospital if condition worsens</li></ul>
Heat Stroke	Life threatening condition from profound disturbance of body's heat-regulating mechanism	<ul style="list-style-type: none"><li>• Dry, hot, and flushed skin</li><li>• Constricted pupils</li><li>• Early loss of consciousness</li><li>• Rapid pulse</li><li>• Deep breathing at first, and then shallow breathing</li><li>• Muscle twitching leading to convulsions</li><li>• Body temperature reaching 104 °F or higher</li></ul>	<ul style="list-style-type: none"><li>• Immediately transport victim to medical facility</li><li>• Move victim to cool area</li><li>• Remove as much clothing as possible</li><li>• Reduce body heat promptly by dousing with water or wrapping in wet cloth</li><li>• Place ice packs under arms, around neck, at ankles, and wherever blood vessels are close to skin surface</li><li>• Protect patient during convulsions</li></ul>

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**TABLE 2**  
**SUGGESTED GUIDELINES WHEN WEARING PPE**

Ambient Temperature	Maximum PPE Wearing Time per Excursion
Above 90 °F	15 minutes
85 to 90 °F	30 minutes
80 to 85 °F	60 minutes
70 to 80 °F	90 minutes
60 to 70 °F	120 minutes
50 to 60 °F	180 minutes

Source: National Institute for Occupational Safety and Health (NIOSH). 1985. Memorandum Regarding Recommended Personal Protective Equipment Wearing Times at Different Temperatures. From Austin Henschel. To Sheldon Rabinovitz. June 20.

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To monitor the level of an employee's heat stress, the following should be measured:

- Heart Rate: Count the radial (wrist) pulse during a 30-second period as early as possible in the rest period; if heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.

If the heart rate still exceeds 110 beats per minute at the next period, shorten the following work cycle by one-third.

- Oral Temperature: Use a disposable oral thermometer (3 minutes under the tongue) to measure the oral temperature at the end of the work period. If oral temperature exceeds 99.6 °F (37.6 °C), shorten the next work cycle by one-third without changing the rest period. If oral temperature still exceeds 99.6 °F at the beginning of the next rest period, shorten the following work cycle by one-third. Do not permit a worker to wear impermeable PPE when his or her oral temperature exceeds 100.6 °F (38.1 °C).

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**COLD STRESS**

**SWP NO.: 6-16**

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## COLD STRESS

This safe work practices (SWP) describes situations where cold stress is likely to occur and discusses procedures for the prevention and treatment of cold-related injuries and illnesses. Cold conditions may present health risks to employees during field activities. The two primary factors that influence the risk potential for cold stress are temperature and wind velocity. Wetness can also contribute to cold stress. Other factors that increase susceptibility to cold stress include age (very young or old), smoking, alcohol consumption, fatigue, and wet clothing. Hypothermia can occur at temperatures above freezing if the individual has on wet or damp clothing or is immersed in cold water. The combined effect of temperature and wind can be evaluated using a wind chill index as shown in Table 1.

Bare flesh and body extremities that have high surface area-to-volume ratios such as fingers, toes, and ears are most susceptible to wind chill or extremely low ambient temperatures. Because cold stress can create the potential for serious injury or death, employees must be familiar with the signs and symptoms and various treatments for each form of cold stress. Table 2 provides information on frostbite and hypothermia, the two most common forms of cold-related injuries.

Training is an essential component of cold stress prevention. Employees are instructed to recognize and treat cold-related injuries during 8-hour health and safety refresher and first aid training courses. When working in cold environments, specific steps should be taken to lessen the chances of cold-related injuries. These include the following:

- Protecting of exposed skin surfaces with appropriate clothing (such as face masks, handwear, and footwear) that insulates, stays dry, and blocks wind
- Shielding the work area with windbreaks to reduce the cooling effects of wind
- Providing equipment for keeping workers' hands warm by including warm air jets and radiant heaters in addition to insulated gloves
- Using adequate insulating clothing to maintain a body core temperature of above 36 °C
- Providing extra insulating clothing on site

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**TABLE 1**  
**COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED**  
**AS EQUIVALENT TEMPERATURE**

Estimated Wind Speed (in miles per hour - mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
CALM	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	<i>LITTLE DANGER</i> in less than 1 hour with dry skin; maximum danger from false sense of security			<i>INCREASING DANGER</i> from freezing of exposed flesh within 1 minute				<i>GREAT DANGER</i> that flesh may freeze within 30 seconds				

Trench foot may occur at any point on this chart.

Source: Modified from American Conference of Governmental Industrial Hygienists. 1997.  
“Threshold Limit Values for Chemical Substances and Physical Agents.”

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**TABLE 2**  
**COLD STRESS CONDITIONS**

Condition	Causes	Signs and Symptoms	Treatment
Frostbite	Freezing of body tissue, usually the nose, ears, chin, cheeks, fingers, or toes	<ul style="list-style-type: none"><li>• Pain in affected area that later goes away</li><li>• Area feels cold and numb</li><li>• Incipient frostbite (frostnip) - skin is blanched or whitened and feels hard on the surface</li><li>• Moderate frostbite - large blisters</li><li>• Deep frostbite - tissues are cold, pale, and hard</li></ul>	<ul style="list-style-type: none"><li>• Move affected worker to a warm area</li><li>• Immerse affected body part in warm (100 to 105 °F) water—not hot!</li><li>• Handle affected area gently; do not rub</li><li>• After warming, bandage loosely and seek immediate medical treatment</li></ul>
Hypothermia	Exposure to freezing or rapidly dropping temperatures	<ul style="list-style-type: none"><li>• Shivering, dizziness, numbness, weakness, impaired judgment, and impaired vision</li><li>• Apathy, listlessness, or sleepiness</li><li>• Loss of consciousness</li><li>• Decreased pulse and breathing rates</li><li>• Death</li></ul>	<ul style="list-style-type: none"><li>• Immediately move affected person to warm area</li><li>• Remove all wet clothing and redress with loose, dry clothes</li><li>• Provide warm, sweet drinks or soup (only if conscious)</li><li>• Seek immediate medical treatment</li></ul>

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- Reducing the duration of exposure to cold
- Changing wet or damp clothing as soon as possible

During periods of extreme cold (10 °F or less) workers should use the buddy system to ensure constant protective observation.

Specific monitoring criteria are not established for cold stress. However, employees should be thoroughly cognizant of the signs and symptoms of frostbite and hypothermia (see Table 1) in themselves as well as in coworkers. All instances of cold stress should be reported to the site safety coordinator. Work schedules may be adjusted and warm-up regimes imposed as needed to deal with temperature and wind conditions.

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**BIOHAZARDS**

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## **BIOHAZARDS**

Biological hazards, or “biohazards,” include plants, animals or their products, and parasitic or infectious agents that may present potential risks to worker health. This safe work practice (SWP) discusses procedures for working with biohazards, preventive guidelines, and first-aid procedures for the most common hazards field staff are likely to encounter. This SWP does not address biohazards such as those associated with medical waste. Procedures for working with this type of biohazard should be addressed in the site-specific health and safety plan (HASP) on a case-by-case basis.

During preparation of the site-specific HASP, the preparer should consider which plants, animals, and other biological agents may be encountered; assess their potential risk to project personnel; and attach this SWP to the HASP, if necessary. Office health and safety representatives should become familiar with biological hazards indigenous to the geographical area in which most of their office personnel work and assist in evaluating the risks to personnel on projects staffed from their offices. SWPs for insects, snakes, animals, plants, waterborne pathogens (giardia), and hantavirus are provided below.

### **1.0 INSECTS**

SWPs for reducing the chance of insect bites or stings and for treating bites or stings are listed below.

- Workers should keep as much skin area covered as possible by wearing long-sleeved shirts, long pants, and a hat. Pant legs should be tucked into socks or boots and shirts into pants. In addition, workers should wear light colored clothing.
- A proven insect repellent should be used on bare skin and clothing.
- When possible, tall grasses and brush that could harbor ticks should be avoided.
- Several times during the day and at the end of the work day, each worker should perform a check for evidence of imbedded ticks or previous bites. Particular attention should be paid to the scalp, neck, ankles, back of the legs, and waist.
- When opening well covers, vaults, or other closed items, workers should watch for hornet or wasp nests and black widow or brown recluse spiders. Workers should never reach into spaces with unprotected arms.
- Workers should watch carefully for bees around open soft drinks or food.

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- If a worker is stung by a bee, the stinger should be carefully removed, if present. The wound should be washed and a cold pack applied. Allergic reaction should be watched for and is evidenced by extreme swelling, redness, pain, or difficulty breathing.
- If a worker is stung or bit by a spider or scorpion, medical attention should be obtained immediately.

## 2.0 SNAKES

SWPs for encounters with snakes and for treating snakebites are listed below.

- Workers should avoid walking in areas known to harbor snakes. Workers should be cautious when picking up or moving items that have been on the ground.
- Workers should wear boots made of heavy material that protect the ankles and pants. Heavy work gloves should be worn for picking up items.
- If one snake is encountered, others may be present. Workers should leave the area by retracing their steps.
- If a worker is bitten, the wound should be washed and the injured area immobilized and kept lower than the heart, if possible. Ice or a tourniquet should not be applied to a snake bite. The wound should not be cut. If medical care is more than 30 minutes away from a work site, a snakebite kit should be available on site and workers should know how to use it.

## 3.0 ANIMALS

SWPs for encounters with animals and for treating associated wounds are listed below.

- If workers encounter a wild animal, the animal should be observed for unusual behavior such as a nocturnal animal out during the day, drooling, an appearance of partial paralysis, irritability, meanness, or a strangely quiet demeanor.
- Workers should never touch the body of a dead animal because certain diseases could be carried by fleas still on the body.
- Workers should avoid animal droppings (including bird droppings). Pathogens, some of which can become airborne, may still be present in the droppings.
- If a worker is bitten, he or she should get away from the animal to avoid further bites. Workers should not try to stop, hold, or catch the animal.

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- If the wound is minor, it should be washed with soap and water. Any bleeding should then be controlled, and an antibiotic ointment and dressing should be applied. All animal bite wounds should be watched for signs of infection.
- If the wound is bleeding seriously, the bleeding should be controlled but the wound should not be cleaned. Medical assistance should be summoned immediately.
- If a rabid animal is suspected, immediate medical attention should be summoned. If possible, workers should try to remember what the rabid animal looked like and the area in which it was last seen. The animal should be reported by calling the local emergency number.

#### 4.0 PLANTS

SWPs for plants are as follows:

- Workers should be aware of the types and appearances of poisonous plants in the work site area. Poison ivy, oak, and sumac are the most frequently encountered plants that can cause reaction from casual contact. If a worker is extremely sensitive to these plants, he or she should avoid the area entirely because airborne drift could be sufficient to cause a reaction. Other plants, such as fireweed, can cause painful, short-term irritation and should be avoided as well. Workers should avoid touching face and eye areas after contact with any suspicious plant.
- Workers should wear proper clothing if working in or near overgrown areas. Disposable outerwear should be used, if necessary, and workers should not touch the material with bare hands during removal if the outerwear may have contacted poisonous plants.
- If contact with a poisonous plant has occurred, the affected area should be immediately washed thoroughly with soap and water. If a rash or weeping sore has already begun to develop, a paste of baking soda and water should be applied to the area several times a day to reduce discomfort. Lotions such as Calamine or Caladryl should be applied to help soothe the area. If the condition gets worse and affects large areas of the body or the face, a doctor should be consulted.
- Bushy and wooded areas should be thoroughly checked for thorn-bearing trees, brush, and bramble. In some cases, impalement can cause severe pain or infection.

#### 5.0 WATERBORNE PATHOGENS-GIARDIA

Giardia is a waterborne pathogen consisting of a protoplasmic parasite of the mammalian digestive tract. Giardia is present worldwide, with the highest occurrence in areas with poor sanitation. In the United

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States, most reported cases are in mountainous regions where drinking water is obtained from streams and is unfiltered or untreated.

Giardia is contracted by ingesting water contaminated with giardia cysts in the dormant state. Giardia parasites can only thrive in the digestive tracts of mammals. Dormant giardia organisms enter water through the feces of infected animals or humans. Giardia symptoms include severe diarrhea and upset stomach. Some people are asymptomatic but can transmit the disease to others. Medical treatment of giardia can be difficult and unpleasant; therefore, prevention is critical. Precautions for preventing exposure to giardia are listed below.

- Workers should assume that all fresh water streams are infected with the giardia organism and not drink any untreated water.
- Team members collecting sediment and water samples from streams should wash their hands thoroughly with soap and water after collecting the samples.
- Giardia parasites are relatively easy to destroy or filter. Water should be treated for drinking or cooking with iodine or another recommended giardia treatment before use.

## 6.0 HANTAVIRUS

Hantavirus pulmonary syndrome (HPS) is a potentially fatal infection caused by a rodent-borne hantavirus. HPS begins with a brief illness most commonly characterized by fever, muscle pain, headache, coughing, and nausea or vomiting. Other early symptoms include chills, diarrhea, shortness of breath, abdominal pain, and dizziness. In the first identified cases of HPS, this stage of the infection lasted 2 to 5 days before victims were hospitalized. Typically, by the time of hospitalization, victims were found to have tachycardia (a heart rate of greater than 100 beats per minute) and tachypnea (a breathing rate of greater than 20 breaths per minute). Fever was also common. In most cases, death occurred within 2 to 16 days of the onset of symptoms, and victims exhibited pulmonary edema and severe hypotension.

Currently, experts believe that HPS is spread by the deer mouse (*Peromyscus maniculatus*). Though the deer mouse has been found to be the primary host of hantavirus, several other rodent species have also tested positive for the virus. Pinon mice (*Peromyscus truei*), brush mice (*Peromyscus boylii*), and western

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chipmunks (*Tamia spp.*) are also likely to carry the virus. Also, cases of HPS have been reported in areas of the United States where these particular rodents are not indigenous.

Infected rodents shed the virus in their urine, feces, and saliva. Humans can be exposed to the virus through (1) inhalation of suspended rodent excreta or dust particles containing rodent excreta, (2) introduction of rodent excreta into the eyes or broken skin, and (3) ingestion of food or water contaminated by rodent excreta. HPS has a reported mortality rate of 55 percent. Transmission of hantavirus from infected individuals to healthy persons has not been documented.

Prevention of HPS infection is essential because no known antidote and no specific treatment exists for treating HPS. Therefore, employees should practice risk reduction and control measures. Guidelines for workers in locations that may have rodent infestations or habitats are listed below.

- The best approach for HPS control and prevention is through environmental hygiene practices that deter rodents from colonizing the work environment.
- Information about the symptoms of HPS and detailed guidance on preventive measures should be provided to all employees assigned to field activities.
- Medical attention should be sought immediately for workers who develop a febrile or respiratory illness within 45 days of the last potential exposure to rodents. Attending physicians should be advised of each worker's potential for occupational exposure to hantavirus. Physicians should contact local health authorities promptly if hantavirus-associated illness is suspected. A blood sample should be obtained from the affected worker and forwarded with the baseline serum sample through the state health department to the Centers for Disease Control and Prevention for hantavirus antibody testing.
- Respiratory protective equipment should be worn when handling rodents, when removing rodents from traps, and when working in areas with evidence of rodent droppings or hair. Respiratory protective equipment should include, at a minimum, a half-face air-purifying respirator (APR) or powered APR equipped with a high-efficiency particulate air (HEPA) filter (P100). Full-face regulators may be needed under some circumstances. Respiratory protective equipment should be used in accordance with Occupational Safety and Health Administration regulations.
- Dermal protection should be worn when handling rodents or traps containing rodents, or if contact with contaminated surfaces could occur. Dermal protection should include rubber or plastic gloves that should be washed and disinfected before removal.

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- A trap contaminated with rodent urine or feces or in which a rodent was captured should be disinfected with a commercial disinfectant or a 0.4 percent bleach solution. A dead rodent should be disposed of by placing the carcass in a plastic bag containing enough general-purpose household disinfectant to thoroughly wet the carcass. The bag should be sealed and disposed of by burning or by burying it in a 2- to 3-foot-deep hole. Local and state health departments can also provide appropriate disposal methods.

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**RADIATION SAFETY PRACTICES**

**SWP NO.: 6-21**  
**ISSUE DATE: JULY 1998**  
**REVISION NO.: 1**

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## **RADIATION SAFETY PRACTICES**

This safe work practice (SWP) applies to employees who work at sites where ionizing radiation (radiation) is a known or suspected hazard. This SWP applies to ionizing forms of radiation only and does not address hazards or SWPs for nonionizing forms of radiation such as infrared, ultraviolet, microwave, radio waves, and so on. This SWP addresses the requirements of Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.96, "Ionizing Radiation," and the requirements of 10 CFR, Part 20, "Standards for Protection Against Radiation" (applicable to environmental consultants and engineers). Health and safety plans (HASP) for work sites with known or suspected ionizing radiation shall include this SWP as an attachment. General guidelines, exposure limits, and procedures are discussed below.

### **1.0 GENERAL GUIDELINES**

Tetra Tech, Inc. (Tetra Tech), intends to keep all employee radiation exposure levels as low as reasonably achievable (ALARA). Field workers should use a combination of engineering controls, administrative controls, and personal protective equipment (PPE) to limit external and internal radiation doses. Basic protection control measures that apply to all forms of radiation include (1) reducing exposure time, (2) increasing distance from the radiation source, and (3) using a shield between the radiation source and employees. Additional guidelines are listed below.

- Employees less than 18 years of age shall not be allowed to work in areas with known or suspected radiation hazards.
- Personnel will be protected from internal and external radiation exposure hazards through general and site-specific training, use of PPE, adherence to strict work practices, and proper decontamination procedures.
- Ingestion of contaminated material will be prevented through good personal hygiene.
- Eating, drinking, and smoking are not permitted in potentially contaminated areas.
- Washing hands when leaving a contaminated area and before eating is required.
- Employees with open cuts or abrasions are not allowed to handle contaminated material because handling may allow entry of the material into the bloodstream.
- Pregnant employees will be advised not to work in areas with known or suspected radiation hazards. However, if a pregnant woman wants to work, limits on declared pregnant workers defined in 10 CFR, Part 20 apply.

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The site safety coordinator (SSC) is responsible for ensuring that personnel are appropriately monitored for exposure to ionizing radiation. A radiation protection officer (RPO) may be assigned to a site to assist the SSC.

## 2.0 EXPOSURE LIMITS

Ionizing radiation presents a hazard as both a source of external exposure and as a contaminant of surfaces and media. Radiation exposure limits as established by the Nuclear Regulatory Commission (NRC) are presented below.

Type of Exposure	Annual Limit
Whole body (head and trunk), active blood-forming organs, or gonads	5 roentgen equivalent in man (rem) per year, total effective dose
Lens of the eye	15 rem per year
Extremities	50 rem per year
Skin of the whole body	50 rem per year

In addition to the whole-body doses listed above, the NRC has also established derived air concentrations (DAC) for airborne radioactive materials (RAM) exposures. Table 1 of Appendix B, 10 CFR, Part 20, lists DACs for RAMs. The DAC values are designed to maintain internal exposure doses below the annual limit for intake (ALI), assuming a 40-hour per week exposure period. Total body dose calculations must factor in the contribution of airborne RAM to the total dose. The table in 10 CFR, Part 20, should be consulted when calculating internal exposures through inhalation of specific radionuclides.

## 3.0 PROCEDURES

The following sections discuss procedures related to personal monitoring, environmental monitoring, restricted areas, training, PPE, decontamination, and exposure and medical records associated with work at sites involving potential exposure to radiation.

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### **3.1 PERSONAL MONITORING**

Each individual working at a site with the potential for radiation exposure will participate in a monitoring program designed to measure worker external and internal radiation doses. The instrument and devices used for this monitoring as well as monitoring procedures and protocol are discussed below.

#### **3.1.1 External Radiation Dosimetry**

External radiation exposure can be measured by thermoluminescent dosimeters (TLD), film badges, and pocket dosimeters. The determination of the appropriate dosimeter for a specific project will be made based on site history and potential risk for exposure to external ionizing radiation. Specific badge handling procedures will be provided on a case-by-case basis.

TLDs that measure x-ray, beta, and gamma radiation are general use dosimeters that measure external ionizing radiation levels to which personnel are exposed. At some work locations, a TLD that also detects fast neutron radiation will be used. The TLDs are analyzed after each calendar quarter to comply with Occupational Safety and Health Administration (OSHA) and NRC requirements. Tetra Tech shall provide TLDs to field workers who routinely work in areas with potential radiation hazards. TLD badges should be ordered from a reputable dosimetry vendor. All personal dosimeters must be worn on the front of the body between the neck and waist. TLDs must be worn outside of any protective clothing. Dosimeters should be protected from inclement weather conditions.

If TLDs are needed for long-term projects lasting more than 5 months, a full TLD program should be set up with a vendor. Employee names, social security numbers, birth dates, and genders must be supplied to the vendor to establish a quarterly monitoring program. At the end of each monitoring period, all TLDs and a control TLD must be returned to the vendor for analysis. The official and permanent record of the cumulative external dose received by each employee is obtained from the quarterly interpretations of the TLD. Billing and exposure reports will be managed by the regional health and safety representative (RHSR) or subsidiary health and safety representative (SHSR). The RHSR or SHSR must be contacted to add employees to the radiation dosimetry program.

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Under certain circumstances, Tetra Tech may allow use of film badges rather than TLDs. Film badges are used to measure external exposure to x-ray and gamma radiation. Film badges are typically analyzed on a monthly basis. Placement and use of film badges is similar to those for TLDs.

Employees scheduled for short-term field work where potential radiation hazards exist should use pocket dosimeters. Pocket dosimeters should be used for field work lasting 1 to 2 days. Pocket dosimeters can be used along with TLDs to provide real-time exposure monitoring. Employees using a pocket dosimeter in areas exceeding the applicable radiation exposure action levels must record the radiation dose daily in a field logbook. A copy of recorded exposures above background levels must be submitted to the RHSR or SHSR within 15 calendar days of field work completion. If the pocket dosimeter indicates that an individual has received a radiation dose of 100 millirems or more, the individual will be removed from field work and his or her TLD will be processed immediately. Pocket dosimeters must be requested through the Tetra Tech equipment vendor.

In the event of a lost or damaged TLD, the site RPO or SSC will determine a dose estimate for the individual by using values recorded on direct-reading instruments. If such a dose cannot be determined, the maximum permissible radiation dose for the time period in question for the affected employee will be recorded in the field logbook.

### **3.1.2 Airborne Radioactive Material Measurement**

Airborne RAM may enter the body during inhalation resulting in an internal radiation dose. NRC regulations require the measurement of airborne RAM concentrations whenever inhalation exposures may result in an intake in excess of 10 percent of the ALI for that RAM as defined in Appendix B, Table 1, of 10 CFR, Part 20. In accordance with principles of ALARA, Tetra Tech shall require monitoring of airborne RAM under all circumstances of potential exposure.

Airborne RAM may be emitted by processes involving RAM or from radioactive contamination in dirt, debris, and on surfaces that have been disturbed. Monitoring shall be conducted using air sampling devices appropriate for personal monitoring and shall account for all potential periods of exposure. Samples shall be submitted to an accredited laboratory for analysis as soon as possible.

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### **3.2 ENVIRONMENTAL MONITORING**

The types of radiation sources, RAM, and types and extent of impacts to the site (such as surficial contamination), will determine which survey instruments are necessary to characterize the site. Both area radiation levels and surface contamination levels will be monitored. Survey instruments will be specified in the HASP. Tetra Tech can obtain the necessary radiation survey instruments for area monitoring through equipment vendors.

During initial site entry, personnel will monitor site conditions with direct-reading instruments when site information is sufficient to show that the potential for ionizing radiation exposure exists or when specific site information is not sufficient to eliminate the possibility of radiation sources or contamination. The initial site evaluation will include a review of available site data, including site history.

Upon startup of field activities, regular monitoring will be conducted if necessary to track the locations and intensities of RAM. Monitoring of airborne RAM within work areas and at the site's downwind perimeters is also required.

Results of radiation and contamination surveys shall be documented in the field logbook and the logbook shall remain on site for the duration of site activities. As work progresses at the site, survey and contamination maps shall be updated accordingly.

### **3.3 RESTRICTED AREAS**

Restricted areas are designated to control personnel exposures to RAM and to prevent the spread of contamination out of the area. The posting of warning signs around restricted areas shall follow the requirements of 10 CFR, Part 20, Subpart J. Restricted areas shall be designated in the HASP as the exclusion zone or a portion of the exclusion zone.

### **3.4 TRAINING**

Specific training requirements for work assignments involving potential exposure to RAM or radioactive contamination should be included in the site-specific HASP. Training requirements are not specified in 10 CFR, Part 20. However, Tetra Tech will require employees working with or potentially exposed to

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RAM to receive specific training on RAM and the hazards associated with the specific site. General

RAM training will include the following topics:

- Types and properties of ionizing radiation
- Acute and long-term health effects of exposure to ionizing radiation
- Exposure routes
- PPE for RAM
- Administrative and engineering exposure controls
- Personal, area, and contamination monitoring devices and their uses
- Basic requirements of 10 CFR, Parts 19 and 20

Site-specific training will address the following topics:

- Types of RAM and ionizing radiation at the site
- Locations of RAM at the site
- Designated restricted and contaminated areas
- Decontamination methods
- Personal, area, and contamination monitoring devices designated for the site
- Emergency procedures for RAM incidents

### **3.5 PERSONAL PROTECTIVE EQUIPMENT**

A minimum of full Level C protection with disposable coveralls must be worn in any potentially radiation-contaminated area. Tetra Tech personnel will use full face air purifying respirators with high-efficiency particulate air (P100) cartridges to prevent inhalation of airborne alpha particles and radionuclides. This level of protection will prevent or minimize radioactive material from contacting skin. PPE must be thoroughly decontaminated with extreme care to prevent the spread of contamination to other areas. Contaminated material on the skin must be removed as quickly as possible. Supplied air respirators can also be used depending on the hazard and work activity.

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### **3.6 DECONTAMINATION**

Generally, decontamination procedures for RAM are the same as for hazardous waste (see Document Control No. 3-8, "Decontamination Program," in Volume II). However, employees should take the following additional precautions:

- Minimize the spread of contamination by following SWPs
- Know where contamination is and avoid tracking equipment and personnel through it
- Use proper decontamination techniques
- Use straight detergent, soap and water, or commercially prepared solutions to remove RAM (solutions containing ethylenediamine tetraacetic acid, such as Radiacwash®, will bind up RAM and maintain the RAM in solution before rinsing)
- Consider all decontamination materials to be contaminated; decontamination waste will contain RAM and must be disposed of properly

### **3.7 EXPOSURE AND MEDICAL RECORDS**

Tetra Tech shall maintain records of radiation exposure of all employees for whom personnel monitoring was conducted. Records will be evaluated to verify that exposures are maintained at ALARA levels.

Tetra Tech is obligated to evaluate ionizing radiation exposure data to verify that exposures are maintained at ALARA levels and will provide a yearly summary exposure report to each participating employee. Tetra Tech will notify each employee who has worn a dosimeter during the year of his or her annual exposure in February of the following year. If quarterly results indicate high exposure, the employee will be notified immediately. Retained radiation exposure records will indicate exposure in millirems per calendar quarter, DAC hours of airborne radiation exposure, and the calculated combined dose for the total body (summary of the external and internal doses) using methods for calculating total body dose presented in 10 CFR, Part 20.1202.

Special medical examinations may be necessary when excessive external or internal doses of radioactive materials are suspected to have occurred. Medical evaluation needs will be established on a case-by-case basis with the advice of the Tetra Tech consulting physician. Any instance of suspected overexposure should be reported immediately to the SSC. The SSC will contact the appropriate RHSR or SHSR for recommendations on how to proceed with follow-up medical evaluations.

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Tetra Tech shall maintain exposure records for former employees along with their medical records as stated in Document Control No. 1-4, "Recordkeeping and Reporting Program," in Volume I and Document Control No. 3-2, "Medical Surveillance Program," in Volume II. These records will be available to former employees within 30 days of receipt of a written request for them.

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**HYDROGRAPHIC DATA COLLECTION**

**SWP NO.: 6-22**  
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**REVISION NO.: 1**

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## HYDROGRAPHIC DATA COLLECTION

These safe work practices are for all employees involved in hydrographic data collection and all activities related to such work when working in or near moving water. While every facet of the work cannot be discussed or foreseen, it is assumed that each employee will hold paramount his or her safety and the safety of the other crew members when collecting hydrographic data.

River data collection involves an array of different working environments such as driving field vehicles; towing, launching, and operating boats; using sampling equipment; and operating surveying equipment. Each task poses different safety concerns. Table 1 lists the general tasks of data collection, the potential safety hazards involved with each task, steps to take to avoid the hazard, and steps to take if an incident does occur.

Safety factors must be considered in addition to the individual tasks of data collection. Emergency preparation procedures, general concerns, and incident reporting are discussed below.

### 1.0 EMERGENCY PREPARATION PROCEDURES

Emergency telephone numbers for the location where data collection is being conducted must be written in the field crew notebook. This list should be updated by the crew chief prior to commencing any work in a new location.

Typically each field crew will have a cellular telephone that should be utilized whenever warranted by an accident. Additionally, the field crew will have two-way radios to allow communication between crew members for data collection purposes and for cases of emergency.

First aid kits must be available in every vehicle and on every boat in use. Fire extinguishers must be located on each boat that has a motor and gas can. Throw ropes must also be provided on each boat.

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## 2.0 GENERAL CONCERNS

When working in the field, exposure to the elements can be extreme. Do not underestimate the power of the weather. It is recommended that at least 50 ounces (1.5 liters) of drinking water be consumed every 8 hours while working in the river environment, regardless of the air temperature.

Heat problems are common in the river environment. Hot weather causes dehydration, as does cold water through the effects of cold water diuresis. Both heat exhaustion and heat stroke can result from exposure to the heat and lack of fluids in the body. Additional information about recognizing and treating heat stress are provided in SWP No. 6-15.

Cold stress is also a serious problem, especially when working in cold water and in colder climates that can lead to hypothermia. Below is an excerpt about immersion in cold water from the *Swiftwater Rescue Technical I Manual* (Croslin and others 1983).

The first effect of cold water is to shut down the circulation to the arms and legs in order for the body to keep warm blood in the core. This shunting makes it difficult for the cold water immersion victim to swim purposefully after only a few minutes. It also causes immersion diuresis. Since the extra blood goes to the core, the kidneys are fooled into thinking there is a fluid overload. The result is frequent urination, and the loss of vital fluids and salts. So the victim on the verge of becoming hypothermic is perhaps shivering, has cold extremities, sluggish circulation to the brain, and is hypovolemic, or low fluid volume due to profuse urination.

The patient that still retains a gag reflex can and should be aggressively treated in the field, with warm fluids, external warmth, and even hot air or oxygen is possible. With no aggressive efforts, the patient will continue to deteriorate. The rescuer is cautioned that best efforts may even then not be successful.

People working in the field are not expected to perform rescues or practice any medical techniques; however, they should be aware of the signs to look for in themselves and coworkers when exposed to extreme conditions. SWP 6-16 provides additional information on cold stress.

Exposure to ultraviolet rays should also not be overlooked when working in the river environment. Sunscreen and good eye protection is highly recommended. The river environment is home to several animals, and insects, some of which are dangerous to humans. Rattlesnakes are not uncommon and

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should be looked for, especially in rocky and riprapped areas, in the cooler hours of the morning and evening.

Storms can move in quickly; be aware of the weather conditions at all times and know the availability of shelter. Use caution when using tall, conductive equipment such as level rods (up to 25 feet) and cable guides when there is a possibility of lightning.

The work load can be taxing. If a crew member feels the effects of fatigue, stop the work and rest or switch tasks with another crew member.

Proper clothing should be worn when working in the field. River boots, waders, dry jackets, and personal flotation devices (PFD) must be worn. Each crew member should also bring proper clothing for various types of weather. Hard hats and florescent safety vests will be worn when working within 500 feet of heavy, large machinery or in designated hard hat areas when construction activities are occurring or expected to be occurring. Prior to working in a construction zone, the crew chief should notify the person supervising construction of the data collection activities that will be occurring. The crew chief should coordinate such issues as places to park vehicles and traffic flow.

If a tag line must be strung across a river, the crew chief must notify appropriate state or local authorities. Extreme caution must be used when the tag line is across a river in areas of recreational use. If the area experiences large amounts of boat traffic, place a large, highly visible sign upstream of the work location notifying boaters of a tag line across the river downstream. Also, tie flagging to the tag line to help boaters to see the line.

### **3.0 INCIDENT REPORTING**

Should an incident occur, the investigation and report will comply with the Tetra Tech, Inc. (Tetra Tech) Accident and Illness Investigation Program, Document Control No. 2-2, Volume 1. The person directly responsible for the supervision of the employee or employees involved in an incident, usually the crew chief, must report the incident within 8 hours of the occurrence, regardless of whether or not medical attention was sought.

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## REFERENCE

Croslin, Make, M.D., Barry Edwards, and Jim Segerstrom (Croslin and others). 1983. *Swiftwater Rescue Technician I Manual*. Rescue 3 International.

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**TABLE 1**

**SAFETY CONCERNS INVOLVED WITH HYDROGRAPHIC DATA COLLECTION**

Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
Loading equipment	Strained muscles, back, legs, arms, and so on	Use proper lifting techniques. Lift with legs, not back.	Report the accident. Seek medical attention if necessary.
	Equipment shifting, sliding, or falling out of vehicle	Take extra time to load equipment so that it rides well without a lot of disturbance.	Rearrange the equipment so that it rides without moving in the vehicle.
Loading and transporting a boat with a vehicle	Trailer becomes unattached from the towing vehicle if the ball hitch is not on securely and safety chains not latched	Be sure the trailer is securely attached to the ball hitch and the safety hitch pin is secure in the hitch. Be sure both chains are securely attached to the towing vehicle.	Stop the vehicle as soon as physically possible. Retrieve the boat and reattach if possible.
	No signal lights if electrical wires not hooked up	Be sure electrical wires are connected and test all lights prior to driving the vehicle.	If connections are not working, try to find the source and correct the problem, otherwise take the trailer to someone who can professionally rewire it.
	Boat does not ride well if not secure to trailer	Be sure boat is centered on trailer, is securely fastened to the trailer and if there is an engine, that it is held securely in place.	Restrap the boat onto the trailer or add more straps to firmly secure the boat onto the trailer.
	Wheels on trailer heat up and deteriorate	Always check to be sure the wheel bearings are lubricated and well packed.	Feel the wheels regularly, if they are hot, have the bearing lubricated or repacked.

**TABLE 1 (Continued)**

**SAFETY CONCERNS INVOLVED WITH HYDROGRAPHIC DATA COLLECTION**

Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
Driving to work site	Accidents due to unfamiliar terrain, transporting equipment, boats, trailers, and so on	Become familiar with the terrain before driving, if necessary, walk the area first. Use maps and aerials to help guide you on the best path	Report the accident and take the steps necessary to remedy the situation, call a tow truck, dig yourself out if stuck, and so forth
Launching boat into water	Strained muscles	Back the boat into the water as much as possible. Use all of the crew members to help launch into the water.	Report any accident and seek medical attention if necessary.
	Swamped boat	Try to back the boat into the water so that the back end will not become submerged when the boat is pushed off of the trailer.	Secure the boat to the bank. Remove important items from the boat that may sink or float away. Try to pull the boat back onto the trailer or up on shore to avoid completely sinking the boat.
	Vehicle or trailer gets stuck	Be aware of the river bed material and the slope of the bank. Avoid launching in areas of thick mud or fines.	Try different measures to get the vehicle or trailer unstuck depending on the situation.

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**TABLE 1 (Continued)**

**SAFETY CONCERNS INVOLVED WITH HYDROGRAPHIC DATA COLLECTION**

Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
Stringing a tag line - person pulling the line on a boat or wading	Tag line gets caught around puller	Be aware of the amount of slack in the line and how the line is positioned with your body. In all crossings, stay in good communication with the person braking the line. Leave a minimum of loose tag line. Hold the tag line so it is not looped or wrapped around the hand or any other part of the body. The tag line should be held so that if the hand is opened, the line freely falls away from the person.	Immediately stop moving across the river and untangle the line. If the wrap is life threatening, cut the line.
	Tag line gets caught on boat parts, engine, propeller, or so on.	Be aware of the amount of slack in the line and how the line is positioned with the boat.	The driver of the boat should hold the position of the boat steady while the puller untangles the line. If the line becomes caught in the propeller, throw the anchor, kill the engine, and untangle the line.

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**TABLE 1 (Continued)**

**SAFETY CONCERNS INVOLVED WITH HYDROGRAPHIC DATA COLLECTION**

Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
Stringing a tag line - person pulling the line on a boat or wading (Continued)	Tag line gets in water and pulls downstream	Be aware of the amount of slack in the line.	Let the braker know how to put more tension on the line. If the line has traveled far downstream, tell the braker not to let out any more line. Pull the line out of the water as much as possible. If necessary, tie the line off on both ends and then pull the slack out of the water. If it becomes too difficult to get the line out of the water, the puller should simply let go of the line and the braker should reel the line back in.
Stringing a tag line - person braking the line (running the reel)	Hands become burned from heat of friction	Always wear gloves when braking the line. It is sometimes helpful to wet the gloves before braking. If the line is being taken across the river by boat, the driver of the boat needs to proceed slowly across the river at a speed similar to walking.	Let the puller know that there is a problem. Tie the line off temporarily and cool hands off. Get proper protection for hands.

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**TABLE 1 (Continued)**

**SAFETY CONCERNS INVOLVED WITH HYDROGRAPHIC DATA COLLECTION**

Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
Stringing a tag line - person braking the line (running the reel) (Continued)	Tag lines becomes tangled around person braking, the reel, or other obstructions in the vicinity of the reel	Try to place the reel in a clear, level area before stringing the line. Use both hands to try to control the tension and backlash in the line so there is no slack to get caught.	Let the puller know that there is a problem. Untangle the line and continue, tie off temporarily if necessary.
Stringing the line - general	People or instruments downstream of the line could get caught or knocked over by the line	Never position yourself downstream of the tag line while it is being strung. Never place any equipment downstream of the tag line before it has been completely strung.	If someone or something gets caught, stop stringing the line and take the necessary steps to untangle the person or equipment.
	Boaters or ATV users (when in a dry river bed) may not see the tag line across the river	Place a sign upstream in areas of heavy recreational use warning boaters of the line. Place florescent flagging on the line to help boaters see the line. When possible, employ a spotter to watch for upstream traffic.	If the boaters do or do not see the line, either lift the line for them to cross under safely, or release the line and let them boat over it.

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**TABLE 1 (Continued)**

**SAFETY CONCERNS INVOLVED WITH HYDROGRAPHIC DATA COLLECTION**

Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
Reeling in a tag line	Tag line could get caught on boat or debris	Always park the boat upstream of the line, never downstream of the line. Try to strategically place cable guides or people (if safe) to help keep the line out of debris while reeling it back in. Always undo any knots that may accidentally form on the tag line and always remove the line clamp before reeling.	If the line does gets caught, first try to unsnag it from the shore. If it is safe, either wade or use the boat (avoid any extra line downstream of the snag) to get close to the snag. Use extreme caution when working near snags as they may be mobile.
Reeling in a tag line	Tag line gets in water and pulls downstream; this can cause the puller and braker to be pulled along the line	Try to maintain a fair amount of tension on the line. Stay in good communication with the puller. Sometimes it is helpful to move the reel to a location where the braker can see the water if the endpoint is far away from the river bank. When possible, install additional tag line guide posts to suspend the cable above the water (this may not be possible if the flow is deep).	Apply more tension to the line. Work with the puller to get the line out of the water.

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**TABLE 1 (Continued)**

**SAFETY CONCERNS INVOLVED WITH HYDROGRAPHIC DATA COLLECTION**

Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
Operating the boat	Hitting obstructions in the river, snags, debris piles, jacks, bridge abutments, and so on	Try to always look for and avoid snags, debris piles, jacks, and so on. Review the notes of the previous surveys for locations in areas of known hazards such as the CA, CC, and BI-lines. Be wary of old pilings or abutments in the close vicinity of the bridge. Also large amounts of debris typically pile up on the upstream side of the bridge abutments.	Evaluate the severity and danger of the situation. Get the boat off of the snag, jack, or other obstruction either by pulling it off with ropes, motoring off, or some other means if possible without putting crew members in danger of injury or drowning.
Operating the boat (Continued)	Motor stops running	Keep the engine well greased, monitor the water exhaust (cooling water) from the engine, avoid motoring over dunes and so on that will cause sediment to get into the engine	Throw the anchor or paddle to avoid obstructions. Lift the motor and try to determine the reason it stopped running: clogged water exhaust line, poor spark plug connection, debris around propeller, debris in the jet intake grate, and so on. Water exhaust may be back flushed with the "turkey baster."
	Slip - climbing in, out, and around the boat	Wear proper footgear, felt-soled shoes when possible. Try to keep the boat as clean as possible; silts and clays become very slippery when wet.	Report the accident and seek medical attention if necessary.

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**TABLE 1 (Continued)**

**SAFETY CONCERNS INVOLVED WITH HYDROGRAPHIC DATA COLLECTION**

Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
	Fall out of the boat	Move carefully about the boat to ensure solid footing.	Help the person back in the boat if close by pulling them up by their PFD. Use a throw rope if the person is far away from the boat or shore.
Using cable guides	Pointed metal ends and sharp surfaces can cause scrapes and punctures	Be aware of the location of and your proximity to other people when carrying the cable guides. Take care to place the cable guides out of the way, especially in the boat.	Report the accident and seek medical attention if necessary.
Wading or swimming in river	Slipping on banks or river beds	Walk carefully and wear proper footwear.	Report the accident and seek medical attention if necessary.
	Getting caught in water; foot entrapment in debris piles, jacks, or so on	Always wear a PFD. As a general rule, if the velocity multiplied by the depth is more than 10, use extra caution when attempting to wade the river. Be aware of the dynamics of the water around obstructions such as boulders, snag piles, overhanging debris, and jacks. There is often a lot more debris below the surface of the water that cannot be easily seen.	Employ the help of other crew members to get you out of danger. Call for emergency help if available and necessary.

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**TABLE 1 (Continued)**

**SAFETY CONCERNS INVOLVED WITH HYDROGRAPHIC DATA COLLECTION**

Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
Carrying equipment to the work site	Strained muscles	Take only what is feasible for you to carry; remember that more than one trip can be made.	Report the accident and seek medical attention if necessary.
Carrying equipment to the work site	Tripping and falling	Try not to obstruct your view while you are walking to the site. There is often a lot of debris, fallen trees, and so on in the area around rivers.	Report the accident and seek medical attention if necessary.
Using sampling equipment	Strained muscles	When lifting equipment over 50 pounds, employ the help of a coworker.	Report the accident and seek medical attention if necessary.
	Pinched extremities	Lift and handle the sampling equipment carefully	Report the accident and seek medical attention if necessary.
Loading the boat on the trailer	Same as launching a boat	Same as launching a boat	Same as launching a boat

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**USE OF HEAVY EQUIPMENT**

**SWP NO.: 6-26**  
**ISSUE DATE: JULY 1998**  
**REVISION: 1**

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## USE OF HEAVY EQUIPMENT

Truck-mounted heavy equipment and field trucks are among the types of equipment that may be used during field work. Heavy equipment can present a substantial hazard to workers. General requirements for motor vehicles and material-handling equipment are provided in the Occupational Safety and Health Administration (OSHA) Construction Industry Standards, 29 CFR 1926, Subpart O. The following precautions will be followed when heavy equipment (such as drill rigs, front-end loaders, and backhoes) is in use:

- Heavy equipment will be inspected by the operator before each work shift. The site safety coordinator (SSC) will ensure compliance with these precautions
- Equipment operators will be instructed to report any abnormalities, such as equipment failure, oozing liquids, and unusual odors, to their supervisors or the SSC
- Only qualified and licensed personnel will operate heavy equipment
- Hard hats, steel-toed boots, and safety glasses or goggles will be worn at all times around heavy equipment. Other personal protective equipment (PPE) specified in the site health and safety plan (HASP) will also be required
- Workers will not assume that the equipment operator is keeping track of their exact location. Workers will never walk directly behind or to the side of heavy equipment without the operator's knowledge
- Workers in close proximity to heavy equipment will maintain visual contact with equipment operators at all times
- When an operator must maneuver equipment in tight quarters, the presence of a second person will be required to ensure adequate clearance. If backing is required, two ground guides will be used: one in the direction the equipment is moving, and the other in the operators's normal field of vision to relay signals
- All heavy equipment used at a contaminated work site will be kept in the exclusion zone until the work has been completed. Such equipment will then be decontaminated within the designated decontamination area
- Hand-signal communications will be established when verbal communication is difficult. One person per work team will be designated to give hand signals to equipment operators
- Equipment with an obstructed rear view must have an audible alarm that sounds when the equipment is moving in reverse (unless a spotter guides the operator)

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- Parking brakes will be kept engaged when equipment is not in use
- Blades, buckets, dump bodies, and other hydraulic systems will be kept fully lowered when equipment is not in use
- Equipment cabs will be kept free of all nonessential and loose items
- Seat belts must be present in all vehicles having a rollover protective structure (ROPS)
- With certain exceptions, all material-handling equipment must be equipped with ROPS
- Material-handling equipment that lacks a ROPS will not be operated on a grade unless the grade can safely accommodate the equipment involved
- Drilling auger sections and other equipment are extremely heavy. All precautions must be taken before moving heavy equipment. Appropriate equipment must be used to transport heavy equipment
- Only chains, hoists, straps, and other equipment that safely aids transport of heavy materials will be used
- Proper personal lifting techniques will be used. Workers will lift using their legs, not their backs
- A safety barrier will be used to protect workers when tires are inflated, removed, or installed on split rims
- An ongoing maintenance program for all tools and equipment must be in place. All tools and moving equipment will be inspected regularly to ensure that parts are secured, are intact, and have no cracks or areas of weakness. The equipment must turn smoothly without wobbling and must operate according to manufacturer specifications. Defective items will be promptly repaired or replaced. Maintenance and repair logs will be kept
- Tools will be stored in clean, secure areas to prevent damage, loss, or theft
- Workers will not use equipment with which they are not familiar. This precaution applies to heavy as well as light equipment
- Loose-fitting clothing and loose, long hair will be prohibited around moving machinery
- Workers will make sure that no underground or overhead power lines, sewer lines, gas lines, or telephone lines present a hazard in the work area
- All personnel who are not essential to work activities will be kept out of the work area

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- Workers will be aware of their footing at all times
- Workers will remain alert at all times

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**RESPIRATOR CLEANING PROCEDURES**

**SWP NO.: 6-27**  
**ISSUE DATE: FEBRUARY 1999**  
**REVISION: 0**

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## **RESPIRATOR CLEANING PROCEDURES**

This safe work practice (SWP) provides guidelines for proper and thorough cleaning of respiratory protection equipment. The Occupational Safety and Health Administration (OSHA) regulates the use of respiratory protection for general industry in Title 29 of the *Code of Federal Regulations* (CFR) Part 1910.134, "Respiratory Protection." Appendix B-2 of the standard outlines mandatory requirements for respirator cleaning and is used as the basis for this SWP. This SWP supplements Document Control No. 2-6, "Respiratory Protection Program." It provides specific respirator cleaning and disinfection procedures and shall be included as an attachment to the site-specific health and safety plan for projects for which respirator use is planned or is a contingency.

### **1.0 APPLICABILITY**

This SWP shall apply to any project that involves use of respirators with reusable facepieces.

Respirators shall be cleaned and disinfected as discussed below.

- Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition.
- Respirators issued to more than one employee shall be cleaned and disinfected before being worn by different individuals.
- Respirators maintained for emergency use shall be cleaned and disinfected after each use.
- Respirators used in fit testing and training shall be cleaned and disinfected after each use.

### **2.0 CLEANING AND DISINFECTION PROCEDURES**

Mandatory respirator cleaning procedures as defined in 29 CFR Part 1910.134, Appendix B-2, are listed below. All wash and rinse water should be warm, with a maximum temperature of 110 °F (43 °C).

1. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, and any other components as recommended by the manufacturer. Discard or repair any defective parts.

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2. Wash components in warm water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.
3. Rinse components thoroughly in clean, warm, preferably running water. Drain all components.
4. When the cleaner does not contain a disinfecting agent, respirator components should be immersed for 2 minutes in one of the following:
  - Hypochlorite solution [50 parts per million (ppm) of chlorine] made by adding approximately one milliliter of laundry bleach to 1 liter of warm water
  - Aqueous solution of iodine [50 ppm iodine made by adding approximately 0.8 milliliter of tincture of iodine (6 to 8 grams ammonium and/or potassium iodide per 100 cubic centimeters of 45 percent alcohol) to 1 liter of warm water]
  - Other commercially available cleansers of equivalent disinfectant quality when used as directed if their use is recommended or approved by the respirator manufacturer
5. Rinse components thoroughly in clean, warm, preferably running water. Drain all components. The importance of thorough rinsing cannot be over emphasized. Detergents or disinfectants that dry on facepieces may cause dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.
6. Components should be air-dried or hand-dried with a clean, lint-free cloth.
7. Reassemble the facepiece. Replace filters, cartridges, and canisters prior to next use.
8. Test the respirator to ensure that all components work properly.
9. Place the respirator in a clean bag and seal for storage.

Depending on work conditions, respirator facial sealing surfaces may need periodic cleaning during the course of daily use. Cleaning of the facial sealing surface during work breaks can reduce the chance of facial irritation caused by sweat, natural skin oil, or irritating materials that may have deposited on the facepiece. Facial sealing surfaces can be cleaned using disinfectant wipes soaked in isopropyl alcohol or benzalkonium chloride. After use of the disinfectant wipe, the sealing surface should air dry or be dried thoroughly using paper towels or tissues.

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**TETRA TECH, INC.**  
**HEALTH AND SAFETY MANUAL**  
**VOLUME III**

**SAFE WORK PRACTICES (SWP)**

**SAFE WORK PRACTICES FOR USE OF AIR PURIFYING RESPIRATORS**

**SWP NO.: 6-28**  
**ISSUE DATE: FEBRUARY 1999**  
**REVISION: 0**

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## SAFE WORK PRACTICES FOR USE OF RESPIRATORS

This safe work practice (SWP) was developed to ensure the proper use of respirators in routine and foreseeable emergency situations. The SWP supplements Document Control No. 2-6, "Respiratory Protection Program." This SWP shall be included as an attachment to the site-specific health and safety plan (HASP) for projects for which respirator use is planned or is a contingency.

### 1.0 APPLICABILITY

This SWP shall apply to any project that involves use of air purifying respirators and shall not be used for situations involving the use of supplied air systems such as self-contained breathing apparatuses and air-line apparatuses.

### 2.0 ROUTINE RESPIRATOR USE PROCEDURES

The procedures below apply to the routine use of air purifying respirators.

- Respirators shall not be issued to or worn by individuals when conditions prevent valve function or a good facial seal. These conditions may include but are not limited to facial hair, such as the growth of beard, sideburns, or excessive mustaches, and possibly the wearing of corrective eyeglasses.
- If spectacles, goggles, face shields, or welding helmets must be worn with a facepiece, they will be worn so as not to adversely affect the seal of the facepiece to the face.
- For all tight-fitting respirators, a positive and negative pressure seal check shall be performed each time the respirator is donned. Seal checks shall be performed as follow:
  - *Negative pressure check:* Close off the inlet opening of the canister or cartridge(s) by covering it with the palm of the hand(s), inhale gently so that the facepiece collapses slightly, and hold the breath for 10 seconds. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is satisfactory.
  - *Positive pressure check:* Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. The exhalation valve cover may have to be removed to perform this procedure.

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- *Manufacturer's recommended seal check:* If the respirator manufacturer recommends specific procedures for performing a user seal check, these procedures may be used instead of the negative and positive pressure checks.
- Work areas must be monitored for conditions that may adversely affect the effectiveness of respiratory protection. Employees may leave the work area where respirators are required under the following conditions:
  - To wash the face and respirator facepieces as necessary to prevent eye or skin irritation
  - If vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece is detected
  - To replace the respirator or the filter, cartridge, or canister elements
  - If established monitoring instrument action levels are exceeded
  - For any other criteria as established in a project specific health and safety plan

### **3.0 RESPIRATOR USE DURING EMERGENCY SITUATIONS**

Emergency situations may arise during the wearing of respiratory protection. These situations could include medical emergency, respirator failure, fire, chemical spills or leaks, and other events that pose an immediate risk. Procedures for respirator use during emergency situations are summarized below.

- When an emergency situation arises that creates or has the potential to create immediately dangerous to life and health (IDLH) conditions, the work environment shall be evacuated immediately and shall not be reentered by employees without suitable protective gear.
- Work environments with the potential for the development of atmospheres that may present IDLH conditions shall only be entered by employees using the buddy system.
- When an emergency situation arises that includes physical hazards that may interfere with the proper use of respiratory protection, the work environment shall be evacuated.
- Under no circumstances shall respirator users remove facepieces in hazardous atmospheres. In the event of respirator malfunction, users should leave the hazardous environment immediately and proceed to a known safe location before removal of the facepiece.
- Episodes of respirator failure shall be thoroughly investigated before work activities begin again. The investigation shall include re-evaluation of work area atmospheric

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conditions, review of the respirator selection criteria and service life calculations, and an evaluation of the working conditions under which respirator failure occurred.

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## **APPENDIX B-3**

### **RESPIRATORY HAZARD ASSESSMENT (FORM RP-2)**

Note: This assessment form will be finalized when site air monitoring data are collected and evaluated.  
Until the assessment is completed, air purifying respirator cartridges will be disposed of every 8 hours.



**TETRA TECH, INC.**  
**RESPIRATORY HAZARD ASSESSMENT**

Project Name:			Project No.:		
Location:			Project Manager:		
Type: <input type="checkbox"/> Baseline <input type="checkbox"/> Reassessment		Date:		Valid for ____ days	
Job/Task Description:				<input type="checkbox"/> Routine <input type="checkbox"/> Escape	
Hazard Identification and Source:		Workplace Factors: Temperature: _____ Humidity: _____ Other: _____		User Factors: Work rate: _____ Protective clothing: _____ Other: _____	
Chemical:					
PEL:					
ACGIH TLV:					
Form (part/gas/vapor):					
IDLH:					
Eye Irritant (Y/N):					
Skin Absorption(Y/N):					
Monitoring (Y/N) :*:					
Frequency:					
Maximum Concentration Estimated:**					
* Monitoring Method: <input type="checkbox"/> PID <input type="checkbox"/> FID <input type="checkbox"/> Detector tube: _____ <input type="checkbox"/> NIOSH method: _____ <input type="checkbox"/> Vapor badge: _____ <input type="checkbox"/> Other: _____			Respirator Type: <input type="checkbox"/> Half-face disposable Brand: _____ <input type="checkbox"/> Half-face reusable Brand: _____ <input type="checkbox"/> Full-face Brand: _____ <input type="checkbox"/> Air-supplied airline Brand: _____ <input type="checkbox"/> Air-supplied SCBA Brand: _____ <input type="checkbox"/> PAPR Brand: _____ <input type="checkbox"/> ESCBA Brand: _____		
** If concentrations exceed the immediately dangerous to life and health (IDLH) value, use air-supplied systems.			Vapor and Gas Cartridge Exchange: ESLI: <input type="checkbox"/> Yes <input type="checkbox"/> No Exchange frequency: _____		
Cartridge/Filter Selection <input type="checkbox"/> N100 <input type="checkbox"/> R100 <input type="checkbox"/> P100 <input type="checkbox"/> N99 <input type="checkbox"/> R99 <input type="checkbox"/> P99 <input type="checkbox"/> N95 <input type="checkbox"/> R95 <input type="checkbox"/> P95 <input type="checkbox"/> Organic vapor <input type="checkbox"/> Acid gas <input type="checkbox"/> Ammonia <input type="checkbox"/> Mercury <input type="checkbox"/> Formaldehyde <input type="checkbox"/> Combo: _____ <input type="checkbox"/> Other: _____			Basis for Exchange Frequency <input type="checkbox"/> Manufacturer's data <input type="checkbox"/> Workplace simulations <input type="checkbox"/> Experimental methods <input type="checkbox"/> AIHA "Rules of Thumb" <input type="checkbox"/> Predictive modeling <input type="checkbox"/> Analogous chemical structure <input type="checkbox"/> OSHA Regulation: _____ <input type="checkbox"/> Other: _____		
Completed by _____ Date _____			Reviewed by _____ Date _____		

## **RESPIRATORY HAZARD ASSESSMENT (Continued)**

### **DEFINITIONS AND ACRONYMS**

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ESLI	End of service life indicator
FID	Flame ionization detector
IDLH	Immediately dangerous to life and health
NIOSH	National Institute for Occupational Safety and Health
N100/99/95	Non-oil-proof particulate filter
OSHA	Occupational Safety and Health Administration
P100/99/95	Oil-proof particulate filter
PEL	Permissible exposure limit
PID	Photoionization detector
PPE	Personal protective equipment
R100/99/95	Oil-resistant particulate filter
SCBA	Self-contained breathing apparatus
TLV	Threshold limit value

Note: This form must be reviewed by a regional health and safety representative or subsidiary health and safety representative (or designee) only and must be attached to the site-specific health and safety plan once completed. A copy must also be placed in the project files.

## **ATTACHMENT**

### **MATERIAL SAFETY DATA SHEETS**

- Alconox® for decontamination
- Isobutylene for PID calibration
- Nitric Acid (preservatives for QC samples)
- Hydrochloric Acid (preservatives for QC samples)

(This list will be updated as additional chemicals are used during site activities.)

---

MSDS Number: **A2052** \* \* \* \* \* *Effective Date: 05/14/03* \* \* \* \* \* *Supersedes: 02/18/03*

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# ALCONOX®

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## 1. Product Identification

**Synonyms:** Proprietary blend of sodium linear alkylaryl sulfonate, alcohol sulfate, phosphates, and carbonates.

**CAS No.:** Not applicable.

**Molecular Weight:** Not applicable to mixtures.

**Chemical Formula:** Not applicable to mixtures.

**Product Codes:** A461

---

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
-----	-----	-----	-----
Alconox® proprietary detergent mixture	N/A	90 - 100%	Yes

---

## 3. Hazards Identification

### Emergency Overview

-----  
**CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.**

**J.T. Baker SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

-----  
Health Rating: 1 - Slight

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT  
Storage Color Code: Orange (General Storage)

---

### Potential Health Effects

---

**Inhalation:**

May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.

**Ingestion:**

May cause irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.

**Skin Contact:**

No adverse effects expected.

**Eye Contact:**

May cause irritation, redness and pain.

**Chronic Exposure:**

No information found.

**Aggravation of Pre-existing Conditions:**

No information found.

---

## 4. First Aid Measures

**Inhalation:**

Remove to fresh air. Get medical attention for any breathing difficulty.

**Ingestion:**

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention.

**Skin Contact:**

Wash exposed area with soap and water. Get medical advice if irritation develops.

**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:**

Not expected to be a fire hazard.

**Explosion:**

No information found.

**Fire Extinguishing Media:**

Dry chemical, foam, water or carbon dioxide.

**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. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. When mixed with water, material foams profusely. Small amounts of residue may be flushed to sewer with plenty of water.

---

## 7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Moisture may cause material to cake. 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.

---

## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

None established.

### **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. 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.

### **Personal Respirators (NIOSH Approved):**

For conditions of use where exposure to dust or mist is apparent and engineering controls are not feasible, a particulate respirator (NIOSH type N95 or better filters) may be worn. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-face 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. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

### **Appearance:**

White powder interspersed with cream colored flakes.



**Odor:**

No information found.

**Solubility:**

Moderate (1-10%)

**Specific Gravity:**

No information found.

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

0

**Boiling Point:**

No information found.

**Melting Point:**

No information found.

**Vapor Density (Air=1):**

No information found.

**Vapor Pressure (mm Hg):**

No information found.

**Evaporation Rate (BuAc=1):**

No information found.

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

Carbon dioxide and carbon monoxide may form when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

No information found.

**Conditions to Avoid:**

No information found.

---

## 11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Alconox®	No	No	None
proprietary detergent mixture			

## 12. Ecological Information

### Environmental Fate:

This product is biodegradable.

### Environmental Toxicity:

No information found.

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal 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

Not regulated.

## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Alconox® proprietary detergent mixture	Yes	No	No	No

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	DSL	--Canada-- NDSL	Phil.
Alconox® proprietary detergent mixture	No	No	Yes	No

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302- RQ	TPQ	-----SARA 313----- List	Chemical Catg.
Alconox® proprietary detergent mixture	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Alconox®	No	No	No

proprietary detergent mixture

Chemical Weapons Convention: No      TSCA 12(b): No      CDTA: No  
SARA 311/312: Acute: Yes      Chronic: No      Fire: No      Pressure: No  
Reactivity: No      (Pure / Solid)

**Australian Hazchem Code:** None allocated.

**Poison Schedule:** None allocated.

**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: **0** Flammability: **0** Reactivity: **0**

**Label Hazard Warning:**

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

**Label Precautions:**

Avoid contact with eyes.

Keep container closed.

Use with adequate ventilation.

Avoid breathing dust.

Wash thoroughly after handling.

**Label First Aid:**

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. 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 eye contact, immediately flush eyes with plenty of water for at least 15 minutes. In all cases, get medical attention.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 8.

**Disclaimer:**

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

HNU SYSTEMS INC -- ISOBUTYLENE SPAN GAS, SEE SUPP DATA -- 6665-01-214-8247

===== Product Identification =====

Product ID:ISOBUTYLENE SPAN GAS, SEE SUPP DATA

MSDS Date:12/08/1987

FSC:6665

NIIN:01-214-8247

MSDS Number: BJDVR

=== Responsible Party ===

Company Name:HNU SYSTEMS INC

Address:160 CHARLEMONT ST

City:NEWTON HIGHLANDS

State:MA

ZIP:02161

Country:US

Info Phone Num:617/964-6690

Emergency Phone Num:800/841-4357

CAGE:57631

=== Contractor Identification ===

Company Name:HNU SYSTEMS INC

Address:160 CHARLEMONT ST

Box:City:NEWTON HIGHLANDS

State:MA

ZIP:02161

Country:US

Phone:617/964-6690

CAGE:57631

===== Composition/Information on Ingredients =====

Ingred Name:ISOBUTYLENE

CAS:115-11-7

RTECS #:UD0890000

Fraction by Wt: 0.01%

===== Hazards Identification =====

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.

Routes of Entry: Inhalation:YES Skin:NO Ingestion:NO

Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO

Health Hazards Acute and Chronic:ISOBUTYLENE IS A SIMPLE ASPHYXIAN;

MODERATE CONCENTRATION IN AIR CAUSE UNCONSCIOUSNESS. CONTACT  
W/LIQUID CAUSES FROSTBITE.

Explanation of Carcinogenicity:NOT RELEVANT

Effects of Overexposure:SEE HEALTH HAZARDS.

Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

===== First Aid Measures =====

First Aid:IF BREATHED, REMOVE INDIVIDUAL TO FRESH AIR. IF BREATHING IS  
DIFFICULT, ADMINISTER OXYGEN. IF BREATHING HAS STOPPED, GIVE  
ARTIFICIAL RESPIRATION. KEEP PERSON WARM, QUIET; GET MEDICAL  
ATTENTION.

===== Fire Fighting Measures =====

Isobutylene Span Gas.txt

Flash Point Method:CC

Flash Point:-76 C OR -105 F

Lower Limits:1.8%

Upper Limits:9.6%

Extinguishing Media:CO2 OR DRY CHEMICAL

Fire Fighting Procedures:STOP FLOW OF ISOBUTYLENE IF POSSIBLE. USE  
WATER SPRAY TO COOL SURROUNDING CONTAINERS.

Unusual Fire/Explosion Hazard:ISOBUTYLENE IS HEAVIER THAN AIR MAY  
TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION. SHOULD FLAME BE  
EXTINGUISHED AND FLOW OF GAS CONTINUE SEE SUPP DATA.

===== Accidental Release Measures =====

Spill Release Procedures:NONE SPECIFIED BY MANUFACTURER.

Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

===== Handling and Storage =====

Handling and Storage Precautions:STORE AWAY FROM HEAT AND PROTECT  
CYLINDERS FROM PHYSICAL DAMAGE.

Other Precautions:DO NOT PUNCTURE CYLINDER.

===== Exposure Controls/Personal Protection =====

Respiratory Protection:POSITIVE PRESSURE AIR LINE OR SCBA FOR EMERGENCY  
USE.

Ventilation:HOOD W/FORCED VENTILATION TO PREVENT ACCUMULATION ABOVE  
LEL.

Protective Gloves:PLASTIC OR RUBBER.

Eye Protection:SAFETY GOGGLES OR GLASSES.

Other Protective Equipment:SAFETY SHOES, SAFETY SHOWER, EYEWASH  
FOUNTAIN.

Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.

Supplemental Safety and Health

MFR PART NO, TRADE NAME:CALIBRATION GAS 101- 350-N, DC102573.EXPLO  
HAZ:INCREASE VENTILATION TO PREVENT FORMATION OF FLAMMABLE MIXTURE  
IN LOW AREAS/POCKETS. NOTE:DATA GIVEN FOR PURE ISOBUTYLENE. CYLINDE  
R OF HNU SPAN GAS/ISOBUTYLENE CALIBRATION GAS CONTAINS 100 PPM IN  
ZERO AIR OR 0.01% ISOBUTYLENE IN AIR.

===== Physical/Chemical Properties =====

Boiling Pt:B.P. Text:19.6F,-6.9C

Melt/Freeze Pt:M.P/F.P Text:-221F,-140C

Vapor Pres:@20C 24SIG

Vapor Density:1.95

Spec Gravity:0.59

Solubility in Water:UNAVAILABLE

Appearance and Odor:CLEAR UNPLEASANT ODOR SIMILAR TO COAL GAS

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES  
OXIDIZERS.

Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.

Hazardous Decomposition Products:NONE

===== Disposal Considerations =====

Waste Disposal Methods:DISPOSAL MUST BE I/A/W FED, STATE AND LOCAL  
REGULATIONS.

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document should seek competent professional advice to verify and  
assume responsibility for the suitability of this information to their  
particular situation.

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MSDS Number: **N3659** \* \* \* \* \* *Effective Date: 11/02/01* \* \* \* \* \* *Supersedes: 10/15/99*

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# NITRIC ACID 1.0 N AND 2.0 N VOLUMETRIC SOLUTIONS

---

## 1. Product Identification

**Synonyms:** Azotic acid solution; nitric acid 6.3%; nitric acid 1.0 N volumetric solution; nitric acid 2.0 N volumetric solution; nitric acid 12.6%

**CAS No.:** 7697-37-2

**Molecular Weight:** 63.00

**Chemical Formula:** HNO<sub>3</sub> in H<sub>2</sub>O

**Product Codes:**

J.T. Baker: 5639

Mallinckrodt: 3510

---

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
-----	-----	-----	-----
Nitric Acid	7697-37-2	6 - 13%	Yes
Water	7732-18-5	> 87%	No

---

## 3. Hazards Identification

### Emergency Overview

-----  
**POISON! DANGER! OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.**



**J.T. Baker SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)  
-----

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 3 - Severe (Oxidizer)

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: Yellow (Reactive)

  
-----**Potential Health Effects**  
-----

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

**Inhalation:**

Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.

**Ingestion:**

Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.

**Skin Contact:**

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

**Eye Contact:**

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

**Chronic Exposure:**

Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.

**Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

---

## 4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.

**Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

**Ingestion:**

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

**Skin Contact:**

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes

before reuse. Get medical attention immediately.

**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:**

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.

**Explosion:**

May react explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc.

**Fire Extinguishing Media:**

If involved in a fire, use water spray.

**Special Information:**

Increases the flammability of combustible, organic and readily oxidizable materials. 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. 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. Neutralize with alkaline material (soda ash, lime), then 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! 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 NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

---

## 7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect from physical damage and direct sunlight. Isolate from incompatible substances. 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:**

For Nitric Acid:

OSHA Permissible Exposure Limit (PEL):

2 ppm (TWA)

ACGIH Threshold Limit Value (TLV):

2 ppm (TWA); 4 ppm (STEL)

### **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.

### **Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.

### **Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

### **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:**

Colorless to yellowish liquid.

### **Odor:**

Suffocating, acrid.

### **Solubility:**

Infinitely soluble.

### **Specific Gravity:**

No information found.

### **pH:**

No information found.

### **% Volatiles by volume @ 21C (70F):**

100 (as water and acid)

### **Boiling Point:**

No information found.

### **Melting Point:**

No information found.

### **Vapor Density (Air=1):**

No information found.

**Vapor Pressure (mm Hg):**

No information found.

**Evaporation Rate (BuAc=1):**

No information found.

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage. Containers may burst when heated.

**Hazardous Decomposition Products:**

When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

**Conditions to Avoid:**

Heat and incompatibles.

---

## 11. Toxicological Information

For Nitric Acid: Investigated as a mutagen and reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
-----			
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

---

## 12. Ecological Information

**Environmental Fate:**

No information found.

**Environmental Toxicity:**

No information found.

---

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. 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:** NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)

**Hazard Class:** 8

**UN/NA:** UN2031

**Packing Group:** II

**Information reported for product/size:** 20L

### International (Water, I.M.O.)

-----

**Proper Shipping Name:** NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)

**Hazard Class:** 8

**UN/NA:** UN2031

**Packing Group:** II

**Information reported for product/size:** 20L

## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----

Ingredient	TSCA	EC	Japan	Australia
Nitric Acid (7697-37-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient	Korea	DSL	NDSL	Phil.
Nitric Acid (7697-37-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient	-SARA 302- RQ	TPQ	-----SARA 313----- List	Chemical Catg.
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA-	-TSCA-
-----	-----	-----	-----
Nitric Acid (7697-37-2)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No      TSCA 12(b): No      CDTA: No  
 SARA 311/312: Acute: Yes      Chronic: Yes      Fire: No      Pressure: No  
 Reactivity: Yes      (Mixture / Liquid)

**Australian Hazchem Code: 2PE**

**Poison Schedule: S6**

**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: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**

**Label Hazard Warning:**

POISON! DANGER! OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

**Label Precautions:**

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Use only with adequate ventilation.

Wash thoroughly after handling.

Keep from contact with clothing and other combustible materials.

Store in a tightly closed container.

**Label First Aid:**

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. 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 all cases call a physician.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 8.

**Disclaimer:**

\*\*\*\*\*

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety  
Phone Number: (314) 654-1600 (U.S.A.)



# Material Safety Data Sheet (MSDS-HCL)

PRODUCT IDENTIFICATION	
Product Name	Hydrochloric Acid Solution 20 Deg. Be – 31.5% 22 Deg. Be – 35.2%
Trade Names and Synonyms	Hydrogen Chloride (Aqueous) Muriatic Acid
Manufacturer/Distributor	Trans Chem, Inc. 1415 Mengel Road Baton Rouge, Louisiana 70807 (504) 355-9977  Various others
Transportation Emergency	<b>800-255-3924 (24 hrs -- CHEM • TEL)</b>

HAZARDOUS COMPONENTS			
Material or Component	CAS No.	TLV	PEL
Hydrochloric Acid	7647-01-0	7mg/m <sup>3</sup>	5PPM
N/A = Not assigned NE = Not established			

PHYSICAL DATA	
Boiling Point	127° F
Vapor Pressure	24mm Hg – 20 Deg. Be 100mm Hg – 22 Deg. Be
Solubility in Water	Complete
Specific Gravity	1.16 @ 15.5° C 20 Deg. Be 1.1789 @ 15.5° C 22 Deg. Be
Melting Point	N/A
Vapor Density	Similar to Water
Evaporation Rate	Not Applicable
Appearance and Odor	Clear Colorless to Yellowish Fuming Liquid, Pungent and Irritating

HAZARDOUS REACTIVITY
Stable under ordinary conditions of use and storage. Does not polymerize. Incompatible with aluminum and aluminum alloys, carbon steel, copper and copper alloys, and nylon. Hydrogen gas will be formed if acid contacts metal.

FIRE AND EXPLOSION DATA	
Flashpoint	Not Flammable
Extinguishing Media	Use any means suitable for extinguishing surrounding fire.
Decomposition Products	Contact with most metals may produce Hydrogen gas to potentially explosive limits.
Unusual Explosion	Containers may explode when heated. Consult the 2000 Emergency Response Guidebook, Guide 157 for further details.



<b>HEALTH HAZARDS / FIRST AID</b>	
<b>Inhalation</b>	Inhalation causes severe irritation of upper respiratory tract. FA: Remove person to fresh air. If not breathing, give artificial respiration. Call physician.
<b>Ingestion</b>	CORROSIVE ! Ingestion of Hydrochloric Acid can cause burns of the mouth, throat, esophagus and gastrointestinal tract. FA: DO NOT INDUCE VOMITING. Give large quantities of water or milk of magnesia. Never give anything by mouth to an unconscious person. Get immediate medical attention.
<b>Skin Contact</b>	CORROSIVE ! Can cause redness, pain and skin burns. Can cause some tissue destruction. FA: Immediately flush with water.
<b>Eye Contact</b>	CORROSIVE ! FA: Continuously flush eyes with large amounts of water for at least 20 minutes. If irritation continues, seek medical attention.

<b>SPILL OR LEAK PROCEDURES</b>	
<b>Spill/leak</b>	In the event of a spill or leak, keep upwind. Ventilate enclosed areas until spill or leak is contained, neutralized and prepared for removal.
<b>Waste disposal</b>	Disposal of waste material or residue may be subject to federal, state, or local regulation. Before transporting waste material see 49 CFR 172.

<b>SPECIAL PROTECTION INFORMATION</b>	
<b>Ventilation</b>	Use only in areas with adequate ventilation.
<b>Eye Protection</b>	Use chemical safety goggles, plus a safety shield is recommended. Contact lenses should not be worn when working with this material.
<b>Skin Protection</b>	Wear impervious protective clothing; i.e., Boots, Gloves, Lab Coat, Apron or Coveralls to prevent skin contact.
<b>Other</b>	If working in an area of potential exposure, use an NIOSH approved respirator when material is fuming and exceeds the TLV.

<b>STORAGE CONDITIONS</b>	
Store and handle only in containers suitably lined with or constructed of materials specified, by the manufacturer, for the product. Protect against physical damage. Keep separated from incompatible materials.	

<b>REGULATORY INFORMATION</b>	
<b>Proper shipping name</b>	Hydrochloric acid
<b>Hazard class</b>	8
<b>UN Number</b>	UN1789
<b>DOT Label &amp; Placard</b>	Corrosive
<b>NFPA / HMIS Ratings</b>	Health – 3; Flammability – 0; Reactivity – 0
<b>SARA Title III</b>	Reporting Sections 302, 311 & 313

The information contained in this Material Safety Data Sheet is based upon available data and believed to be correct; however, as such has been obtained from various sources, including the manufacturer and independent laboratories, it is given without warranty or representation that it is complete, accurate, and can be relied upon. *OWEN COMPLIANCE SERVICES, INC.* has not attempted to conceal in any manner the deleterious aspects of the product listed herein, but makes no warranty as to such. Further, *OWEN COMPLIANCE SERVICES, INC.* cannot anticipate nor control the many situations in which the product or this information may be used; there is no guarantee that the health and safety precautions suggested will be proper under all conditions. It is the sole responsibility of each user of the product to determine and comply with the requirements of all applicable laws and regulations regarding its use. This information is given solely for the purposes of safety to persons and property. Any other use of this information is expressly prohibited.

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## **ATTACHMENT**

### **MATERIAL SAFETY DATA SHEETS**

- Alconox® for decontamination
- Isobutylene for PID calibration
- Nitric Acid (preservatives for QC samples)
- Hydrochloric Acid (preservatives for QC samples)

(This list will be updated as additional chemicals are used during site activities.)