

**HEALTH AND SAFETY PLAN
TAR LAKE SITE
MANCELONA TOWNSHIP, MICHIGAN**

**Prepared for
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604**

Work Assignment No.	:	064-TATA-0571
EPA Region	:	5
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Contract No.	:	EP-S5-06-02
Prepared by	:	SulTRAC
SulTRAC Project Manager	:	Dave Franc
Telephone No.	:	(312) 201-7778
EPA Work Assignment Manager	:	Karen Cibulskis
Telephone No.	:	(312) 886-1843

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REVIEWS AND APPROVALS
CLIENT NAME: U.S. EPA
CONTRACT NO.: EP-S5-06-02
TAR LAKE SITE
MANCELONA TOWNSHIP, MICHIGAN

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 at the Tar Lake site.

Name	Signature	Date
<u>Chris Draper</u> SulTRAC EM Inc. (SulTRAC) Health and Safety Representative	<u></u>	<u>8 June 2010</u>
<u>Dave Franc</u> SulTRAC Project Manager	<u></u>	<u>8 June 2010</u>

This certifies that SulTRAC 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 1910.132.

Certified by		
<u>Chris Draper</u> SulTRAC Technical Reviewer	<u></u>	<u>8 June 2010</u>

EMERGENCY INFORMATION POST ON SITE

EMERGENCY CONTACTS AND ROUTE TO HOSPITAL

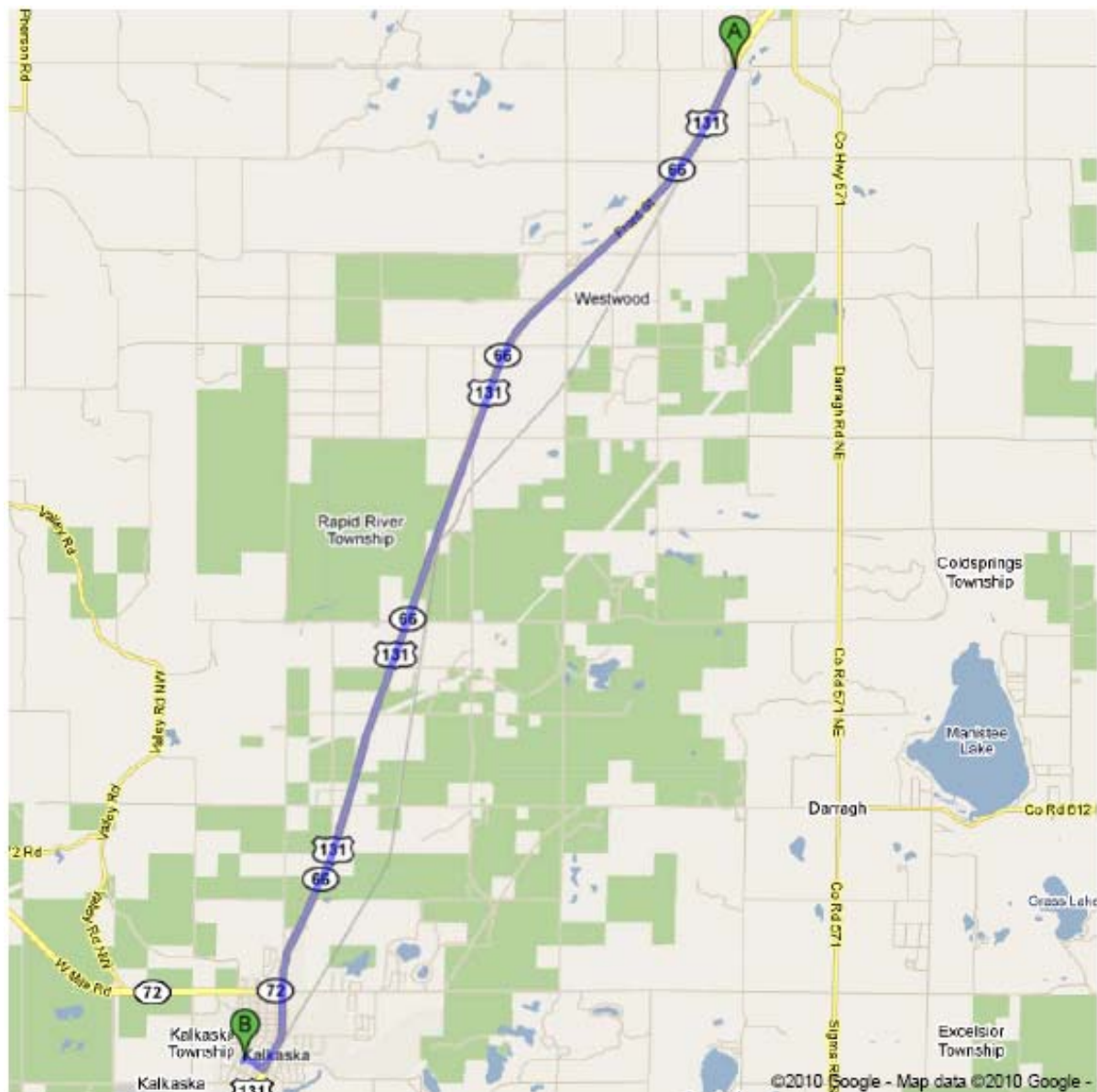
Emergency Contact	Telephone No.
U.S. Coast Guard National Response Center	(800) 424-8802
InfoTrac Chemical Monitoring System	(800) 535-5053
WorkCare	(800) 455-6155
Fire Department	911
Police Department	911
SulTRAC EM Inc. Personnel:	
Human Resource Development: Amy Clark	(626) 470-2516
Health and Safety Representative: Chris Draper	(615) 969-1334
Office Health and Safety Coordinator: Robert Kondreck	(312) 201-7479
Project Manager: Dave Franc	(312) 201-7778
Site Safety Coordinator: TBD	TBD
Client Contact:	
Karen Cibulskis	(312) 886-1843
Medical Emergency	
Hospital Name:	Kalkaska Memorial Health Center
Hospital Address:	419 South Coral Street Kalkaska, MI 49646
Hospital Telephone No.:	Emergency - (231) 258-7500 General – (231) 258-7500
Ambulance Telephone No.:	911
Route to Hospital: (see next page hospital route map)	
1.Head southwest on Front St/MI-66 S/US-131 S toward Mackinac Trail Continue to follow MI-66 S/US-131 S 12.3 mi 2.Turn right at 3rd St 0.2 mi 3.Take the 3rd left onto S Coral St Destination will be on the left 197 ft	

Note: This sheet must be posted on site.

EMERGENCY INFORMATION

POST ON SITE

HOSPITAL ROUTE MAP



1. Head **southwest** on **Front St/MI-66 S/US-131 S** toward **Mackinac Trail**
Continue to follow MI-66 S/US-131 S 12.3 mi
 2. Turn **right** at **3rd St** 0.2 mi
 3. Take the 3rd **left** onto **S Coral St**
- Destination will be on the left 197 ft

SOURCE: MODIFIED FROM Googlemaps 4-2010

Note: This sheet must be posted on site.

1.0 INTRODUCTION

SulTRAC, a joint venture between Sullivan International (Sullivan) and Tetra Tech EM Inc. (Tetra Tech) received Work Assignment No. 064-TATA-0571 from United States Environmental Protection Agency (EPA) Region 5 under Remedial Action Contract No. EP-S5-06-02 (RAC 2) to conduct data collection and analysis, risk assessment, and, if warranted, development and evaluation of cleanup alternatives to address remaining areas of contamination above acceptable risk levels at the Tar Lake site in Mancelona Township, Michigan. The site-specific health and safety provisions in this document have been developed for use during field activities at the Tar Lake site. 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.” This health and safety plan (HASP) will be available to all on-site personnel who may be exposed to hazardous on-site conditions, including SulTRAC and subcontractor personnel participating in field activities, and all site visitors, including regulatory agency representatives.

The purpose of this HASP is to define requirements and designate protocols to be followed during soil, groundwater, and fish sampling at the Tar Lake site. All personnel on site, including SulTRAC 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. This HASP summarizes potential hazards and defines protective measures planned for site activities.

This plan must be reviewed and approved by the SulTRAC health and safety representative (HSR) or a designee and the SulTRAC project manager (see the Reviews and Approvals form after the Contents in this document). The Compliance Agreement form in Appendix A must be signed by all personnel before they enter the site. Protocols established in this HASP 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 SulTRAC project manager and the SulTRAC HSR. SulTRAC employees must also follow safety requirements taught during safety training and described in the SulTRAC, 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 Tar Lake site, and discusses HASP 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>
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Client Representative:

Karen Cibulskis	EPA Work Assignment Manager	(312) 886-1843
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SulTRAC Personnel:

Dave Franc	Project Manager	(312) 201-7778
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Chris Draper	HSR	(615) 969-1334
--------------	-----	----------------

TBD	Site Safety Coordinator (SSC)	TBD
-----	-------------------------------	-----

TBD	Field Manager	TBD
-----	---------------	-----

Subcontractors:

Drilling and Excavation Subcontractor:

TBD	Project Manager	TBD
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The SulTRAC project manager, field manager, SSC, and HSR will be responsible for implementation and enforcement of the provisions of this HASP. Their duties and the expectations for SulTRAC employees are described in the following sections.

2.1.1 Project Manager and Field Manager

The SulTRAC project manager has ultimate responsibility for ensuring implementation of the requirements set forth in this HASP. 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 SulTRAC field manager will oversee and direct field activities and has day-to-day responsibility for ensuring implementation of the HASP. Subcontractor compliance with the HASP 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 SulTRAC SSC will be appointed by the project manager and will be responsible for field implementation of tasks and procedures contained in this HASP, 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 A) by all personnel working on site. 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 A).

2.1.3 Health and Safety Representative

The SulTRAC 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 SulTRAC project manager will establish a liaison between officers and representatives of EPA and the HSR on matters relating to health and safety.

2.1.4 SulTRAC Employees

SulTRAC employees are expected to fully participate in implementing the site HASP 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 SulTRAC SSC of health and safety concerns at the site.

2.2 SUBCONTRACTORS

Subcontractor personnel participating in subsurface investigations or any other potential subcontracted work 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 A). 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.

2.3 VISITORS

All site visitors will be required to read the HASP and sign the Compliance Agreement form (see Appendix A). Visitors will be expected to comply with relevant OSHA requirements. Visitors will also be expected to provide their own PPE required by the HASP. 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 HASP applies to all site activities and all personnel working on the Tar Lake site. HASP enforcement shall be rigorous. Violators of the HASP will be verbally notified upon first violation, and the violation will be noted by the SulTRAC SSC in a field logbook. Upon second violation, the violator will be notified in writing, and the SulTRAC project manager and the violator's supervisor will be notified. A third violation will result in a written notification and 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. Every employee has the right to stop work if they feel any worksite condition, practice, or operation causes or presents a hazard that can reasonably be expected to result in immediate death, serious physical harm, or severe damage to the environment.

At least one copy of this HASP will be available to all site personnel at all times. Minor changes in HASP 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

The purpose of the field investigation is to address issues and follow-up actions identified in EPA's 2009 FYR Report for the site. Specific activities include data collection and analysis, risk assessment, and, if warranted, development and evaluation of cleanup alternatives to address remaining areas of contamination above acceptable risk levels. Additional activities may also include contaminant fate and transport modeling.

3.1 SITE DESCRIPTION

The site is in a rural area about one mile south of Mancelona, Michigan. The site currently includes about 189 acres and covers 13 properties. The site does not include the 45 acre east tailings area (ETA) which EPA determined was acceptable for unrestricted use/unlimited exposure (UU/UE) and deleted from the site in 2005. About 12 acres of the site is fenced and includes a groundwater treatment and monitoring system.

Two businesses operate at the site on 13.57 and 4.8 acre properties along Route 131. Mancelona Township uses part of their 7.9 acre site property to store wood chips and manage wood and brush waste. About 3 acres of the northeast corner of the site has been a residential property since at least 1978. The rest of the site has been vacant since 1945. In 2009, Mancelona Power Producers (MP3) purchased the 45-acre ETA and 75 other acres of the site and plans to build a biomass energy plant on the property.

3.2 SITE HISTORY

The Tar Lake site is a former iron manufacturing facility (Antrim Iron Works) that operated from about 1882 to 1945. Antrim Iron Works (AIW) produced iron at the site using the charcoal method. AIW made the charcoal from wood in sealed retorts. The process created a pyroligneous (made by the destructive distillation of wood) liquor. AIW recovered the pyroligneous liquor and used it in secondary chemical manufacturing processes to produce calcium acetate, methanol, acetone and creosote oil. The secondary

processes created a tar-like waste residue (tar), which AIW discharged to a low-lying area called Tar Lake. From 1957 to 1967, a metal products company also disposed waste in the Tar Lake area of the site. Other major operations areas of the site include the iron production area, creosote area, and the retort and chemical production area. Peckham Lake and Nelson Lake were also used for cooling water withdrawal and discharge.

In 1998-1999, EPA conducted a fund-lead removal action and removed 47,043 tons of tar and tar debris from the Tar Lake area of the site (operable unit 1 or OU1). EPA also began a fund-lead remedial investigation/feasibility study (RI/FS) to address the soil below the excavated tar, groundwater and other site areas (OU2).

In 1998, Michigan Department of Environmental Quality (MDEQ) installed an on-site, in-situ biosparge groundwater treatment system downgradient of the tar removal area. MDEQ also provided residents with bottled water until 2002, when MDEQ connected residents to the Mancelona water supply through a state-funded water supply expansion.

EPA signed the OU2 ROD in 2002. EPA's selected remedy for OU2 is based on commercial, industrial and recreational use, and includes the following major components:

- Continue to operate MDEQ's biosparge groundwater treatment system to prevent groundwater contaminants from moving off-site, and to return on-site groundwater to drinking water levels.
- Install groundwater circulation and soil bioventing systems in the Tar Lake excavation to increase air flow through soil and groundwater, and increase the aerobic degradation of soil and groundwater contaminants. Restore soil to MDEQ drinking water protection criteria (DWPC) and site-specific values calculated for chemicals for which MDEQ DWPC are not available. Restore groundwater in the Tar Lake excavation to MCLs and MDEQ residential drinking water criteria (RDWC).
- Excavate tar in the creosote area and transport to an off-site energy recovery facility.
- Long-term groundwater monitoring to verify the effectiveness of the remedial action and monitor groundwater conditions over time.
- Institutional controls (ICs) such as restrictive covenants to reduce the potential for exposure to on-site groundwater and restrict residential use at the site. The restrictions on groundwater use will apply until the groundwater is demonstrated to be below MCLs and MDEQ RDWC. The restrictions on residential use will apply until risks associated with residential use are properly assessed and determined to be acceptable.

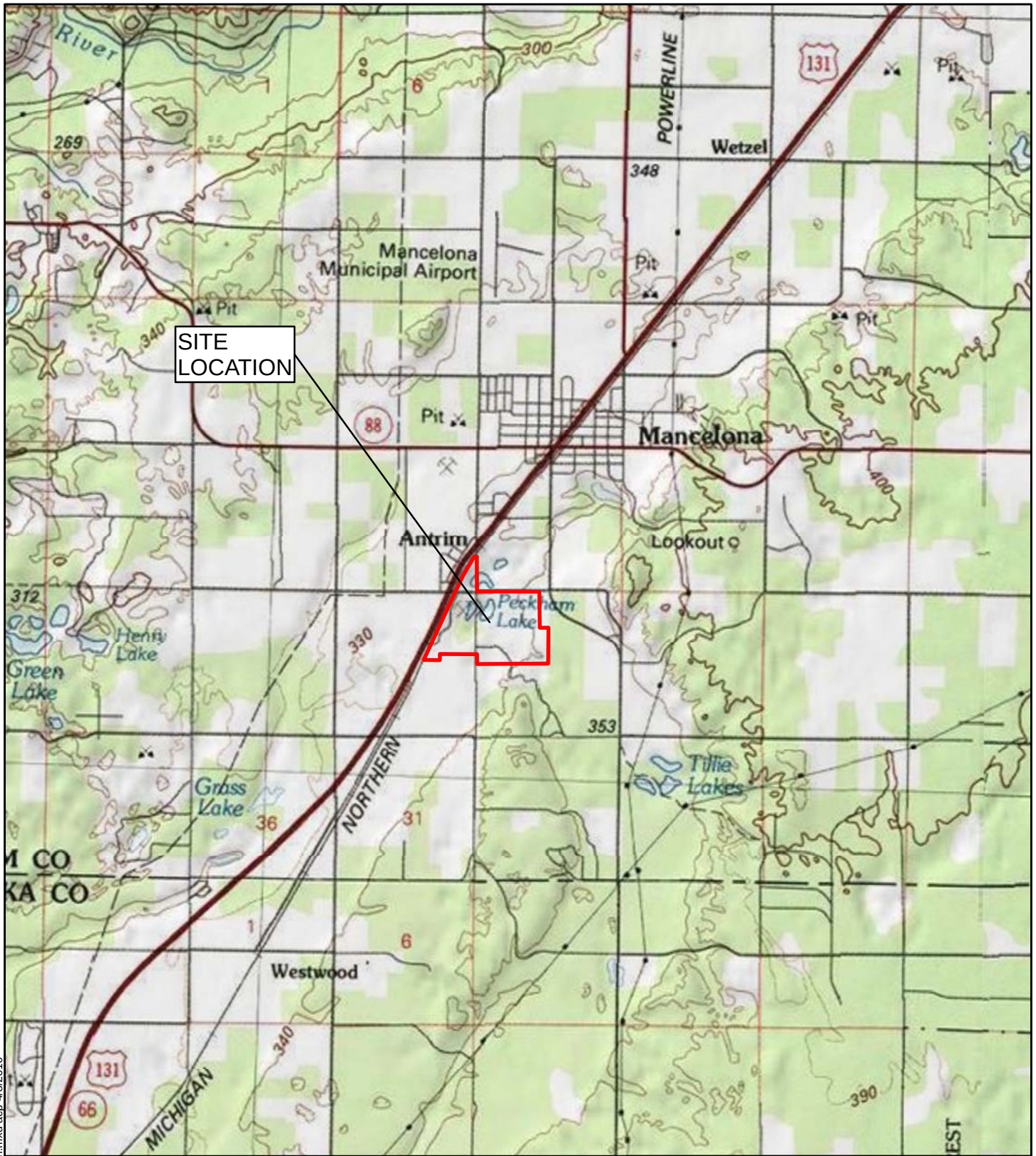
In 2004, EPA determined it was more cost effective to remove the contaminated soil from the Tar Lake area instead of constructing the groundwater circulation and soil bioventing systems in the excavation. EPA issued an ESD and completed the remedial action soil removal and creosote area tar removal in 2004. EPA estimated the cleanup time for groundwater would be one to three years.

MDEQ (now Michigan Department of Natural Resources and Environment [MDNRE]) continues to operate the biosparge system at the site and conduct routine groundwater monitoring. In 2009, EPA issued an ESD clarifying that, under certain conditions, potable and non-potable groundwater use at the site would be acceptable.

EPA conducted the first FYR for the site in 2009. EPA's FYR concluded the remedial actions in the Tar Lake area of the site (tar and soil removal, biosparge groundwater treatment system) are protective in the short-term. However, chemical concentrations in the groundwater in the north part of the Tar Lake area are increasing, and have not decreased to MCLs and MDNRE drinking water criteria as expected. The increased chemical concentrations in the groundwater are, however, being cleaned up by the biosparge system, and are not spreading downgradient.

Long-term protectiveness at the site requires compliance with effective ICs, which EPA and MDNRE are still working to implement. Also, EPA's 2007 title search indicates some areas of the approximate 200-acre site that were not the focus of previous investigations were owned by AIW, and may be within the site boundary. For the site to be protective in the long-term, additional information is needed including:

- Data to demonstrate the on-site potable well on PIN 05-11-130-003-00 does not contain any chemicals above applicable or relevant appropriate drinking water criteria.(i.e., MCLs and MDEQ industrial/commercial criteria);
- Data to demonstrate the 3.48 residential property northeast of the original operations area does not contain site-related contamination above residential standards and can be deleted as UU/UE with the rest of the adjacent ETA;
- Data to demonstrate the Mancelona Township landfill property (reported to contain visible tar at the surface in one area) does not contain any chemicals at levels that would not allow for industrial, commercial and recreational use;
- Data to determine whether the tar in AIW's underground smoke tunnels under and adjacent to Elder Road is a source of groundwater contamination; and
- Additional evaluation to demonstrate sediment concentrations in Nelson Lake, and mercury and lead in Peckham Lake fish samples, are consistent with the MDNRE general fishing advisory for inland lakes and streams.



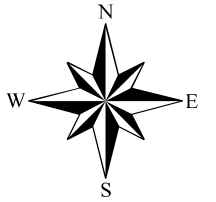
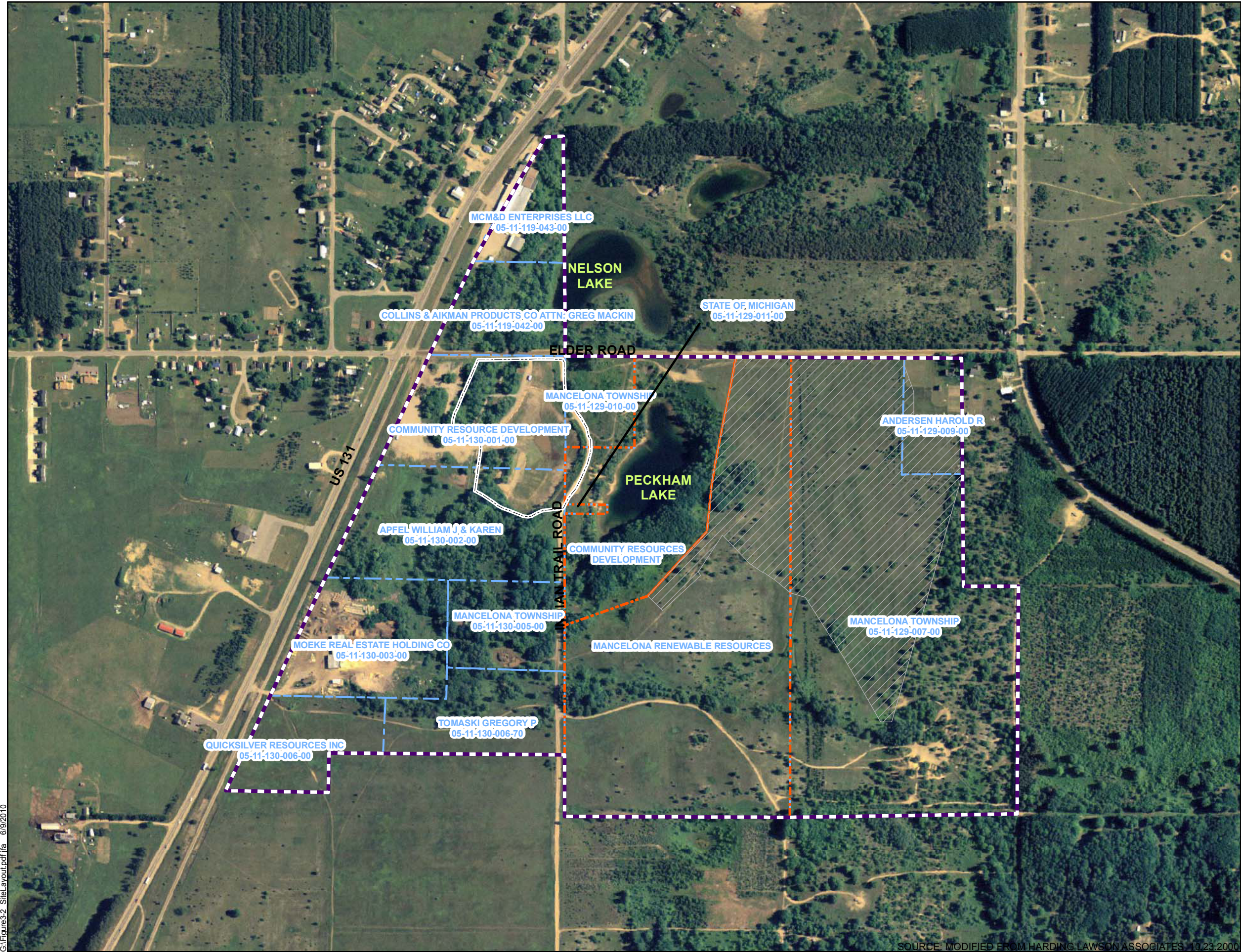
0 2,000 4,000 Feet



TAR LAKE SITE
ANTRIM COUNTY, MICHIGAN

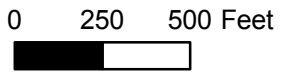
FIGURE 3-1
SITE LOCATION



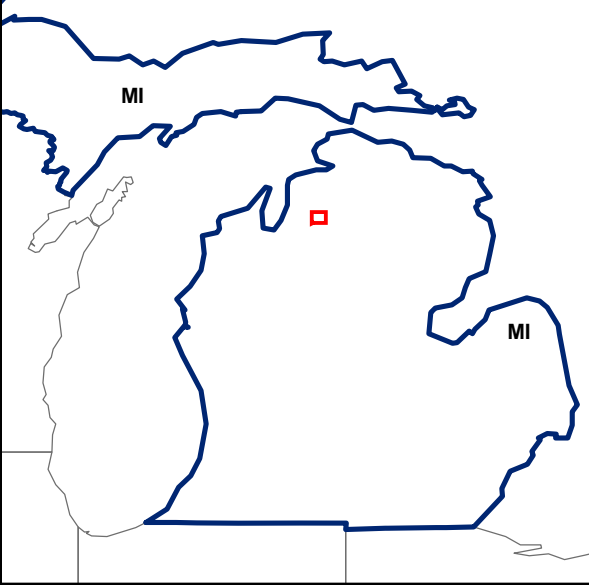


LEGEND

- SITE BOUNDARY
- EAST TAILINGS AREA
- FENCELINE
- SPLIT PARCEL BOUNDARY
- PARCEL BOUNDARY



REFERENCE MAP



TAR LAKE SITE
ANTRIM COUNTY, MICHIGAN

FIGURE 3-2
SITE LAYOUT MAP



3.3 PLANNED ACTIVITIES

Field activities to be performed during the field investigation include the following tasks:

- Site Reconnaissance
- Surface and Subsurface Soil Sampling
- Trench Excavation Sampling
- Groundwater and Residential Well Sampling
- Monitoring Well Installation
- Fish Sampling

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, SulTRAC 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 a task hazard analysis of the planned field activities listed in Section 3.3.

**TABLE 4-1
POTENTIAL CHEMICAL HAZARDS
TAR LAKE SITE**

Chemical and Media	Exposure Limits and IDLH Level	Exposure Routes	Toxic Characteristics
Coal Tar Pitch Volatiles (Methylphenols and 2,4-Dimethylphenol) (aqueous, soil)	PEL = 0.2 mg/m ³ TWA REL = 0.1 mg/m ³ Ca, TWA TLV = 0.2 mg/m ³ TWA IDLH = 80 mg/m ³ Ca	inhalation, skin and/or eye contact	dermatitis, bronchitis, [potential occupational carcinogen]
Benzene (aqueous, soil)	PEL = 1 ppm, TWA; 5 ppm STEL REL = 0.1 ppm, Ca, TWA; 1 ppm STEL TLV = 10 ppm, TWA; 2.5 STEL IDLH = 500 ppm, Ca	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]
Arsenic (aqueous, soil)	PEL = 0.010 mg/m ³ TWA REL = 0.002 mg/m ³ C, Ca, TWA TLV = 0.01 mg/m ³ TWA IDLH = 5 mg/m ³ , Ca	inhalation, skin absorption, skin and/or eye contact, ingestion	ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]
Iron (aqueous, soil)	PEL = 5 mg/m ³ TWA REL = 10 mg/m ³ TWA TLV = 5 mg/m ³ TWA IDLH = N.D	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, mucous membrane, respiratory system; headache, dizziness, nausea, vomiting; fever, cyanosis, cough, dyspnea (breathing difficulty); liver, kidney, lung injury; degenerative changes in central nervous system

TABLE 4-1 (Continued)
POTENTIAL CHEMICAL HAZARDS
TAR LAKE SITE

Notes:

ACGIH American Conference of Governmental Industrial Hygienists

Ca Potential occupational carcinogen

IDLH Immediately dangerous to life or health

mg/m³ Milligram per cubic meter

ND Not determined

OSHA Occupational Safety and Health Administration

PEL Permissible exposure limit

ppm Part per million

REL Recommended exposure limit

TLV Threshold limit value

TWA Time weighted average

Sources: ACGIH. "Threshold Limit Values and Biological Exposure Indices for 1998." Latest edition.

National Institute for Occupational Safety and Health (NIOSH). 2005. "NIOSH Pocket Guide to Chemical Hazards." U.S. Department of Health and Human Services. <http://www.cdc.gov/niosh/npg/> September

EPA. 2009. "Explanation of Significant Difference, Tar Lake Superfund Site, Mancelona, Michigan." September.

TABLE 4-2
TASK HAZARD ANALYSIS
TAR LAKE SITE

Task Number	Task	Potential Hazard	Controls	Initial Level of Protection	Upgraded Level of Protection
1	Site Reconnaissance	Exposure to chemicals listed in Table 4-1; Heat and/or cold stress; Sun exposure; Working over or near water; Uneven, muddy, sandy, marshy, or rugged terrain; General slips, trips, and falls; Heavy lifting; Biohazards, including poisonous animals, poisonous plants, ticks, and mosquitoes	Use appropriate safe work practices for field work (SWP 5-1), HAZWOPER (SWP 5-2), working over or near water (SWP 5-6), heat and/or cold stress (SWP 5-15, SWP 5-16), sun exposure (SWP 5-26); Hydrographic Data Collection (SWP 5-22), safe lifting practices (SWP 5-19), biohazards (SWP 5-17	Level D ensemble: Clothing: work uniform or coveralls, safety glasses. Respirator: N/A Gloves: Leather work or nitrile as needed Boots: leather steel toe/steel shank Other: hardhat, high-visibility vest, personal floatation device (within 15 feet of water), ear plugs (near heavy equipment or in high noise areas), sunscreen, insect repellant, and snake leggings/chaps as needed	N/A

TABLE 4-2 (Continued)
TASK HAZARD ANALYSIS
TAR LAKE SITE

Task Number	Task	Potential Hazard	Controls	Initial Level of Protection	Upgraded Level of Protection
2	Surface and Subsurface Soil Sampling	Exposure to chemicals listed in Table 4-1; Underground utilities; Heavy equipment (Drill Rig); High noise; Heat and/or cold stress; Sun exposure; Working over or near water; Uneven, muddy, sandy, marshy, or rugged terrain; General slips, trips, and falls; Heavy lifting; Vehicle and pedestrian traffic; Biohazards, including poisonous animals, poisonous plants, ticks, and mosquitoes	Use appropriate safe work practices for field work (SWP 5-1), HAZWOPER (SWP 5-2), safe drilling practices (SWP 5-4), safe direct push practices (SWP 5-5), working over or near water (SWP 5-6), heat and/or cold stress (SWP 5-15, SWP 5-16), sun exposure (SWP 5-26), safe lifting practices (SWP 5-19); working near heavy equipment (SWP 5-7), Hearing Conservation Program (DCN 2-4), biohazards (SWP 5-17), respirator cleaning and use of air purifying respirators (SWP 5-27, SWP 5-28)	Level D ensemble: Clothing: work uniform or coveralls, safety glasses. Respirator: N/A Gloves: Leather work or nitrile as needed Boots: leather steel toe/steel shank Other: hardhat, high-visibility vest, personal floatation device (within 15 feet of water), ear plugs (near heavy equipment or in high noise areas), sunscreen, insect repellent, and snake leggings/chaps as needed	Level C ensemble: Respirator: full-face air purifying respirator with appropriate P100 cartridge Tyvek QC or SL as needed to avoid contamination If personnel do not have a respirator, personnel must leave area until H&S concern subsides

TABLE 4-2 (Continued)
TASK HAZARD ANALYSIS
TAR LAKE SITE

Task Number	Task	Potential Hazard	Controls	Initial Level of Protection	Upgraded Level of Protection
3	Trench Excavation Sampling	Exposure to chemicals listed in Table 4-1; Underground utilities; Open excavations and / or trenches; Heavy equipment (Drill Rig); High noise; Heat and/or cold stress; Sun exposure; Uneven, muddy, sandy, marshy, or rugged terrain; General slips, trips, and falls; Heavy lifting; Vehicle and pedestrian traffic; Biohazards, including poisonous animals, poisonous plants, ticks, and mosquitoes	Use appropriate safe work practices for field work (SWP 5-1), HAZWOPER (SWP 5-2), Trenching and Excavation Safety (DCN 4-5), Fall protection practices (SWP 5-10), working over or near water (SWP 5-6), heat and/or cold stress (SWP 5-15, SWP 5-16), sun exposure (SWP 5-26), safe lifting practices (SWP 5-19); working near heavy equipment (SWP 5-7), Hearing Conservation Program (DCN 2-4), biohazards (SWP 5-17), respirator cleaning and use of air purifying respirators (SWP 5-27, SWP 5-28)	Level D ensemble: Clothing: work uniform or coveralls, safety glasses. Respirator: N/A Gloves: Leather work or nitrile as needed Boots: leather steel toe/steel shank Other: hardhat, high-visibility vest, ear plugs (near heavy equipment or in high noise areas), sunscreen, insect repellent, and snake leggings/chaps as needed	Level C ensemble: Respirator: full-face air purifying respirator with appropriate P100 cartridge Tyvek QC or SL as needed to avoid contamination If personnel do not have a respirator, personnel must leave area until H&S concern subsides

TABLE 4-2 (Continued)
TASK HAZARD ANALYSIS
TAR LAKE SITE

Task Number	Task	Potential Hazard	Controls	Initial Level of Protection	Upgraded Level of Protection
4	Groundwater and Residential Well Sampling	Biological hazards (bugs, poison ivy, etc.) slips, trips, and falls, and potential chemicals from the water. Exposure to chemicals listed in Table 4-1; High noise; Heat and/or cold stress; Sun exposure; Working over or near water; Uneven, muddy, sandy, marshy, or rugged terrain; General slips, trips, and falls; Heavy lifting; Vehicle and pedestrian traffic; Biohazards, including poisonous animals, poisonous plants, ticks, and mosquitoes	Use appropriate safe work practices for field work (SWP 5-1), HAZWOPER (SWP 5-2), heat and/or cold stress (SWP 5-15, SWP 5-16), sun exposure (SWP 5-26), safe lifting practices (SWP 5-19); working near heavy equipment (SWP 5-7), Hearing Conservation Program (DCN 2-4), biohazards (SWP 5-17), respirator cleaning and use of air purifying respirators (SWP 5-27, SWP 5-28)	Level D ensemble: Clothing: work uniform or coveralls, safety glasses. Respirator: N/A Gloves: Leather work or nitrile as needed Boots: leather steel toe/steel shank Other: hardhat, high-visibility vest, personal floatation device (within 15 feet of water), ear plugs (near heavy equipment or in high noise areas), sunscreen, insect repellent, and snake leggings/chaps as needed	Level C ensemble: Respirator: full-face air purifying respirator with appropriate P100 cartridge Tyvek QC or SL as needed to avoid contamination If personnel do not have a respirator, personnel must leave area until H&S concern subsides

TABLE 4-2 (Continued)
TASK HAZARD ANALYSIS
TAR LAKE SITE

Task Number	Task	Potential Hazard	Controls	Initial Level of Protection	Upgraded Level of Protection
5	Monitoring Well Installation	Exposure to chemicals listed in Table 4-1; Underground utilities; Heavy equipment (Drill Rig); High noise; Heat and/or cold stress; Sun exposure; Working over or near water; Uneven, muddy, sandy, marshy, or rugged terrain; General slips, trips, and falls; Heavy lifting; Vehicle and pedestrian traffic; Biohazards, including poisonous animals, poisonous plants, ticks, and mosquitoes	Use appropriate safe work practices for field work (SWP 5-1), HAZWOPER (SWP 5-2), safe drilling practices (SWP 5-4), safe direct push practices (SWP 5-5), working over or near water (SWP 5-6), heat and/or cold stress (SWP 5-15, SWP 5-16), sun exposure (SWP 5-26), safe lifting practices (SWP 5-19); working near heavy equipment (SWP 5-7), Hearing Conservation Program (DCN 2-4), biohazards (SWP 5-17), respirator cleaning and use of air purifying respirators (SWP 5-27, SWP 5-28)	Level D ensemble: Clothing: work uniform or coveralls, safety glasses. Respirator: N/A Gloves: Leather work or nitrile as needed Boots: leather steel toe/steel shank Other: hardhat, high-visibility vest, personal floatation device (within 15 feet of water), ear plugs (near heavy equipment or in high noise areas), sunscreen, insect repellent, and snake leggings/chaps as needed	Level C ensemble: Respirator: full-face air purifying respirator with appropriate P100 cartridge Tyvek QC or SL as needed to avoid contamination If personnel do not have a respirator, personnel must leave area until H&S concern subsides

TABLE 4-2 (Continued)
TASK HAZARD ANALYSIS
TAR LAKE SITE

Task Number	Task	Potential Hazard	Controls	Initial Level of Protection	Upgraded Level of Protection
6	Fish Sampling	Exposure to chemicals listed in Table 4-1; Heat and/or cold stress; Entanglement in nets or sharps posed from conventional fishing Sun exposure; Working over or near water; Uneven, muddy, sandy, marshy, or rugged terrain; General slips, trips, and falls; Heavy lifting; Vehicle and pedestrian traffic; Biohazards, including poisonous animals, poisonous plants, ticks, and mosquitoes	Use appropriate safe work practices for field work (SWP 5-1), HAZWOPER (SWP 5-2), working over or near water (SWP 5-6), heat and/or cold stress (SWP 5-15, SWP 5-16), sun exposure (SWP 5-26), safe lifting practices (SWP 5-19); Hearing Conservation Program (DCN 2-4), biohazards (SWP 5-17), respirator cleaning and use of air purifying respirators (SWP 5-27, SWP 5-28)	Level D ensemble: Clothing: work uniform or coveralls, safety glasses. Respirator: N/A Gloves: Leather work or nitrile as needed Boots: leather steel toe/steel shank Other: hardhat, high-visibility vest, personal floatation device (within 15 feet of water), ear plugs (near heavy equipment or in high noise areas), sunscreen, insect repellent, and snake leggings/chaps as needed	Level C ensemble: Respirator: full-face air purifying respirator with appropriate P100 cartridge Tyvek QC or SL as needed to avoid contamination If personnel do not have a respirator, personnel must leave area until H&S concern subsides

Notes:

H&S Health and Safety
N/A Not Applicable
SWP Safe work practice

The Material Safety Data Sheets (MSDS) included in the attachment to this HASP 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:

- Hydrochloric Acid
- Nitric Acid
- Sodium Hydroxide
- Alconox

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. Specific SWPs applicable to the Tar Lake site are listed in Section 9.5 and are provided in Appendix B of this HASP. To ensure a safe workplace, the SSC will conduct and document regular safety inspections and will make sure that all SulTRAC 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:

- Biological Hazards (plants and insects)
- Heat/cold stress
- Working over or near water
- Operating near heavy machinery (drill rigs)
- Excavation/Trenching

5.0 TRAINING REQUIREMENTS

All on-site personnel who may be exposed to hazardous conditions, including SulTRAC 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.” All personnel and visitors entering the site will be required to review this HASP and sign the Compliance Agreement form (HSP-4), and site workers will be required to sign the Daily Tailgate Safety Meeting form (HST-2) (see Appendix A).

Before on-site activities begin, the SulTRAC 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 A). 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 Tar Lake 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 matrixes. 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, Task 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 SulTRAC SSC, and wait for further instructions. 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)
- High-visibility vest
- Class II Personal Floatation Device when on or near the water
- 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 D)
 - 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)

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

SulTRAC 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 A 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 Tar Lake site, a respiratory hazard assessment has been 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 C and defines respiratory protection requirements for the project. Amendments to this HASP 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.

7.0 MEDICAL SURVEILLANCE

The following sections describe SulTRAC'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 Tar Lake site. Additional requirements are defined in the Tetra Tech EM, Inc., "Health and Safety Manual."

7.1 HEALTH MONITORING REQUIREMENTS

All SulTRAC and subcontractor personnel involved in on-site activities at the Tar Lake site must participate in a health monitoring program as required by 29 CFR 1910.120(f). SulTRAC has established a health monitoring program with WorkCare, Inc., of Orange, California. Under this program, SulTRAC 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, SulTRAC receives a copy of the examining physician's written opinion after postexamination laboratory tests have been completed; the SulTRAC 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

For activities at the Tar Lake site, there are no site-specific medical monitoring requirements.

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 A) must be completed by the SulTRAC 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 SulTRAC'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. Site-specific air monitoring requirements and action levels are provided in Table 8-1.

8.1 INITIAL AND BACKGROUND AIR MONITORING

Initial and background air monitoring are not planned during the field investigation. Open excavations, large vehicle traffic, and other activities that would cause airborne soil particles will not be conducted as part of the field activities. As a result, site-wide air monitoring will not be a safety concern. SulTRAC may implement an air monitoring program during the field activities if site conditions warrant.

8.2 PERSONAL MONITORING

Personal air monitoring is not planned during field activities. While personal will be exposed to soil during subsurface investigations, the small quantity and the moistness of the soil will mitigate any hazards that would cause airborne soil particles to become a safety concern. SulTRAC may implement an air monitoring program during the field activities if site conditions warrant.

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.

TABLE 8-1
SITE-SPECIFIC AIR MONITORING REQUIREMENTS AND ACTION LEVELS

Contaminant or Hazard	Task	Monitoring Device	Action Level	Monitoring Frequency	Action ^a
Organic vapors	2 & 3	PID or FID Photovac or Micro FID or MultiRAE or Foxboro PID/FID	5 ppm	Every 30 to 60 minutes	Use Level D PPE
			5 to 100 ppm	Every 30 minutes	Use Level C PPE (unless specific chemicals are identified and evaluated using detector tube)
			> 100 ppm	NA	Stop work and evacuate area; implement vapor suppression controls
Combustible atmosphere	N/A	CGI	<10% LEL	Continuous	Continue work
			10 to 25% LEL		Continue work with extreme caution
			>25% LEL		Stop work, evacuate area, and evaluate source
Oxygen-deficient or enriched atmosphere	N/A	Oxygen meter	19.5 to 23.5%	Continuous	Continue work
			<19.5% or >23.5%		Stop work and evacuate area
†Particulates	N/A	Particulate monitor	<5 mg/m ³	*Hourly or more frequent, as determined by SSC	Use Level D PPE
			5 to 10 mg/m ³	*Continuous	Use Level C PPE and implement dust suppression activities
			>10 mg/m ³	NA	Stop work and implement dust suppression activities
‡Noise	N/A	*Sound level meter	\$85 dBA	When necessary	Use hearing protection

Notes: † Soil encountered will either be in a small quantity (Geoprobe or Rotosonic) or saturated (soil below water table) therefore no particle monitoring will be conducted

‡ Personnel will wear hearing protection around drill rigs therefore a noise meter will not be required

CGI	Combustible gas indicator	mg/m ³	Milligram per cubic meter	PID	Photoionization detector
dBA	Decibel as measured on the A-weighted scale	mRem/hr	Millirem per hour	PPE	Personal protective equipment
FID	Flame ionization detector	NA	Not applicable	ppm	Part per million
LEL	Lower explosive limit	PEL	Permissible exposure limit	SSC	Site Safety Coordinator
				TLV	Threshold limit value

^a Refer to Table 4-2 for specific types of gloves, chemical resistant clothing, respirators, and cartridges.

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.

8.4 MONITORING PARAMETERS AND DEVICES

The following sections below briefly describe the use and limitations of instruments used to monitor for organic vapors, combustible atmospheres, percent oxygen, and particulates. Site-specific air monitoring requirements and action levels are listed in Table 8-1.

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.

8.4.2 Known Individual Compounds

If individual compounds must be identified, compound-specific instrumentation or colorimetric detector tubes may be required. Table 8-1 specifies compound-specific instruments or detector tubes needed for this project, as required. Monitoring frequency and action levels for organic vapors during site activities are also listed in Table 8-1. Generally, action levels for organic vapors are set at one-half of the permissible exposure limit (PEL) or threshold limit value (TLV) of the compound with the lowest PEL or TLV.

No known individual compounds will need to be identified at the LSR site.

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 (10 percent in a confined space). The monitoring device, monitoring frequency, and general action levels for combustible atmospheres during site activities are outlined in Table 8-1.

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. The monitoring device, monitoring frequency, and general action levels for oxygen-deficient and -enriched atmospheres during site activities are outlined in Table 8-1.

8.4.5 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 SulTRAC 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 SulTRAC 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).

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 Tar Lake site 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 SulTRAC 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 HASP 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.

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 SulTRAC 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 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 SulTRAC SSC authorization. Due the expansive nature of the field investigation an exclusion area would be difficult to impossible to establish. Therefore, no exclusion

zone will be established for any of the tasks. Instead, each work area will be isolated as appropriate based on the hazards present (i.e. chemicals, high noise, open excavations, etc.) and access will be restricted.

9.2.2 Zone 2: Decontamination Zone

A decontamination zone is not required for the Tar Lake site. 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 SulTRAC SSC authorization.

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. Exclusion zone includes areas where contamination is either known or likely to be present or, because of work

9.3 SITE ACCESS CONTROL

The main study area at the Tar Lake site is bounded by US HWY 131/MI-66/Front Road to the west, Elder Road to the north, Indian Trail Road to the east, and vacant property to the south. Other field investigation areas include Nelson Lake, located directly north of the site and residential properties located northwest of the site. Access to the site is controlled by a chain linked fence with locked entrances on the north and west side.

9.4 SITE SAFETY INSPECTIONS

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

9.5 SAFE WORK PRACTICES

Various SWPs are applicable to the Tar Lake site. These SWPs are included in Appendix B to this HASP. The following SWPs and safety programs apply to the site:

- DCN 2-4, Hearing Conservation Program
- DCN 4-5, Trenching and Excavation Safety
- SWP 5-1, General Safe Work Practices for Field Work
- SWP 5-2, General Safe Work Practices for Hazardous Waste Activities
- SWP 5-4, Safe Drilling Practices
- SWP 5-5, Safe Direct-Push Boring Practices
- SWP 5-6, Working Over or Near Water
- SWP 5-7, Use of Heavy Equipment
- SWP 5-10, Fall Protection Practices
- SWP 5-15, Heat Stress Prevention and Monitoring
- SWP 5-16, Cold Stress Safe Work Practices
- SWP 5-17, Biohazard Safety
- SWP 5-19, Safe Lifting Procedures
- SWP 5-22 Hydrographic Data Collection
- SWP 5-26, Protection from Sun Exposure
- SWP 6-27, Respirator Cleaning Procedures
- SWP 6-28, Safe Work Practices for Use of Respirators

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[®] or Alconox[®] 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[®] or Alconox[®] 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 C). 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 and will be disposed of in accordance with procedures described in the FSP portion of the SAP (SulTRAC 2010). 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 FSP portion of the SAP (SulTRAC 2010).

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.

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 SulTRAC 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 SulTRAC 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 HASP before site work begins.

11.3 EMERGENCY RECOGNITION AND PREVENTION

Table 4-1 lists potential on-site chemical hazards, and Table 4-2 provides 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 SulTRAC 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.

11.5 EMERGENCY CONTACTS AND NOTIFICATIONS

The emergency information before Section 1.0 of this HASP 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 SulTRAC 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 ROUTE DIRECTIONS

Before performing any site activities, SulTRAC 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 HASP.

11.7 EMERGENCY MEDICAL TREATMENT PROCEDURES

A persons 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 in 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 SulTRAC 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 SulTRAC 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 SulTRAC SSC, a SulTRAC 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.

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
- Eye wash (portable)
- Mobile telephone

11.13 REPORTING

All emergency situations require follow-up and reporting. Appendix A includes the SulTRAC Accident and Illness Investigation Report (Form AR-1). This report must be completed and submitted to the SulTRAC project manager within 24 hours of an emergency situation. The project manager will review the report and then forward it to the SulTRAC 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.

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.
- SulTRAC. 1999. "Health and Safety Manual."
- SulTRAC. 2010. "Sampling and Analysis Plan, Tar Lake Site, Mancelona Township, Michigan." Prepared for EPA under Contract No. EP-S5-06-02. May 12.
- U.S. Environmental Protection Agency (EPA). 2009. "Explanation of Significant Difference, Tar Lake Superfund Site, Mancelona, Michigan." September.

APPENDIX A

SULTRAC FORMS

(Nine 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 AR-1)
- 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.

Name	Signature	Employer	Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____



TETRA TECH, INC.
DAILY TAILGATE SAFETY MEETING FORM

Date: _____ Time: _____ Project No.: _____

Client: _____ Site Location: _____

Site Activities Planned for Today: _____

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



TETRA TECH, INC.

DAILY TAILGATE SAFETY MEETING FORM (Continued)

Attendees	
Printed Name	Signature

Meeting Conducted by:

Name

Title

Signature



TETRA TECH, INC.
DAILY SITE LOG

Site Name: _____ Date: _____

Name (print)	Company	Time	
		In	Out

Comments:



Report Date	Report Prepared By	Incident Report Number
INSTRUCTIONS: 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.		
TYPE OF INCIDENT (Check all that apply)	Additional Form(s) Required for this type of incident	
Near Miss (No losses, but could have resulted in injury, illness, or damage)	☐ Complete IR Form Only	
Injury or Illness	☐ Complete Form IR-A; Injury or Illness	
Property or Equipment Damage, Fire, Spill or Release	☐ Complete Form IR-B; Damage, Fire, Spill or Release	
Motor Vehicle	☐ Complete Form IR-C; Motor Vehicle	
INFORMATION ABOUT THE INCIDENT		
Name of Affected Employee		
Description of Incident		
Note: If no employee was directly affected, enter the employee that witnessed the event or who would have been impacted. If the individual involved is a subcontractor directly supervised by a Tetra Tech employee, check below and enter the supervisor or project manager above.		
Subcontractor ☐		
Date of Incident	Time of Incident	
	_____ AM ☐ PM ☐ OR Cannot be determined ☐	
Weather conditions at the time of the incident	Was there adequate lighting?	
	_____ Yes ☐ No ☐	
Location of Incident		
_____ Was location of incident within the employer's work environment? Yes ☐ No ☐		
Street Address	City, State, Zip Code and Country	
Operating Unit	Office Location	
Project Name / Project#	Client	
Tt Supervisor or Project Manager	Was supervisor on the scene?	
	Yes ☐ No ☐	



WITNESS INFORMATION (attach additional sheets if necessary)				
Name		Company		
Street Address		City, State and Zip Code		
Telephone Number(s)				
RESPONSE ACTIONS				
Response action(s) immediately taken by unit reporting the incident:				
NOTIFICATIONS				
Title				
Project Manager or Supervisor	Printed Name	Signature	Telephone Number	Date
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.

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Project Name: _____ Project No.: _____

Field Location: _____ Completed by: _____

Project Manager: _____ Site Safety Coordinator: _____

General Items		In Compliance?		
		Yes	No	NA
Health and Safety Plan Requirements				
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			

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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			

Safety Items		In Compliance?		
Personal Protection		Yes	No	NA
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			
Instrumentation				
10	Combustible gas meter			
11	Oxygen meter			

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12	Organic vapor analyzer			
Supplies				
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

SAFE WORK PRACTICES

(69 Sheets)

- DCN 2-4, Hearing Conservation Program
- DCN 4-5, Trenching and Excavation Safety
- SWP 5-1, General Safe Work Practices for Field Work
- SWP 5-2, General Safe Work Practices for Hazardous Waste Activities
- SWP 5-4, Safe Drilling Practices
- SWP 5-5, Safe Direct-Push Boring Practices
- SWP 5-6, Working Over or Near Water
- SWP 5-7, Use of Heavy Equipment
- SWP 5-10, Fall Protection Practices
- SWP 5-15, Heat Stress Prevention and Monitoring
- SWP 5-16, Cold Stress Safe Work Practices
- SWP 5-17, Biohazard Safety
- SWP 5-19, Safe Lifting Procedures
- SWP 5-22 Hydrographic Data Collection
- SWP 5-26, Protection from Sun Exposure
- SWP 6-27, Respirator Cleaning Procedures
- SWP 6-28, Safe Work Practices for Use of Respirators

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This hearing conservation program has been established by Tetra Tech to protect employees from the harmful effects of noise exposure. This program is designed to comply with the Occupational Safety and Health Administration (OSHA) occupational noise exposure standard in Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.95, as well as federal, state, local, and contractual requirements.

The hearing conservation program elements describe how the criteria specified by the OSHA standard shall be implemented, reviewed and maintained. Program elements include responsibilities, action levels, monitoring, employee notification, audiometric testing, hearing protection, warning signs and information, and training. This hearing conservation program shall be made available upon request to employees and their representatives.

1.0 SCOPE

An action level for noise has been established by OSHA based on an 8-hour, time-weighted average (TWA) of 85 decibels measured on the A-weighted scale (dBA) in the slow response mode. When employees are exposed to sound that exceeds this action level, employers must implement a hearing conservation program. All employees exposed to sound levels exceeding the action level of 85 dBA fall under the scope of this Hearing Conversation Program.

2.0 RESPONSIBILITIES

Operating unit health and safety managers (HSMs) are responsible for application and oversight of the hearing conservation program within their respective organizations. Each HSM will maintain records of all noise exposure measurements for at least two (2) years, in accordance with Tetra Tech Recordkeeping and Reporting Requirements (Document Control Number (DCN) 1-4). The HSM is also responsible for identifying employees to be included in the audiometric testing program and for scheduling audiometric exams through the Tetra Tech corporate medical surveillance provider.

Project managers are responsible for ensuring compliance with hearing conservation controls and protection at their project sites. Site safety coordinators (SSCs) are responsible for identifying noise control areas or operations and implementing the program on a site-specific basis. The HSM will assist project managers and SSCs with assessing the need for and implementing hearing conservation programs at individual sites. Employees are responsible for wearing appropriate hearing protection devices and following hearing conservation procedures in noise control areas.

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3.0 PROGRAM ELEMENTS

Permissible Exposure Limits

The following table identifies OSHA permissible exposure limits for noise exposures. Whenever possible, administrative or engineering controls will be used to reduce sound levels. If controls are not feasible or fail to reduce sound levels to below 85 dBA, hearing protection will be provided to employees to reduce sound exposures to below the 85 dBA limit. This Tetra Tech hearing conservation program **mandates** the use of hearing protection for 8-hour, TWA exposures of 85 dBA or greater.

TABLE 1 - PERMISSIBLE NOISE EXPOSURES*

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1-1/2	102
1	105
1/2	110
1/4 or less	115

* When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: $C(1)/T(1) + C(2)/T(2) + C(n)/T(n)$ exceeds unity, then, the mixed exposure should be considered to exceed the limit value. C_n indicates the total time of exposure at a specified noise level, and T_n indicates the total time of exposure permitted at that level. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

Monitoring

In most instances, high noise levels at a project site are generated by heavy equipment, such as drill rigs and backhoes, or sources associated with the work site operations such as operating equipment and vehicles. Most common high-noise-level sources have been measured, and instances where hearing protection is required shall be indicated in the site-specific hazard assessment documents such as a health and safety plan (HASP), construction health and safety plan (C-HASP), job hazard analysis (JHA), job safety analysis (JSA), or permit. When noise

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exposures at a work site are suspected to equal or exceed an 8-hour, TWA of 85 dBA resulting from noise sources not previously measured, the SSC will conduct an evaluation to characterize the noise sources and exposure levels.

A portable sound-level meter is recommended for surveying general work areas and for estimating noise exposure when the noise levels are relatively constant. Noise dosimeters are recommended for documenting full-shift noise exposures when noise sources fluctuate, are intermittent, or otherwise difficult to document with the sound-level meter. Monitoring for occupational noise exposure will be conducted for each representative task or job position that the SSC deems necessary. The HSM shall assist with sound level monitoring and reporting as necessary.

All noise measurements will be taken in the hearing zone of the affected employee. The hearing zone is an area within a radius not to exceed 12 inches from the ear closest or in most direct proximity to the noise source.

Monitoring equipment must be in factory calibration and will be checked in the field with an appropriate field calibration check standard according to the equipment manufacturer's recommendation before and after each set of measurements. Documentation of test field calibration checks will be kept with the field data collected.

In some cases, such as on short-term projects, the SSC may forgo actual noise level measurements and use a simple rule-of-thumb test to determine if noise levels are in excess of 85 dBA. The test requires the SSC to determine how loud he or she must speak to be heard at arm's length from another person. If the SSC must raise his or her voice to be heard, average noise levels likely exceed 85 dBA.

Employee Notification

The SSC is responsible for informing employees exposed at or above an 8-hour, TWA of 85 dBA of the results of the monitoring.

Audiometric testing

Audiometric testing shall be conducted for all Tetra Tech employees potentially exposed to sounds levels greater than 85 dBA TWA. The audiometric testing program consists of baseline audiograms, annual audiograms, and termination audiograms. Employees will be informed of the results of these tests at the time of their examination. Audiometric test results will be retained for Tetra Tech by the corporate medical advisor and will become a part of each employee's permanent

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medical record. Exposure and audiometric records will be made available to employees upon request.

Hearing Protection

Tetra Tech will provide hearing protection to all personnel that may experience noise exposures at or greater than 85 dBA. Hearing protection must provide sufficient attenuation to limit employee noise exposure to an 8-hour, TWA of less than 85 dBA. Hearing protection will be replaced as necessary. The SSC will supervise the correct use of hearing protection at a work site. Personnel will receive instruction in proper fitting during initial and refresher hearing conservation training classes.

Warning Signs and Information

The SSC will post “Hearing Protection Required” signs in areas where noise levels have been measured and determined to exceed the 85-dBA, TWA action level. Signs may also be posted in areas where monitoring has not been conducted but noise levels are expected to exceed the 85-dBA, TWA level based on similarity to past activities or on the judgment of the SSC.

For short-duration projects or where personnel exposure in the high-noise area is limited and controlled, the SSC may provide verbal notice of the need for hearing protection in place of the signs described above.

4.0 Training

Hearing conservation training may be conducted as a stand-alone course or may be included in HAZWOPER, construction safety, or other health and safety training. Hearing Conservation training will include the following:

- Effects of noise on hearing;
- The purpose of hearing protectors;
- The advantages, disadvantages, and attenuation of various types of hearing protection;
- Instruction on selection, fitting, use, and care of hearing protectors; and
- The purpose of audiometric testing and an explanation of the test procedure.

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Documentation of initial and refresher training will be through class attendance records and course agendas.

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This program outlines minimum requirements to protect employees who may be exposed to hazards during trenching and excavation activities and to provide general guidance for compliance with Title 29 of the *Code of Federal Regulations* (CFR), Part 1926, Subpart P, “Excavations.”

1.0 SCOPE

This program and procedures applies to all sites and activities involving excavation or trenching as defined in 29 CFR 1926 Subpart P.

2.0 RESPONSIBILITIES

Project managers (PMs) shall ensure that all excavation, shoring, and trenching activities are conducted in accordance with the requirements outlined in this document and Subpart P of 29 CFR 1926. Project managers must also ensure that projects involving trenching and excavation are staffed by an individual trained and qualified to perform “competent person” duties as described in this procedure. Operating unit health and safety managers (HSMs) will provide assistance to PMs in implementing this SWP.

The site safety coordinator (SSC) is responsible for on-site enforcement of this SWP.

3.0 DEFINITIONS

The following definitions apply to this SWP:

Benching: Forming one or a series of horizontal levels or steps in the sides of an excavation to protect employees from cave-ins.

Competent Person: One capable of identifying existing or predictable hazards in the work environment that are unsanitary or dangerous to employees and who has authorization to take prompt corrective measures to eliminate the hazards.

Excavation: Any manmade cut, cavity, trench, or depression in an earth surface formed by earth removal.

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Shoring: Metal, hydraulic, mechanical, or timber system that supports the sides of an excavation and that is designed to prevent cave-ins.

Sloping: Sloping the sides of an excavation at an incline away from the excavation to protect employees from cave-ins.

Trench: A narrow excavation (in relation to its length) that is usually deeper than it is wide but less than 15 feet wide.

4.0 PROCEDURES

Described below are the general safety requirements and protective system requirements for trenching and excavation activities.

4.1 General Safety Requirements

General safety requirements that must be in place before work begins are as follows:

- Utility companies or a utilities locating service in the area must be notified **before excavation or trenching activities begin** to arrange for locating and protecting underground utilities.
- Access to trenching areas must be controlled and limited to authorized personnel. Prior to entering a trench or excavation, workers must notify the project manager, SSC, and nearby equipment operators whose activities could affect the trench or excavation.
- No person may enter a trench or work at the foot of the face of an excavation until a qualified, competent person has inspected the excavation and determined whether sloping or shoring is required to protect against cave-in or subsidence and the appropriate protection has subsequently been installed.
- Trenches and excavations must be assessed by a qualified, competent person, even in the absence of working personnel, whenever heavy equipment will be operating nearby in order to ensure that the trench or excavation will support the weight of the equipment without subsistence or causing the accidental overturning of machinery.

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- Trenches and excavations must be inspected regularly (daily at a minimum) to ensure that changes in temperature, precipitation, shallow groundwater, overburden, nearby building weight, vibration, or nearby equipment operation have not caused weakening of the sides, faces, and floors and to ensure that personnel protection is being maintained. Form TEC – Trenching and Excavation Checklist or its equivalent is to be used to document inspections.
- When subsidence or tension cracks are apparent anywhere in an excavation, all work should be stopped until the problem is corrected.
- The competent person must inspect trenches or excavations after any precipitation event to ensure integrity has been maintained.
- Sufficient ramps or ladders must be provided in excavations 4 or more feet deep to allow quick egress. Ramps or ladders may be placed no more than 25 feet apart, must be secured from shifting, and must extend at least 3 feet above the top of the trench or excavation. Structural ramps must be designed by a competent person.
- Material removed from an excavation or trench must be placed far enough from the edge (at least 2 feet) to prevent it from sliding into the excavation or trench or from stressing the trench or excavation walls. Worker protection must also be provided from loose rock or soil on the excavation faces.
- If trenches or excavations are near walkways or roadways, guards or warning barriers must be placed to alert pedestrians and drivers of the presence of the trench or excavation.
- If possible, trenches or excavations should be covered or filled in when unattended. Otherwise, strong barriers must be placed around the trench or excavation and lighting must be provided at night if the trench or excavation is near a walkway or roadway.
- When a hazardous atmosphere could exist, the excavation must be tested for appropriate hazardous substances and oxygen level before personnel entry. Excavation where hazardous atmospheres exist must be treated as a confined space. Entry must follow procedures outlined in “Confined Spaced Entry Program,” Document Control No. 2-5.

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- Entry is not allowed into excavations where water has accumulated.

4.2 Protective System Requirements

Protective systems protect employees from cave-ins, material that could fall in or roll off the face of the excavation, and collapse of adjacent structures. Protective systems include shoring, shielding, sloping and benching, and other systems. Sloping and benching and shoring system requirements are described below.

4.2.1 Sloping and Benching Requirements

Sloping and benching system construction must follow the guidelines established in Appendix B to Subpart P of 29 CFR 1926. Maximum allowable slopes for excavations are summarized below. All slopes indicated are expressed as the ratio of horizontal distance (H) to vertical rise (V).

Soil or Rock Type	Maximum Allowable Slope (H:V) for Excavations Less than 20 Feet Deep
Stable Rock	Vertical (90°)
Type A	0.75:1 (53°)
Type B	1:1 (45°)
Type C	1.5:1 (34°)

Soil types are defined in Appendix A to Subpart P of 29 CFR 1926 and are summarized below.

- Type A:** Cohesive soils with an unconfined compression strength of 1.5 tons per square foot (ton/ft²) or greater (such as clay, silty clay, sandy clay, or clay loam)
- Type B:** Cohesive soils with unconfined compression strength of greater than 0.5 but less than 1.5 ton/ft² (such as angular gravel, silt, silt loam, or sandy loam)
- Type C:** Cohesive soils with an unconfined compression strength of less than 0.5 ton/ft² (such as gravel, sand, loamy sand, submerged soil, or unstable submerged rock)

Sloping and benching for excavations greater than 20 feet deep must be designed by a registered professional engineer.

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Soil types must be determined by the competent person using at least one visual and one manual test. Manual tests include plasticity, dry strength, thumb penetration, and drying tests.

4.2.2 Shoring System Requirements

Appendixes C, D, and E to Subpart P of 29 CFR 1926 outline requirements for timber shoring for trenches, aluminum hydraulic shoring for trenches, and alternatives to timber shoring, respectively. Guidelines for shoring systems are listed below.

- If it is not economically feasible or there are space restrictions to prevent cutting the trench or excavation walls back to a safe angle of repose, all trenches or excavations 5 feet deep or more must be shored.
- Shoring should be erected as trenching or excavation progresses and as closely as possible to the excavation floor.
- Shoring timber dimensions must meet the minimum timber requirements specified in Tables C1.1 through C1.3 of Appendix C to Subpart P 29 CFR 1926. Aluminum hydraulic shoring must be constructed using the guidelines and dimension requirements specified in Appendix D of the same standard.
- Trench shields may be used instead of shoring or bracing. Shields must be constructed of steel flat sides welded to a heavy framework of structural pipe. Shields should be moved along by the excavator as trenching or excavation proceeds.

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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 field operations not conducted on hazardous waste sites. This list is not inclusive and may be amended as necessary.

- Be familiar with and knowledgeable of and adhere to all instructions in the construction health and safety plan (C-HASP), job safety analysis, job hazard analysis, work permit or other health and safety documentation.
- At a minimum, a safety meeting will be held at the start of each project to discuss the hazards of the site and site work. 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, fall protection, or other protective equipment is in use. Buddies should establish hand signals or other means of emergency communication in case radios break down or are unavailable.
- In order to assist each other in the event of an emergency, buddies should maintain visual contact with each other and with other on-site team members by remaining in close proximity.
- Do not bring nonessential vehicles and equipment onto 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 personnel, subcontractor personnel, and project site visitors; and other information related to safety matters.

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- A portable eyewash station should be located in the support zone if corrosive materials are used or stored on the site.
- Smoking is not allowed on Tetra Tech projects sites, except in designated smoking areas.
- 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.
- Anyone known to be under the influence of drugs or intoxicating substances that impair the employee's ability to safely perform assigned duties shall not be allowed on the job while in that condition.
- Horseplay, scuffling, and other acts that tend to have an adverse influence on the safety or well-being of the employees is prohibited.
- Work shall be well planned to prevent injuries in the handling of materials and when working with equipment.
- No one shall knowingly be permitted or required to work while the employee's ability or alertness is so impaired by fatigue, illness, or other causes that might unnecessarily expose the employee or others to injury.
- Use proper lifting techniques. Heavy objects will be lifted using the large muscles of the leg instead of the smaller muscles of the back.
- Wear appropriate footwear and all other protective equipment required for work.
- Cleanse thoroughly after handling hazardous substances.
- Maintain all tools and equipment in good condition.
- First aid kits shall be located in a prominent location and stocked with basic first aid supplies.

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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 on hazardous waste sites. 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 contact with site contamination exists.
- Wash hands and face thoroughly upon leaving a contaminated or suspected contaminated area. If a source of potable water is not available at the work site that can be used for hands-washing, the use of waterless hand cleaning products will be used, followed by actual hand-washing as soon as practicable upon exiting the site. A thorough shower and wash 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 interferes 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.

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- 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.
- 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 personnel, subcontractor personnel, and project site visitors; 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. Flames and open fires are not permitted on site.
- 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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	TETRA TECH, INC. SAFE DRILLING PRACTICES	Revision Date: 10/1/2008
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This document establishes safe work practices (SWP) to follow during drilling operations. These SWPs are based on suggested safety procedures provided in the National Drilling Association's "Drilling Safety Guide." Procedures to follow before, during, and after drilling are listed below.

Before beginning any drill operation, each employee must conform to the following requirements:

- Wear a hard hat, safety glasses or goggles, steel-toed work boots, a shirt and full-length pants when working with or near the drill rig. Shirts must be tucked in at the belt.
- Do not wear loose or frayed clothing, loose long hair, or loose jewelry while working with rotating equipment.
- Do not eat, drink, or smoke near the drill rig.
- Identify all underground utility and buried structure locations before drilling.
- Ensure that drill masts or other projecting devices will be farther than 25 feet in any direction from overhead power lines.
- Ensure that the drill rig and any other machinery used is inspected daily by competent, qualified individuals. The site safety coordinator (SSC) will ensure compliance with this precaution.
- Drill rig operators will be instructed to report any abnormalities, such as equipment failure, oozing liquids, and unusual odors, to their supervisors or the SSC.
- Establish hand-signal communications for use when verbal communication is difficult. One person per work team will be designated to give hand signals to equipment operators.

While the drill rig is operating, employees must:

- Wear appropriate respiratory and personal protective equipment (PPE) when conditions warrant their use.
- Avoid direct contact with known or suspected contaminated surfaces.
- Move tools, materials, cords, hoses, and debris to prevent tripping hazards and contact with moving drill rig parts.

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- Adequately secure tools, materials, and equipment subject to displacement or falling.
- Store flammable materials away from ignition sources and in approved containers.
- Maintain adequate clearance of the drill rig and mast from overhead transmission lines. The minimum clearance is 25 feet unless special permission is granted by the utility company. Call the local utility company for proper clearance.
- Only qualified and licensed personnel should operate drill rigs.
- Workers should not assume that the drill rig operator is keeping track of the rig's exact location. Workers should never walk directly behind or beside heavy equipment without the operator's knowledge.
- Workers should maintain visual contact with drill rig operators at all times.
- When an operator must maneuver equipment in tight quarters, the presence of a second person is required to ensure adequate clearance. If much backing is required, two ground guides will be used: one in the direction the equipment is moving, and the other in the operator's normal field of vision to relay signals.
- Auger sections and other equipment are extremely heavy. All lifting precautions should be taken before moving heavy equipment. Appropriate equipment, such as chains, hoists, straps, and other equipment, should be used to safely transport heavy equipment too heavy to safely lift.
- Proper personal lifting techniques will be used. Workers should lift using their legs, not their backs.
- Workers will not use equipment they are not familiar with. This precaution applies to heavy as well as light equipment.
- All personnel not essential to work activities will be kept out of the work area.
- Workers will be aware of their footing at all times.
- Workers will remain alert at all times.

After drilling operations are completed, employees should do the following:

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- Shut down machinery before repairing or lubricating parts (except parts that must be in motion for lubrication).
- Shut down mechanical equipment prior to and during fueling operations. When refueling or transferring fuel, containers and equipment must be bonded to prevent the buildup of static electricity.
- Keep drill rigs in the exclusion zone until work has been completed. Such equipment should then be decontaminated within the designated decontamination area.
- Engage parking brakes when equipment is not in use.
- Implement an ongoing maintenance program for all tools and equipment. All tools and moving equipment should 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 in accordance with manufacturer specifications. Defective items should be promptly repaired or replaced. Maintenance and repair logs will be kept.
- Store tools in clean, secure areas to prevent damage, loss, or theft.

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	TETRA TECH, INC. SAFE BORING PRACTICES USING DIRECT PUSH TECHNOLOGY	Revision Date: 10/1/2008
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This document establishes safe work practices (SWP) to follow during operating involving boring using direct push technology (DPT). These SWPs are based on suggested safety procedures provided in the National Drilling Association's "Drilling Safety Guide." Procedures to follow before, during, and after drilling are listed below.

Conventional and sonic drilling rigs can penetrate virtually any material to great depth, but they are expensive and cumbersome to operate in environmental investigations. Contaminated material brought to the surface requires special handling and can be a safety concern for workers. An alternative, the direct-push cone penetrometer, was developed in the 1930s in The Netherlands. This device uses up to 40,000 pounds of hydraulic force to push a steel instrumented cone or a sampling device into the ground. No material comes to the surface unless soil or groundwater samples are being collected. Direct-push technology eliminates the need for disposal of cuttings and solidification of drilling fluid. Therefore, DPT is frequently used for environmental investigation applications as an alternative to conventional drilling.

Before beginning any DPT operation, employees must understand and comply with the following requirements:

- Safety glasses or goggles, steel-toed work boots, hard hat, a shirt and full-length pants must be worn when working with or near the direct push rig. Shirts must be tucked in at the belt.
- Do not wear loose or frayed clothing, loose long hair, or loose jewelry while working with rotating equipment.
- Do not eat, drink, or smoke near the direct push rig.
- Identify all underground utility and buried structure locations before drilling.
- Ensure that the direct push rig and any other machinery used is inspected daily by competent, qualified individuals. The site safety coordinator (SSC) will ensure compliance with this precaution.
- Direct push rig operators will be instructed to report any abnormalities, such as equipment failure, oozing liquids, and unusual odors, to their supervisors or the SSC.
- Establish hand-signal communications for use when verbal communication is difficult. One person per work team will be designated to give hand signals to equipment operators.

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While the direct push rig is operating, employees should be aware of the following:

- Wear appropriate respiratory and personal protective equipment (PPE) when conditions warrant their use.
- Avoid direct contact with known or suspected contaminated surfaces.
- Move tools, materials, cords, hoses, and debris to prevent tripping hazards and contact with moving direct push rig parts.
- Adequately secure tools, materials, and equipment subject to displacement or falling.
- Store flammable materials away from ignition sources and in approved containers.
- Maintain adequate clearance of the direct push rig and mast from overhead transmission lines. The minimum clearance is 25 feet unless special permission is granted by the utility company. Call the local utility company for proper clearance.
- Only qualified and licensed personnel should operate direct push rigs.
- Workers should not assume that the direct push rig operator is keeping track of their exact location. Workers should never walk directly behind or beside heavy equipment without the operator's knowledge.
- Workers should maintain visual contact with direct push rig operators at all times.
- When an operator must maneuver equipment in tight quarters, the presence of a second person is required to ensure adequate clearance. If much backing is required, two ground guides will be used: one in the direction the equipment is moving, and the other in the operator's normal field of vision to relay signals.
- Proper personal lifting techniques will be used. Workers should lift using their legs, not their backs.
- Workers will not use equipment they are not familiar with. This precaution applies to heavy as well as light equipment.
- All personnel not essential to work activities will be kept out of the work area.
- Workers will be aware of their footing at all times.

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- Workers will remain alert at all times.

After drilling operations are completed, employees should do the following:

- Shut down machinery before repairing or lubricating parts (except parts that must be in motion for lubrication).
- Shut down mechanical equipment prior to and during fueling operations. When refueling or transferring fuel, containers and equipment must be bonded and grounded to prevent the buildup of static electricity.
- Keep direct push rigs in the exclusion zone until work has been completed. Such equipment should then be decontaminated within the designated decontamination area.
- Engage parking brakes when equipment is not in use.
- Implement an ongoing maintenance program for all tools and equipment. All tools and moving equipment should 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 in accordance with manufacturer specifications. Defective items should be promptly repaired or replaced. Maintenance and repair logs will be kept.
- Store tools in clean, secure areas to prevent damage, loss, or theft.

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	TETRA TECH, INC. SAFE WORK PRACTICES for WORKING OVER OR NEAR WATER	Revision Date: 10/1/2008
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The following sections discuss general procedures for working over or near water, underwater work, and cold water procedures.

1.0 SCOPE

This safe work practice (SWP) provides guidelines for all Tetra Tech employees and subcontractors who work over or near bodies of water three (3) or more feet deep or swiftly moving water. This SWP was developed in accordance with the Occupational Safety and Health Administration (OSHA) standard specified in Title 29 of the *Code of Federal Regulations* (CFR), Part 1926.106, "Working Over or Near Water."

2.0 RESPONSIBILITIES

The project manager (PM) is responsible for identifying all health and safety requirements of each project, including all tasks that may involve worker exposure to hazards or working in or near bodies of water. The PM will appoint a site safety coordinator (SSC) to ensure that this SWP is followed in the field. Workers will follow this SWP whenever working near or in any body of water that is over three (3) feet deep or swiftly moving.

3.0 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) when working 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 and after each use.
- Ring buoys with at least 90 feet of line shall be provided and readily available for employee rescue operations.
- The distance between ring buoys shall not exceed 200 feet.

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- 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, a ring buoy, branch, paddle, pole, or other floating object should be extended to the person in the water. Resist the impulse to dive in; employees should not attempt a deep water rescue unless they have been trained in water lifesaving skills. When the person in the water grabs the extended item, the worker 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.

4.0 UNDERWATER WORK

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

5.0 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. Additional protective equipment such as cold water immersion suits may be required. 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. Cold water safe work practices must be addressed in site specific safety documents.

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

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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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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) may be required as specified in the site health and safety plan (HASP); construction site health and safety plan (C-HASP); Job Hazard Analysis (JHA), Job Safety Analysis (JSA) or other site-specific health and safety documentation.
- Workers will not assume that the equipment operator is keeping track of the exact location of operating equipment. 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 operator's normal field of vision to relay signals.
- All heavy equipment used at a contaminated work site will be kept in the exclusion



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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).
- 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



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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 all equipment and tools.
- 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.
- Workers will be aware of their footing at all times.
- Workers will remain alert at all times.

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This safe work practice (SWP) presents general guidelines for basic fall protection when working in elevated areas. Elevated work or elevated construction work will require detailed procedures included in a site-specific health and safety plan (HASP), or construction health and safety plan (C-HASP). SWP 5-11, “Portable Ladder Safety,” should also be consulted.

1.0 RESPONSIBILITIES

The project manager (PM) is responsible for ensuring that work areas are evaluated for the presence of slip, trip, stumble and fall hazards prior to the start of work. Any site-specific fall protection practices should be identified and detailed in the site-specific health and safety plan (HASP), construction health and safety plan (C-HASP), job hazard analysis (JHA), job safety analysis (JSA), work permit or other site-specific health and safety documentation. The site safety coordinator is responsible for ensuring that on-site work is performed in accordance with this SWP.

Site specific fall protection procedures must be developed by an employee trained and qualified as a “competent person” in accordance with OSHA standard 29 CFR 1926 Subpart M. Anchor points and lifelines must be designed and approved by a trained “Qualified Person.” The operating unit health and safety manager (HSM) shall assist with the implementation of the SWP.

2.0 PRACTICES

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 shock-absorbing lanyards or self-retracting lifelines (SRLs) shall be worn by employees whose work exposes them to falls of greater than six (6) feet.
- Workers must be protected from falls of less than 4 feet when working over machinery or equipment that would pose an additional hazard if the employee were to fall.



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- Anchorage points for lanyards or SRLs should be located at a level no lower than the employee's waist to limit the free 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 force of 5,400 pounds should be used.
- Employees who are required to wear fall protection must be trained in the use of the equipment, as well as in fall protection work practices.

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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	• Painful muscle cramps, especially in legs and abdomen • Faintness • Profuse perspiration	• Move affected worker to cool location • Provide sips of liquid such as Gatorade® • Stretch cramped muscles • Transport affected worker to hospital if condition worsens
Heat Exhaustion	Blood transport to skin to dissipate excessive body heat, resulting in blood pooling in the skin with inadequate return to the heart	• Weak pulse • Rapid and shallow breathing • General weakness • Pale, clammy skin • Profuse perspiration • Dizziness • Unconsciousness	• Move affected worker to cool area • Remove as much clothing as possible • Provide sips of cool liquid or Gatorade® (only if conscious) • Fan the person but do not overcool or chill • Treat for shock • Transport to hospital if condition worsens
Heat Stroke	Life threatening condition from profound disturbance of body's heat-regulating mechanism	• Dry, hot, and flushed skin • Constricted pupils • Early loss of consciousness • Rapid pulse • Deep breathing at first, and then shallow breathing • Muscle twitching leading to convulsions • Body temperature reaching 105 or 106 °F or higher	• Immediately transport victim to medical facility • Move victim to cool area • Remove as much clothing as possible • Reduce body heat promptly by dousing with water or wrapping in wet cloth • Place ice packs under arms, around neck, at ankles, and wherever blood vessels are close to skin surface • Protect patient during convulsions

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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.

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

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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.

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	• Pain in affected area that later goes away • Area feels cold and numb • Incipient frostbite (frostnip) - skin is blanched or whitened and feels hard on the surface • Moderate frostbite - large blisters • Deep frostbite - tissues are cold, pale, and hard	• Move affected worker to a warm area • Immerse affected body part in warm (100 to 105 °F) water— not hot! • Handle affected area gently; do not rub • After warming, bandage loosely and seek immediate medical treatment
Hypothermia	Exposure to freezing or rapidly dropping temperatures	• Shivering, dizziness, numbness, weakness, impaired judgment, and impaired vision • Apathy, listlessness, or sleepiness • Loss of consciousness • Decreased pulse and breathing rates • Death	• Immediately move affected person to warm area • Remove all wet clothing and redress with loose, dry clothes • Provide warm, sweet drinks or soup (only if conscious) • Seek immediate medical treatment

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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), construction health and safety plan (C-HASP), job safety analyses (JSAs), activity hazard analyses (AHAs), or other health and safety project planning documents on a case-by-case basis.

During preparation for site work, the document 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 document 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.

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- 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.
- 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.

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- 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.
- 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.

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- 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 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.

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- 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 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.

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- 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.
- 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. SAFE LIFTING and CARRYING PRACTICES	Revision Date: 10/1/2008
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To prevent injuries and adverse health effects, the following general safe work practices (SWP) are to be followed when lifting and carrying while in an office or field environment. These SWPs establish a pattern of general precautions and measures for reducing risks associated with back injury and trauma associated with improper lifting and carrying of heavy objects. This list is not inclusive and may be amended as necessary.

- First, inspect the area where the load will be lifted, transported, and then deposited. Remove any obstacles that could present a tripping or other hazard.
- Perform a "test lift" by slightly pushing or moving the object to gauge your ability to safely lift/move/deposit the item without injuring yourself. IF YOU ARE NOT CONFIDENT THAT YOU CAN MOVE THE OBJECT WITHOUT INJURING YOURSELF - THEN EITHER GET A MECHANICAL LIFTING AID OR GET HELP. DO NOT ATTEMPT TO MOVE THE OBJECT YOURSELF.
- Get as close to the object as you can, and bend at the knees (not at the back).
- Assure that can get a firm grasp on the object.
- Keeping the load as close to you body as possible, lift with your legs, and avoid turning or twisting while lifting, carrying, or depositing the load.
- Carry the object in a manner that it does not obstruct your vision and so that you can maintain a clear line of sight of your path of travel and the area where you will set it down.
- Set the object down using the same techniques as you did in lifting it (don't turn or twist, keep it close to your body, use your legs - not your back).

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This safe work practice (SWP) is intended 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 posted at the site. This list should be updated by the crew chief prior to commencing any work in a new location.

Typically each field crew will have at least one mobile telephone that can be utilized in an emergency. Additionally, the field crew may carry two-way radios to allow communication between crew members for data collection purposes and in case 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.

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

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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 5-15.

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 if 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 5-16 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 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.

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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) Incident Reporting and Investigation Program, Document Control Number 2-2. 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.

4.0 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.

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Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
Driving to work site	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.
	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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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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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.
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.

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Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
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.
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 un snag 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.

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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 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.
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.

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Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
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.
	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.

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Data Collection Tasks	Potential Safety Hazards	Steps to Avoid the Hazard	What to Do if a Problem Occurs
	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.
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. PREVENTION of SUN EXPOSURE	Revision Date: 10/1/2008
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By far, the most common cause of skin cancer is overexposure to the sun. Ninety percent of all skin cancers occur on parts of the body that not usually covered by clothing. People who sunburn easily, and those with fair skin and red or blond hair are more prone to develop skin cancer. The amount of time spent in the sun also affects a person's risk of skin cancer. Premature aging of the skin also occurs with prolonged sun exposure. Tetra Tech encourages personnel to avoid prolonged exposure to the sun, and recommends the following:

- Sunburn can occur during any time of the year. To avoid sunburn, wear hats with wide brims.
- Use sunscreen with a Sun Protective Factor (SPF) rating of 15 or higher.
- To prevent skin cancer:
 - o Cover up with a wide brimmed hat and a bandanna for your neck. Wear long-sleeved shirts and pants which the sun cannot penetrate.
 - o Use sunscreens to help prevent skin cancer as well as premature aging of your skin. Use a Sun Protective Factor (SPF) rating of 15 or higher.
 - o Apply sunscreen at least an hour before going into the sun and again after swimming or perspiring a lot.
 - o Do not use indoor sun lamps, tanning salons/parlors, or tanning pills.
- You can still get burned on a cloudy day. Try to stay out of the direct sun at midday, because sun rays are their strongest between 10 a.m. and 3 p.m. Beware of high altitudes - where there is less atmosphere to filter out the ultraviolet rays. Skiers should remember that snow reflects the sun's rays, too.
- Know your skin. Whatever your skin type, do a monthly self-examination of your skin to note any moles, blemishes or birthmarks. Check them once a month and if you notice any changes in size, shape or color, or if a sore does not heal, see your physician without delay.

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Revision Date	Document Authorizer		Revision Details
	Name	Approval Date	
10/1/2008	Chris McClain		NEW
	Rick Lemmon		

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	TETRA TECH, INC. PREVENTION of SUN EXPOSURE	Revision Date: 10/1/2008
		Document Control Number:
		SWP 5-26
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	TETRA TECH, INC. RESPIRATOR CLEANING PROCEDURES	Revision Date: 10/1/2008
		Document Control Number:
		SWP 5-27
		Page 1 of 3

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 Number (DCN) 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

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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. GENERAL SAFE WORK PRACTICES for USE OF AIR PURIFYING RESPIRATORS	Revision Date: 10/1/2008
		Document Control Number:
		SWP 5-28
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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; or
 - For any other criteria as established in a site-specific health and safety plan (HASP), construction health and safety plan (C-HASP), job hazard analysis (JHA), job safety analysis (JSA), work permit or other site-specific health and safety document.

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.

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- 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 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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	Rick Lemmon		

APPENDIX C
RESPIRATORY HAZARD ASSESSMENT (FORM RP-2)

(Two Pages)

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

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FORM RP-2

Page 1 of 2

Project Name:				Project No.:	
Location:				Project Manager:	
Type: ☐ Baseline ☐ Reassessment			Date:		Valid for ____ days
Job/Task Description:				☐ Routine ☐ 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: ☐ PID ☐ NIOSH method: _____ ☐ FID ☐ Vapor badge: _____ ☐ Detector tube: _____ ☐ Other: _____			Respirator Type: ☐ Half-face disposable Brand: _____ ☐ Half-face reusable Brand: _____ ☐ Full-face Brand: _____ ☐ Air-supplied airline Brand: _____ ☐ Air-supplied SCBA Brand: _____ ☐ PAPR Brand: _____ ☐ ESCBA Brand: _____		
** If concentrations exceed the immediately dangerous to life and health (IDLH) value, use air-supplied systems.			Vapor and Gas Cartridge Exchange: ESLI: ☐ Yes ☐ No Exchange frequency: _____		
Cartridge/Filter Selection ☐ N100 ☐ R100 ☐ P100 ☐ N99 ☐ R99 ☐ P99 ☐ N95 ☐ R95 ☐ P95 ☐ Organic vapor ☐ Acid gas ☐ Ammonia ☐ Mercury ☐ Formaldehyde ☐ Combo: _____ ☐ Other: _____			Basis for Exchange Frequency ☐ Manufacturer's data ☐ Workplace simulations ☐ Experimental methods ☐ AIHA "Rules of Thumb" ☐ Predictive modeling ☐ Analogous chemical structure ☐ OSHA Regulation: _____ ☐ Other: _____		
Completed by _____ Date _____			Reviewed by _____ Date _____		

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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 the operating unit health and safety manager (or designee) only and must be attached to the site-specific health and safety plan, construction health and safety plan, or other site-specific health and safety documentation, once completed. A copy must also be placed in the project files.

ATTACHMENT
MATERIAL SAFETY DATA SHEETS

(17 Sheets)

- Hydrochloric Acid
- Nitric Acid
- Sodium Hydroxide
- Alconox



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	800-255-3924 (24 hrs -- CHEM • TEL)

HAZARDOUS COMPONENTS			
Material or Component	CAS No.	TLV	PEL
Hydrochloric Acid	7647-01-0	7mg/m ³	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.

HEALTH HAZARDS / FIRST AID	
Inhalation	Inhalation causes severe irritation of upper respiratory tract. FA: Remove person to fresh air. If not breathing, give artificial respiration. Call physician.
Ingestion	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.
Skin Contact	CORROSIVE ! Can cause redness, pain and skin burns. Can cause some tissue destruction. FA: Immediately flush with water.
Eye Contact	CORROSIVE ! FA: Continuously flush eyes with large amounts of water for at least 20 minutes. If irritation continues, seek medical attention.

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

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

STORAGE CONDITIONS	
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.	

REGULATORY INFORMATION	
Proper shipping name	Hydrochloric acid
Hazard class	8
UN Number	UN1789
DOT Label & Placard	Corrosive
NFPA / HMIS Ratings	Health – 3; Flammability – 0; Reactivity – 0
SARA Title III	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.

For further information contact:

David W. Boston, President
OWEN COMPLIANCE SERVICES, INC.
8805 Forum Way
P.O. Box 40150
Fort Worth, TX 76140
Telephone number:
FAX number:

817-551-0660
817-551-1032

MSDS prepared by:

Allen M. Sweeney
Original publication date:
Revision date

8/5/1999
11/2/00

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

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: HNO₃ in H₂O
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^(tm) 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	--Canada--		
		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-		-----SARA 313-----	
	RQ	TPQ	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-
		261.33	8(d)	
Nitric Acid (7697-37-2)	1000	No	No	No
Water (7732-18-5)	No	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.)

MSDS Number: **S4037** * * * * * Effective Date: **08/02/01** * * * * * Supersedes: **08/20/98**

SODIUM HYDROXIDE SOLUTIONS (MORE THAN 10% NaOH)

1. Product Identification

Synonyms: Caustic soda solution; lye solution; sodium hydroxide liquid; sodium hydrate solution, Sodium Hydroxide Concentrate Solution StandARd®, Sodium Hydroxide, DILUT-IT® Analytical Concentrates, sodium hydroxide volumetric solutions

CAS No.: 1310-73-2

Molecular Weight: 40.00

Chemical Formula: NaOH in water

Product Codes:

J.T. Baker: 0337, 0338, 0339, 3719, 3725, 3727, 3729, 4689, 4690, 5000, 5661, 5666, 5668, 5669, 5671, 5672, 5674, 5676

Mallinckrodt: 6290, 7701, 7702, 7703, 7705, 7706, 7775, H369, H382, H385, V038, V679

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
-----	-----	-----	-----
Sodium Hydroxide	1310-73-2	10 - 60%	Yes
Water	7732-18-5	40 - 90%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 2 - Moderate

Contact Rating: 4 - Extreme (Corrosive)

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

Storage Color Code: White Stripe (Store Separately)

Potential Health Effects

Inhalation:

Severe irritant. Effects from inhalation of mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Severe pneumonitis may occur.

Ingestion:

Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result. Symptoms may include bleeding, vomiting, diarrhea, fall in blood pressure. Damage may appears days after exposure.

Skin Contact:

Corrosive! Contact with skin can cause irritation or severe burns and scarring with greater exposures.

Eye Contact:

Corrosive! Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.

Chronic Exposure:

Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

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

Ingestion:

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:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician, immediately. Wash clothing before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

Perform endoscopy in all cases of suspected sodium hydroxide ingestion. In cases of severe esophageal corrosion, the use of therapeutic doses of steroids should be considered. General supportive measures with continual monitoring of gas exchange, acid-base balance, electrolytes, and fluid intake are also required.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard. Hot or molten material can react violently with water.

Can react with certain metals, such as aluminum, to generate flammable hydrogen gas.

Explosion:

May cause fire and explosions when in contact with incompatible materials.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.

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. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Contain and recover liquid when possible. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal.

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 NEUTRACIT®-2 or BuCAIM® caustic neutralizers are recommended for spills of this product.

7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Store above 16C (60F) to prevent freezing. Always add the caustic to water while stirring; never the reverse. 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. Do not store with aluminum or magnesium. Do not mix with acids or organic materials.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

- OSHA Permissible Exposure Limit (PEL):

2 mg/m³ Ceiling

- ACGIH Threshold Limit Value (TLV):

2 mg/m³ Ceiling

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, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. 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-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect

workers in oxygen-deficient atmospheres.

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

Physical data is displayed for 10%, 30% and 50% aqueous sodium hydroxide solutions. (Merck Index).

Appearance:

Clear, colorless solution.

Odor:

Odorless.

Solubility:

Completely miscible with water.

Density:

10% solution - 1.11; 30% solution - 1.33; 50% solution - 1.53

pH:

14.0 (10%, 30% and 50% solutions)

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

No information found.

Boiling Point:

For 10% solution = 105C (221F); for 30% solution = 115C (239F); for 50% solution = 140C (284F).

Melting Point:

For 10% solution = -10C (14 F); for 30% solution = 1C (34F); for 50% solution = 12C (53.6F).

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

13 @ 60C (140F) (50% solution)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Sodium oxide. Decomposition by reaction with certain metals releases flammable and explosive hydrogen gas.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Sodium hydroxide in contact with acids and organic halogen compounds, especially trichloroethylene, may causes violent reactions. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, magnesium, tin, and zinc cause formation of flammable hydrogen gas. Sodium hydroxide, even in fairly dilute solution, reacts readily with various sugars to produce carbon monoxide. Precautions should be taken including monitoring the tank atmosphere for carbon monoxide to ensure safety of personnel before vessel entry.

Conditions to Avoid:

Heat, moisture, incompatibles.

11. Toxicological Information

Sodium hydroxide: irritation data: skin, rabbit: 500 mg/24H severe; eye rabbit: 50 ug/24H severe. Investigated as a mutagen.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Sodium Hydroxide (1310-73-2)	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: SODIUM HYDROXIDE SOLUTION

Hazard Class: 8

UN/NA: UN1824

Packing Group: II

Information reported for product/size: 360LB

International (Water, I.M.O.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLUTION

Hazard Class: 8

UN/NA: UN1824

Packing Group: II

Information reported for product/size: 360LB

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Sodium Hydroxide (1310-73-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	DSL	--Canada-- NDSL	Phil.
Sodium Hydroxide (1310-73-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302- RQ	TPQ	List	-SARA 313- Chemical Catg.
Sodium Hydroxide (1310-73-2)	No	No	No	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----				
Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)	
Sodium Hydroxide (1310-73-2)	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: 2R

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: 1

Label Hazard Warning:

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF

CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

Label Precautions:

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

Do not breathe mist.

Keep container closed.

Use only with adequate ventilation.

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. 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 inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

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

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety

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

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

ALCONOX®

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^(tm) 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® proprietary detergent mixture	No	No	None

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

-----	-----	-----	-----
Alconox®	No	No	No
proprietary detergent mixture			
-----\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.)