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# HEALTH AND SAFETY PLAN

## Time Critical Removal Indiana Battery Project Indianapolis, Marion County, Indiana

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Prepared for:



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Contract # EP-S4-16-03

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## 1. REVIEWS AND APPROVAL

**Contract No.:** EP-S4-16-03

**Date:** April 5, 2018

**Project Name:** Indiana Battery, Indianapolis, Marion County, Indiana

**EQM Project No.:** 030325.049

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	EQM Director of Quality Control	

OSC Approval:		
	Jason Sewell	Date
	On-Scene Coordinator (OSC)	
	U.S. Environmental Protection Agency, Region 5	

## 2. ACRONYMS AND SYMBOLS

§	Section	HAZWOPER	Hazardous Waste Operations and Emergency Response
ACGIH	American Conference of Governmental Industrial Hygienists	HR	Human Resources
AHA	Activity Hazard Analysis	HZ	Hot Zone
AIHA	American Industrial Hygiene Association	IAW	in accordance with
ANSI	American National Standards Institute	IDEM	Indiana Department of Environmental Management
APR	air purifying respirator	IPL	Indiana Power & Light
As	Arsenic	IDLH	Immediately Dangerous to Life and Health
BDA	Bayesian Decision Analysis	MCL	Maximum Concentration Level
C	Ceiling Limitation Value	NFPA	National Fire Protection Association
Ca	NIOSH Suspected Carcinogen	NIOSH	National Institute for Occupational Safety and Health
CFR	Code of Federal Regulations	OEL	Occupational Exposure Limit
CHMM	Certified Hazardous Materials Manager	OSC	On-Scene Coordinator
CI	confidence interval	OSHA	Occupational Safety and Health Administration
CIH	Certified Industrial Hygienist	OTM	OSHA's Technical Manual
CO	Contracting Officer	PAH	polycyclic aromatic hydrocarbons
CPR	Cardiopulmonary Resuscitation	Pb	Lead
CRZ	Contamination Reduction Zone	PEL	Permissible Exposure Limit
CSP	Certified Safety Professional	PFAS	personal fall arrest system
DoT	Department of Transportation	PM	Project/Program Manager
ECP	entry/exit control point	POL	corporate policy
EPA	Environmental Protection Agency	PPE	personal protective equipment
EQM	Environmental Quality Management, Inc.	REL	Recommended Exposure Level
ERRS	Emergency and Rapid Response Services	RM	Response Manager or Site Superintendent
EZ	Exclusion Zone	RML	EPA Removal Management Level
H&S	health and safety	SAR	Supplied Air Respirator
HASP	health and safety plan	SCBA	Self-Contained Breathing Apparatus
HAZCOM	Hazard Communication		

SDS	Safety Data Sheet	TSDF	Treatment, Storage & Disposal Facility
SEG	similar exposure group	UL	Underwriter Labs
SHSO	Site Health and Safety Officer	USACE	U.S. Army Corps of Engineers
SOP	Standard Operating Procedure	USEPA	U.S. Environmental Protection Agency
START	Superfund Technical Assistance and Response Team	WBGT	Wet Bulb Globe Temperature
SZ	Support Zone	WI	Work Instruction
TBD	To be determined		
TLV	Threshold Limit Value		

**Units of Measure**

dBa	decibels A-weighted
°	Degree(s)
F	Fahrenheit
hr	Hour
mg/kg	milligrams per kilogram
mg/m <sup>3</sup>	milligrams per cubic meter
ppm	parts per million
TWA	time weighted average

### 3. KEY PERSONNEL AND EMERGENCY CONTACT NUMBERS

The following sections contain contact information for those personnel and agencies affiliated with both general and contingency operations. This information should be posted in vehicles and on bulletin boards as necessary for emergency reference. Table 3-1 presents a list of key personnel.

#### 3.1 Key Personnel

**Table 3-1. Key Personnel**

Name	Co./Agency	Title	Phone #	Email
Jason Sewell	US Environmental Protection Agency (USEPA)	On Scene Coordinator (OSC)	317-517-6987	sewell.jason@epa.gov
Eric Bowman	EQM, Inc.	Program Manager (PM)	513-265-8875	ebowman@eqm.com
Gary Butcher	EQM, Inc.	RM /Site Health and Safety Officer (SHSO)	513-532-2120	gbutcher@eqm.com
John Kominsky CIH, CSP, CHMM	EQM, Inc.	Director of H&S	513-310-4473	jkominsky@eqm.com
David Arthur	EQM, Inc.	H&S Manager	513-742-7297	darthur@eqm.com
Lucas Stamps	TetraTech	START* Project Manager/Field Team Leader/SHSO	317-797-2420	lucas.stamps@tetrattech.com

\* Superfund Technical Assistance and Response Team (START)

#### 3.2 Emergency Contacts

The incident and emergency procedural steps are contained in Section 8, *Emergencies, Accidents, and Injuries*.

- Fire, Police/Sheriff, and Ambulance.....911
- EQM Medical Services – 1Source Case Management.....855-517-6872
- Occupational Clinic: MedCheck Speedway Occupational Health.....317-957-9000  
1011 Main St.,  
Speedway, IN 46224

- Hospital ER: IU Health Methodist Hospital Emergency Room.....317-528-5261  
1701 Senate Blvd.  
Indianapolis, IN 46206
- Chemical Trauma Facility: Same as above
- START Medical Services – Work Care (*Dr. P. Greaney*).....800-455-2114
- Directions from the EQM Field Office to the hospital are provided in Appendix F, *Maps*.  
The occupational health clinic is approximately 11 miles from this work location.

*(NOTE: Maps and directions to the hospital will be posted in the Command Post Office and in site vehicles.)*

### **3.2.1 Additional Emergency Numbers**

- National Response Center (24-hr).....800-424-8802
- Centers for Disease Control (24-hr).....770 488 7100
- ATF (Explosives Hotline) (24-hr).....888 283 2662
- Chemtrec (24-hr).....800 262 8200
- Poison Control Center (24-hr).....800-222-1222

### **3.2.2 Excavation Numbers and Contacts**

- National “Call Before You Dig”.....811

### **3.2.3 Environmental Quality Management, Inc. Contacts**

- EQM Project Office.....812-422-4440
- EQM Hotline (24-hr).....800-500-0575

### **3.2.4 START Contacts**

- START Safety Manager – Chris Draper.....615-969-1334
- Monitoring Technician – Lucas Stamps.....317-797-2420

## **4. INTRODUCTION AND SITE ENTRY REQUIREMENTS**

### **4.1 Introduction**

This document describes the health and safety (H&S) guidelines developed to protect on-site personnel from physical harm and exposure to hazardous materials or wastes. The procedures and guidelines contained herein are based on the best available information at the time the plan was prepared. As new information arises, revise the plan to address those specific requirements or conditions that change. To document these changes, use written amendments including those in Appendix A – H&S Plan Amendments.

### **4.2 Site Location & History**

The site is located at 1302 South Bedford Street in Indianapolis, Marion County, Indiana. The geographic coordinates at the center of the site are 39.747600° north latitude and 86.205175° west longitude. The site consists of the 1.44-acre parcel located at 1302 South Bedford Street and approximately 10 acres of city-owned property that includes portions of Eagle Creek and a flood control levee east of the creek.

The site is bordered to the south and the west by additional portions of Eagle Creek and the city-owned flood control levee. The city has begun construction on a multi-use walking path along the crest of the levee, which also runs through the site. To the north lie industrial and commercial properties, with residential areas across West Morris Street within 0.25 mile. To the east lie industrial and commercial properties, with residential areas along South Pershing Avenue within 0.25 miles.

According to EPA, the property at 1302 South Bedford Street was operated by Indiana Battery Company from approximately 1962 until 2008. The site is currently owned by B1 Properties, LLC, and occupied by a pallet company and a fencing installation and service company. Three small commercial/industrial buildings are located on the property.

On August 3, 2015, Environmental Protection Agency (EPA) received an anonymous complaint that “truckloads” of batteries had been buried at the site for an unknown number of years. The EPA On-Scene Coordinator (OSC) visited the site and found that Indianapolis Power

and Light (IPL) had recently discovered battery waste buried on the north adjacent property (2749 West Morris Street), which the utility had recently purchased. At that time, IPL was conducting its own site assessment and removal action. The OSC received a Final Excavation Report from IPL that described the assessment and removal action conducted at the property.

Based on the findings of IPL's investigation and removal, the Tetra Tech Superfund Technical Assessment and Response Team (START) and EPA conducted an assessment during three separate sampling events from September 2015 to December 2016. As part of the assessment, Tetra Tech START collected 85 soil samples, 16 groundwater samples, and 52 sediment samples. Analytical results revealed lead impacts that exceeded the EPA Removal Management Level (RML) for industrial soils of 800 milligrams per kilogram (mg/kg) and the Indiana Department of Environmental Management (IDEM) Recreational Soil Direct Contact Screening Level for Trails of 800 mg/kg (Tetra Tech 2016a, 2016b, and 2017a). A time-critical removal action was planned at the site for the spring of 2018, which includes surface soils removal in the areas where lead was detected above the RML.

### **4.3 Scope and Purpose**

This Health and Safety Plan (HASP) establishes the framework to safely achieve the performance objectives and standards for the remedial activities at this site. The objective of this project is to alleviate the human health risk posed by abandoned chemicals, contaminated soils, and/or other hazardous materials by properly manifesting and disposing of all excavated material, collected containers, and general demolition debris in accordance with (IAW) all local, state, and federal regulatory guidelines.

The plan addresses the requirements of Occupational Safety and Health Administration (OSHA) Standard 29 CFR §1910.120(b)(4), *Site-Specific Safety and Health Plan*, and the U.S. Army Corps of Engineers' (USACE) EM 385-1-1, *USACE Safety and Health Requirements Manual*. It outlines the work practices and procedures implemented on site to minimize worker contact with hazardous materials and to reduce the possibility of physical injury. This entails performing all work in accordance with applicable Code of Federal Regulation (CFR), Title 29, Sections (§) 1910 and 1926, specifically 29 CFR §1910.120, *Hazardous Waste Operations and Emergency Response* (HAZWOPER).

Although visitors and the public are not of consideration to OSHA, they are a concern of EQM and our clients. Therefore, information regarding public safety was added herein for that purpose.

Specific site activities will consist of the following:

- Plan Preparation/Procurement
- Mobilization
- Site Preparation
- Excavate contaminated soils into dump trucks
- Transport of all contaminated soils to the Appropriate Treatment Storage and Disposal Facility (TSDF)
- Demobilization

#### **4.4 EQM Health and Safety Policy**

Environmental Quality Management, Inc. (EQM) uses its POL 300 – EQM, Health and Safety Policy, as the basis for our H&S program, which is applicable to all EQM employees, consultants, and subcontractors on this project. Simply stated, EQM’s H&S policy is to never knowingly undergo an operation or activity where the exposure risk presents a clear and present danger to employees.

#### **4.5 Daily Safety Meetings**

The RM, or his designee, will hold daily safety meetings on site at the start of each shift to ensure that all personnel understand site conditions and operating procedures, to ensure correct Personal Protective Equipment (PPE) use, and to address worker health and safety concerns. Discuss new activities in detail to include a review of Activity Hazard Analyses (AHAs), as appropriate.

#### **4.6 Safety Recognition**

The purpose is to increase safety awareness and to promote “All-In” participation in safe practices. To accomplish this, there will be a project-specific safety incentive program that includes all EQM employees working at the Site. It will consist of the following three-pronged approach:

- A Safety Improvement/Awareness Plan which includes identifying “Near Miss” incidents where the workers are involved directly.
- Monthly Safety Progress Meetings where recognition is provided during a slightly extended Tailgate Safety Meeting.
- Identifying and recognizing field staff members monthly that demonstrate outstanding adherence to safety policies and/or otherwise promote the safety culture by reporting near-miss incidents, offering suggestions for procedural improvements, and/or by conducting effective safety inspections.

#### **4.7 Site Health and Safety Plan Acceptance/Acknowledgment**

The RM is responsible for informing all individuals entering the Exclusion Zone (EZ) of the contents of this plan and ensuring that each person signs the HASP Acknowledgment Form. By signing the HASP Acknowledgment Form, an individual acknowledges he/she recognizes the potential hazards present on site and the policies and procedures required to minimize exposure or adverse effects of these hazards.

## **5. HEALTH AND SAFETY ORGANIZATION**

### **5.1 Roles and Responsibilities**

Three entities are working together to accomplish the project: EQM, USEPA, and a START contractor. Their roles and responsibilities are as follows.

#### **5.1.1 On-Scene Coordinator**

The OSC, as the representative of the Federal Government, is responsible for overall project administration, coordinating health and safety standards for all individuals on site at all times, and ensuring all parties are applying the applicable federal (OSHA standards) and contractor's health and safety guidelines and requirements. The OSC is the overall SHSO and is responsible for the health and safety of onsite visitors. Contractors (as individual employers under OSHA), however, are also responsible for their own employees' health and safety. If a dispute arises with regard to health and safety, attempt to resolve the issue directly on site. If the issue cannot be resolved, consult off-site health and safety personnel for assistance. In the interim, discontinue the specific task or operation in dispute until the issue is resolved.

The OSC may designate an alternate individual to act in his stead; for this document, however, any reference to the OSC will refer to either the OSC or his designee.

#### **5.1.2 Response Manager**

The RM, as the field representative and OSHA Competent Person for EQM and Emergency and Rapid Response Services (ERRS) cleanup contractor, has the responsibility for fulfilling the terms of the EPA Task Order. The RM must oversee the project and ensure that all technical, regulatory, and safety requirements are met. It is the RM's responsibility to communicate with the OSC as frequently as dictated by the OSC, but at least daily, regarding the project's progress and any problems encountered.

### 5.1.3 Superfund Technical Assessment and Response Team

The START contractor is responsible for providing technical, regulatory, and safety assistance to the OSC for all aspects of the site activity. The START contractor is also available to advise the OSC on matters relating to hazardous materials and waste sampling, treatment, packaging, labeling, compatibility, transport, and disposal, but is not limited to the above mentioned.

### 5.1.4 Site Health and Safety Officer (SHSO)

ERRS and START SHSOs are assigned on a full-time basis with functional responsibility to implement the Health and Safety Plan as it applies to ERRS and START personnel. Typically, the RM is designated as the ERRS SHSO. The START Site Lead is the designated START SHSO, unless otherwise appointed. The ERRS Director of Health & Safety, START personnel, and/or the USEPA may conduct site audits as approved by the OSC.

The SHSO's specific duties include:

- Assuming responsibility for the health and safety of ERRS and/or START personnel.
- Documenting health and safety problems.
- Overseeing personnel and equipment decontamination.
- Conducting personal air monitoring on all ERRS and/or START employees as outlined in 29 CFR §1910.120(h)(4).
- Selecting PPE levels based on the chemical properties, route(s) of exposure, and air sampling results based on the specific site contaminants and atmospheres.
- Ensuring all ERRS and/or START personnel are fit for duty based on medical surveillance reports and personal observations.
- Inspecting first-aid kits, fire extinguishers, and equipment, as necessary and before use.
- Updating the HASP to reflect changes in site conditions or the scope of work. (*NOTE: HASP updates must be reviewed and approved before being implemented.*)
- Inspecting the site for HASP compliance.
- Working with the EQM RM and OSC to develop and implement corrective action plans to correct deficiencies discovered during site inspections.
- Determining emergency evacuation routes, posting local emergency telephone numbers, and arranging for emergency transportation, should the need arise.
- Ensuring that all site personnel and visitors have the proper training and medical clearance prior to entering the site.

- Establishing any necessary controlled work areas (as designated in this HASP or other safety documentation).
- Initiating tailgate safety meetings and maintaining attendance logs and records.

## 6. HEALTH AND SAFETY HAZARDS

This section details the chemical, physical, biological, and task-specific hazards posed to site personnel during planned project activities. Prior to each day's field activities, the RM/SHSO will conduct a daily tailgate safety briefing at the beginning of each shift. Discuss the potential chemical, physical, and biological hazards and preventive safety measures at these briefings.

EQM has developed detailed AHA for each definable work element. These AHAs identify the hazards anticipated during the project, along with related control measures to minimize or eliminate them. Use these to augment the daily safety meetings to heighten safety and hazard awareness. Appendix B contains the various EQM health and safety Standard Operating Procedures (SOPs) that relate to this project. Copies of these AHAs are presented in Appendix C. Appendix H presents START-specific information, including safe work practices, policies and procedures, forms, additional AHAs, and safety data sheets

### 6.1 Chemical Hazards

This section relates to the chemical hazards encountered during materials removal. Manage them in accordance with the HAZCOM Standard (29 CFR 1910.1200) and the EQM HAZCOM Program.

Appendices D and E contain basic chemical exposure and avoidance information, along with the Safety Data Sheets (SDSs) for the materials brought onsite, and for the project waste which includes the following as indicated in the table below:

**Table 6-1 - Threshold Values By Contaminant**

SUBSTANCE	OSHA PEL	IDLH
	NIOS REL	Notes
Arsenic	TWA 0.010 mg/m <sup>3</sup>	Ca 5 mg/m <sup>3</sup> (as As)
	Ca C 0.002 mg/m <sup>3</sup> [15-minute]	Inorganic as As
Lead	TWA 0.050 mg/m <sup>3</sup>	100 mg/m <sup>3</sup> (as Pb)
	TWA (8-hour) 0.050 mg/m <sup>3</sup>	PEL/REL is for all Pb compounds

Index: A ceiling REL is designated by "C" preceding the value; unless noted otherwise, the ceiling value should not be exceeded at any time. Any substance that NIOSH considers to be a potential occupational carcinogen is designated by the notation "Ca"

The list above should not be taken as a complete hazard assessment posed by the materials on site. Remedial operations includes using hazardous materials, e.g.; fuels, decontamination chemicals, hydraulic fluid, detergents, etc. Though not listed specifically there are SDS located in Attachment E for each of the materials brought onsite. Therefore, always be alert for the signs and symptoms that may indicate possible exposure, such as:

- Unusual smells
- Stinging or burning eyes, nose, or throat
- Skin irritation
- Mood changes such as euphoria or depression
- Sleepiness or tiredness

Report any symptoms immediately to the RM/SHSO.

## **6.2 Physical Hazards**

Numerous potential hazards are associated with this and any project that, if not identified and addressed, could lead to accidents and personal injury. To minimize physical hazards, EQM has developed a set of Corporate Policies (POL), SOPs, and Work Instructions (WI) that provide the basic safety and health requirements for remedial work. Workers must always follow these safety protocols. Failure to follow them, or continued negligence of the company's work policies, may result in disciplinary actions up to and including expulsion from the site.

### **6.2.1 General Site Hazards**

The RM/SHSO will observe the general work practices of each site worker and enforce safe procedures to minimize safety hazards. The following sections discuss additional safety hazard considerations that may occur at this site, along with relevant hazard control procedures, beyond what is covered in the referenced SOPs.

#### **Utilities**

Overhead power lines, downed electrical wires, and buried cables all pose a danger of shock or electrocution if workers contact or sever them during site operations. Workers must use extreme caution when moving or operating equipment near overhead power lines. Always assume that downed or buried cables are energized, unless proven otherwise, and lock them out appropriately before beginning operations.

Obtain a utility clearance no less than two (2) full working days prior to starting intrusive operations and obtain authorization from all concerned public utility department offices. There are two ways to report in Indiana. The first is to call 811 and report over the phone. The other is to go to [www.811now.com](http://www.811now.com) or [www.indiana811.org](http://www.indiana811.org) to request a dig ticket. The first address will only allow for a single address, whereas, the latter will allow entering multiple addresses under the same ticket.

After contacting Indiana 811, they will assign an Excavator Identification number that will be specific to EQM. It is meant to assist you when calling in locate requests to Indiana 811. Ensure the following information is readily available:

- Street Address(es)
- Intersecting Streets/Roads
- Distance from Intersections
- Direction (If trenching)
- Extent of Work from Front/Rear/Both Sides
- Date of Excavation
- Start Time of Excavation
- Type of Work
- Caller's Name
- Contact Number
- Contractor Name
- Fax Number
- Contact Person/Additional Information
- Ticket Number Provided by Indiana 811

After giving all the appropriate information to Indiana 811, the operator will read all information back. Listen carefully and verify its accuracy. They will then provide a list of member utilities that Indiana 811 notifies. The operator will then indicate when the locate ticket expires, along with a reference number that is proof of the call. Record the number and keep it for the duration of the excavation or longer when applicable. (NOTE: Ensure the application involves multiple addresses, or the ticket number may not cover a broad enough area to cover the affected property/properties. Next, the area to be located must be accessible to the member companies. Not all Indiana 811 members utilize a contract locator, so there may be several companies that respond to the locate request.

Within two full working days after contacting Indiana 811, member facility operators with underground facilities at or near the excavation site will mark the approximate location of those facilities with color-coded paint or flags. Some notified member companies may clear the

ticket by telephone or electronic communications. There may also be marks that designate an “all clear,” meaning no buried facilities are present in the dig area for that utility. Marks may be confusing, so if there are any questions, contact the utility directly.

Rain, snow, lawn mowing, traffic or other activities may cause the marks to fade or disappear. Should this occur, notify Indiana 811 immediately and have the reference number ready to request a remark. An additional notice of two full working days is required for the remark, so plan accordingly.

Once the utilities have been located and Pot Holed, use day-lighted hand digging to further clear utility lines through excavations. Indiana state law requires hand excavation when working within the “Tolerance Zone”, which is an area along each side of a marked utility to a width of 24 inches. Mechanized equipment is prohibited within the Tolerance Zone!

Should equipment contact utility lines during intrusive operations, as soon as any damage is discovered, including gouges, dents or breaks to coating, cable sheathes, and cathodic protection anodes or wiring, notify the RM/SHSO immediately and suspend work. The RM/SHSO will then report the type and location of the damage to the USEPA and the appropriate utility to make necessary repairs. EQM’s policy is to immediately remove any operator from the project who violates this protocol. (Note: EQM’s Zero Tolerance Policy applies.)

## **Confined Spaces**

There are no Confined Spaces associated with this project. If site changes make confined spaces necessary, however, address these spaces according to SOP 314 *Confined Spaces*.

### **6.2.2 Specific Site Hazards**

Table 6-2 indicates typical hazardous conditions that workers may encounter on site. These issues are addressed in each of the documents referenced below. These documents are contained in Appendix B.

**Table 6-2. Specific POL, SOP, and WI Applicability**

EQM SOPs Site Specific Hazards	POL 300	SOP 301	SOP 303	SOP 309	SOP 315	SOP 316	SOP 318	SOP 326	SOP 328	SOP 329	SOP 344	SOP 344	SOP 347
Electrical Lines and/or Equipment					X						X	X	
Elevated Noise Levels				X									
Excavations					X	X		X					
Fire Prevention and Protection										X			
Flammable and Combustible Liquids			X										
Hazard Communication		X											
Hazard Testing and Delineation													
Lifting Heavy Objects													X
Powered Tools, Including Hand Tools									X				
Slips, Trips, and Falls	X												
Working Around Heavy Equipment						X		X					
Working Around Utilities					X						X	X	
Working in Adverse Weather							X						

Publications Index:

- EQM POL 300 *Incident Prevention Plan*
- EQM SOP 301 *Hazard Communication Program*
- EQM SOP 303 *Flammable Combustible Liquid Transfer*
- EQM SOP 309 *Hearing Conservation Program*.
- EQM SOP 311 *Personal Protection Equipment*
- EQM SOP 315 *Electrical Safety*
- EQM SOP 316 *Excavation and Trenching*
- EQM SOP 318 *Cold-Heat Stress*
- EQM SOP 326 *Working Around Heavy Equipment and Machinery Excavators and Loaders*
- EQM SOP 329 *Fire Prevention and Protection*
- EQM SOP 332 *Respiratory Protection*
- EQM SOP 344 *Use of a Live Line Telescoping Tool*
- EQM SOP 347 *Manual Lifting*

### 6.3 Biological Hazards

Biological hazards present a unique obstacle to personnel working in environments that contain biological hazards or performing operations involving bio-hazardous materials. Protection must be identified and provided when biological hazards are anticipated. Contact with bodies of water, animals, insects, and plants can cause injury and illness to personnel. Care must be taken to ensure that these types of injuries are avoided. Some examples of biological hazards that may be encountered at the site, although such encounters are not anticipated to pose a significant risk to site personnel, include:

- Water – Natural and artificial bodies of water (e.g., ponds, streams, lagoons, etc.) may contain a variety of microorganisms, many of which are hazardous, or at a minimum may cause infection. Contacting these microorganisms may present a significant hazard of dermatitis, infection (e.g., through cuts or lacerations), digestive distress, and other diseases. Always be aware of areas that may contain contaminated water (e.g., cooling tower effluents, or any standing or discolored puddles, etc.) and areas downstream of municipal wastewater treatment. To prevent exposure to these microorganisms, always wear protective gloves (e.g., latex, nitrile, etc.) and other appropriate PPE to prevent skin contact with water.
- Animals – When encountering wild animals such as snakes, bats, raccoons, squirrels, and rats, avoidance is the best course of action. These animals not only can bite and scratch, but some can carry transmittable diseases (e.g., rabies). Even domesticated animals can be an issue, either by size, temperament, or disease. Therefore, avoid contacting or cornering any animals whenever possible. If bitten, scratched, or trampled, notify your supervisor immediately and seek medical attention. Also avoid dead animal carcasses, as they generally carry disease and infectious substances. Animal carcasses can harbor the disease that killed the animal, which could be toxic or infectious to humans as well.
- Insects – Insects such as mosquitoes, ticks, bees, and wasps can cause injury through either direct contact or through the diseases they carry. Whenever you enter areas that provide an insect habitat (e.g., tall grass, brush, or woods), wear light-colored clothing, long pants, and a long-sleeve shirt, and apply a repellent that contains DEET to exposed skin and clothing. Use such sprays or lotions sparingly, and always follow manufacturer's instructions. In general, keep away from high grass wherever possible, and keep your eyes and ears open for insect nests. If bitten, seek medical attention if symptoms appear or there is any question of a serious allergic reaction. Current infectious disease and outbreak data may be found at HealthMap ([www.healthmap.org/en](http://www.healthmap.org/en)). In particular:
  - Although a mosquito bite generally causes brief skin irritation, it can also potentially carry and transmit serious diseases such as the West Nile Virus, a disease that causes forms of encephalitis or meningitis, or malaria, which is generally found in tropical climates.
  - A tick bite, on its own, is harmless. Like mosquitos, however, the tick itself can carry such diseases as Lyme Disease or Rocky Mountain spotted fever (RMSF). Remove ticks promptly and carefully using tweezers to grasp the tick near its head or mouth and pulling gently to remove the whole tick without crushing it. Use soap and water to wash your hands and the area around the tick bite after handling it. Seek medical attention if you are unable to completely remove it; if possible, seal the tick in a jar, since a physician may want to see it for further diagnosis. If signs or symptoms (e.g., rash, fever, stiff neck, muscle aches, joint pain and inflammation, swollen lymph nodes, and/or flu-like symptoms) develop, immediate medical attention may be necessary to keep from further injury.
  - Bees and wasps can inject venom when they sting, which causes some individuals to experience anaphylactic shock (extreme allergic reaction). In certain areas of the country, Africanized bees are a particular menace, and multiple stings can be extremely toxic, even potentially fatal.

- A number of spiders have venom that is toxic to humans. You will usually notice a spider bite directly. However, that doesn't mean the full impact of the bite will be immediate. The toxin from a brown recluse, for example, will take weeks or months to completely work through your system, and the impact of the bite could result in losing large areas of skin or even fingers or limbs. Therefore, take spider bites very seriously and report the incident to your supervisor immediately to receive a medical evaluation.
- Plants such as nettles, poison ivy, and poison oak can cause rashes on exposed skin. Be careful where you walk, wear long pants and a long-sleeve shirt, and minimize touching exposed skin with your hands after walking through thickly vegetated areas until after you have thoroughly washed your hands with soap and water.

One final consideration is that biological hazards don't just exist in rural or isolated environments. Urban areas also provide plenty of habitats for all of the considerations above.

## 6.4 Exposure Monitoring

Depending on the project's scope, along with the nature and form of contaminants, assess the degree of hazard exposure to determine if they require assessment through personal and/or area monitoring. Primarily, this involves onsite sampling to determine the various hazard parameters (e.g., airborne contaminant concentrations and heat stress effects). In some instances, however, it may be necessary to supplement these methods with more sophisticated monitoring techniques. Should the latter be the case, ensure the additional requirements are listed in Table 6-2 by contaminant.

### 6.4.1 General Air Monitoring Action Levels

The air monitoring values for each chemical hazard are addressed in the National Institute of Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards. According to 29 CFR §1910.120, use air monitoring as a primary means toward identifying and quantifying airborne hazardous substances and health hazards, and to determine the appropriate employee protection level(s). Table 6-3 provides a summary of air monitoring requirements for personnel protection during site activities. Additional details regarding personnel monitoring are presented in the next section.

**Table 6-3. Detailed Air Monitoring Summary**

Contaminant	Instrument	Frequency	Action Level/Comment
Nuisance	MiniRam	Periodic during	• < 2.0 mg/m <sup>3</sup> - No Action

Particulates (Total)	(or equivalent)	soil handling	<ul style="list-style-type: none"> <li>• &gt; 2.5 mg/m<sup>3</sup> - Stop excavation activities, reassess engineering controls, and possibly upgrade PPE to incorporate respiratory protection.</li> </ul>
Arsenic	NIOSH Method 7300	Personnel will be monitored, worst-case scenario, to be representative of each work task.	<ul style="list-style-type: none"> <li>• &lt; 0.005 mg/m<sup>3</sup> - No Action</li> <li>• &gt; 0.005 mg/m<sup>3</sup> - Implement engineering controls and respiratory protection as necessary. <i>(See comment below.)</i>*</li> </ul>
Lead	NIOSH Method 7300	Personnel will be monitored, worst-case scenario, to be representative of each work task.	<ul style="list-style-type: none"> <li>• &lt; 0.03 mg/m<sup>3</sup> - No Action</li> <li>• &gt; 0.03 mg/m<sup>3</sup> - Implement engineering controls and respiratory protection as necessary. <i>(See comment below.)</i>*</li> </ul>

\* Conduct sampling for the first 3 full shifts to assess exposure and sample analysis performed on a same-day 24-hr TAT.

## 6.4.2 Personal Air Monitoring

Base the personal air monitoring strategy for this project on the following Bayesian Analysis. The lead in soil analyses were analyzed to determine the likelihood of an overexposure to inorganic lead above the OSHA Permissible Exposure Limit (50 µg/m<sup>3</sup>) during soil disturbance activities.

The approach included calculating robust descriptive statistics for the data to estimate the hypothetical air level of lead (µg/m<sup>3</sup>) based on a maximum air concentration of total particulate (Table 1). These calculations show that based on the soil containing 8.69% lead (95<sup>th</sup> percentile concentration) a total particulate air concentration of 250 µg/m<sup>3</sup> and 500 µg/m<sup>3</sup> would potentially contain a lead concentration of ≈22 µg/m<sup>3</sup> and ≈44 µg/m<sup>3</sup>, respectively.

**Table 1 - Descriptive Statistics and Maximum Hypothetical Air Level of Lead in Particulate**

Descriptive Statistic (N = 20)	Lead in Soil, mg/kg	Lead in Soil, % by wt.	Projected Lead Air Level (µg/m <sup>3</sup> ) based Maximum Air Level of Total Particulate	
			250 µg/m <sup>3</sup>	500 µg/m <sup>3</sup>
95 <sup>th</sup> Percentile	86,900	8.69	21.73	43.45
75 <sup>th</sup> Percentile	23,900	2.39	5.98	11.97

50 <sup>th</sup> Percentile	700	0.070	0.18	0.35
Mean	15,400	1.54	3.85	7.69
Mean + 95 <sup>th</sup> CI	28,000	2.80	7.00	14.00
		<b>PEL</b>	<b>50</b>	

Bayesian Decision Analysis (BDA) was applied to the descriptive statistics (Table 1) to estimate the probability that the true exposure profile falls into an Exposure Rating defined by the AIHA Exposure Banding Model (Table 2).<sup>1</sup>

**Table 2. AIHA (2013) Occupational Exposure Limit (OEL) Banding Model.**

Exposure Rating Category		Cutoff (% OEL) <sup>a</sup>
	1	$X_{0.95} \leq 10\%$
	2	$10\% < X_{0.95} \leq 50\%$
	3	$50\% < X_{0.95} \leq 100\%$
	4	$X_{0.95} > 100\%$

<sup>a</sup> The sample 95<sup>th</sup> percentile is considered the “decision criteria.”

Using the data in Table 1, Bayesian Decision Analysis provides the following Likelihood Decision Charts (Figures 1 and 2). The decision charts summarize the information from both the likely Exposure Rating and the uncertainty in that rating. The latter is driven by variability in the exposure data. The Bayesian Decision Analysis is based on an occupational exposure limit (OEL) for inorganic lead of 50 µg/m<sup>3</sup>; i.e., the OSHA PEL.

Figure 1 indicates that the exposure profile is likely (≈80%) a Category 2 (i.e., 95<sup>th</sup> percentile ≤ 50% of OEL) exposure, but there is still a 17% likelihood that the 95<sup>th</sup> percentile is a Category 3, and ≈2% likelihood it is a Category 4.

<sup>1</sup> AIHA. A Strategy for Assessing and Managing Occupational Exposures. 4<sup>th</sup>. Ed. American Industrial Hygiene Association, 2015.

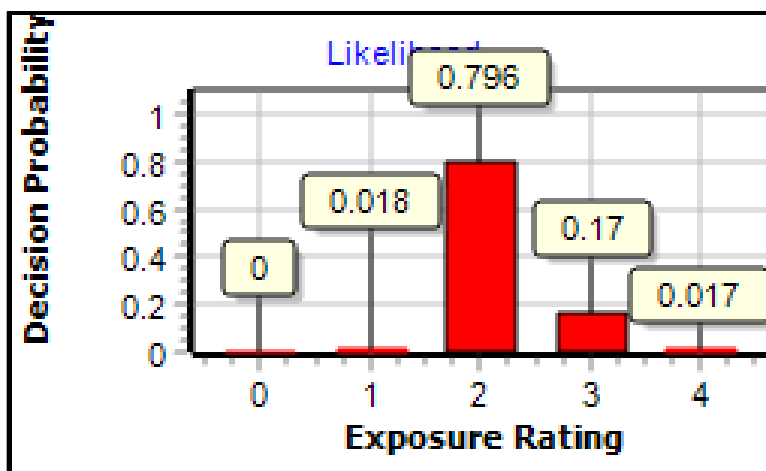


Figure 1. Lead Exposure Likelihood Decision Chart based on total particulate level of 250  $\mu\text{g}/\text{m}^3$ .

Figure 2 indicates that the exposure profile is likely ( $\approx 36\%$ ) a Category 2 (i.e., 95<sup>th</sup> percentile  $\leq 50\%$  of OEL) exposure, an  $\approx 46\%$  likelihood that the 95<sup>th</sup> percentile is a Category 3, and  $\approx 18\%$  likelihood it is a Category 4.

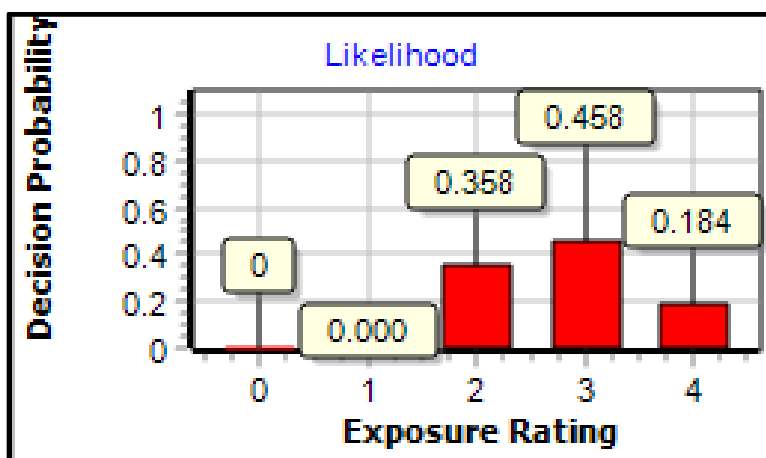


Figure 2. Lead Exposure Likelihood Decision Chart based on total particulate level of 500  $\mu\text{g}/\text{m}^3$ .

Based on this analysis it appears that if a worker's personal breathing zone exposure to total airborne particulate is maintained at or below 250  $\mu\text{g}/\text{m}^3$  it is not likely that the worker's exposure would numerically exceed the OSHA PEL; i.e.,  $<2\%$  likelihood (Figure 1). Whereas, if a worker's personal breathing zone exposure to total airborne particulate is maintained at or below 500  $\mu\text{g}/\text{m}^3$  there is an  $\approx 18\%$  likelihood that the exposure would numerically exceed the OSHA PEL. It should be noted that these probabilities are based on comparison of absolute values to an OSHA PEL, which is an 8-hour time weighted average (TWA). That is, a time-

weighted average exposure implies that concentrations will be both above and below the average value during the work shift. Hence, a concentration of 500  $\mu\text{g}/\text{m}^3$  of total particulate can be numerically exceeded without exceeding the OSHA PEL, depending on the frequency and duration of exceedances over the work shift.

Prudence suggests that a projected exposure scenario be verified by actual personal breathing zone sampling over two to three consecutive days. Each day of samples should be analyzed and analyses reported <24 hours from time of sample collection. The need for PPE (i.e., respiratory protection) should be adjusted accordingly.

When air sampling is required, EQM will use appropriate NIOSH or OSHA analytical methods, and will complete the analyses at an AIHA-accredited laboratory to ensure the results are within the quality assurance limits the standard(s) require(s). Within five business days after receiving the results from the lab, the SHSO or RM will inform each sampled employee of his test results, and both the SHSO/RM and the employee will sign an acknowledgement form to indicate the employee has obtained and understands the results. Once the process is complete, forward the signed form to the Corporate Human Resources Director (HR) to place it in the employee's personnel file. All other site employees will be notified of the results, minus the names, that are below the action limit or PEL. Document the correction actions for any results above the action limit, and then communicated the corrections to the site employees.

### **6.4.3 Monitoring Noise Exposure**

Excessive noise exposure is not anticipated during planned activities due to the duration of exposure and because of sound control measures (e.g., enclosed-cab equipment). However, the EQM SHSO will periodically perform general screening to ensure personnel remain below the exposure threshold during routine activities. For non-routine activities involving powered equipment, also monitor the sound environment to ensure that using ear plugs/muffs for noise attenuation, which is required for working around heavy equipment, is adequate, as noted in EQM SOP 309 *Hearing Conservation Program*. If any activity or equipment results in exposure outside of normal project expectations, the RM/SHSO will re-evaluate the exposure to ensure workers are protected by adjusting the hearing protection equipment and practices on site.

### **6.4.4 Heat/Cold Stress Monitoring**

Begin heat stress monitoring when ambient temperatures exceed 70°F. Conduct heat stress monitoring for personnel working in permeable clothing (e.g., normal work cloths, single launderable cloth, or single disposable Tyvek), semi-permeable clothing (e.g., double launderable cloth, double disposable Tyvek, or single poly-coated Tyvek), and impermeable clothing (e.g., triple launderable cloth, triple disposable Tyvek, or single Saranex coated Tyvek) in accordance with the ACGIH TLVs for heat stress. The SHSO is responsible to verify the work/rest schedules; determine Wet Bulb Globe Temperatures (WBGT) using a black globe thermometer, a natural wet bulb thermometer, and a dry bulb thermometer (or WBGT monitor); document the results; and then notify the workers. In addition, the SHSO may use OSHA's Smartphone App (*OSHA Heat Safety Tool* for Android and iPhone) in place of the aforementioned instruments for calculating and evaluating the conditions for conduciveness to a heat-related injury.

Begin cold stress monitoring when temperatures fall below 40°F. Conduct cold stress monitoring in accordance with the ACGIH TLV for cold stress on personnel working in permeable clothing such as cotton or synthetic work clothes. The SHSO is responsible to verify the work/rest schedules, and to notify workers of, and document, the results.

#### **6.4.5 Calibration Procedures**

Calibrate all direct-reading instruments that are used on site at the beginning and end of each work shift in accordance with the manufacturer's recommendations. If the owner's manual is not available, contact the applicable office representative, rental agency, or manufacturer for technical guidance on proper calibration. If equipment cannot be pre-calibrated to the proper specifications, postpone or temporarily cease site operations that require exposure monitoring or off-site contaminant migration until this requirement is completed.

Calibrate personal sampling pumps during pre- and post-shift sampling by using a calibrated primary calibration standard or flowmeter calibrated against a primary flow standard at the lab.

#### **6.4.6 Monitoring Technician**

Name the Monitoring Technician in Paragraph 3.2.4, START Contacts.

### **6.4.7 Maintaining Monitoring Records**

Retain copies of the monitoring records in EQM's onsite office during the project, and in the job file upon its completion. Monitoring records will include, but are not necessarily limited to, all of the following:

- Name of the person sampled
- Task(s) performed during monitoring
- Exposure levels during sampling
- Sample number
- Pre-and post-sampling calibration flowrates
- Start and stop times
- PPE worn by the employee during sampling

Each sampled employee's personnel file will contain his sampling results. These files will be kept within the Corporate HR department in Cincinnati, Ohio.

## **6.5 Personal Protective Equipment (PPE) Selection**

There are four PPE levels: A, B, C, and D. Each relates to a specific level of isolation necessary to keep the worker under the OSHA PEL for various contaminants. As a rule, PPE does not keep a worker completely isolated from hazards, but only reduces the contaminant level to an acceptable amount. Therefore, always take the individual worker's personal physiology into consideration prior to making work assignments or issuing protective gear. The various levels are discussed as follows, from least restrictive to the most.

Note that the PPE discussed in this section relates to industrial chemical environments and does not equate to that which is used for military nuclear, biological, or chemical contaminants. If tasked to work in those areas, choose appropriate PPE as indicated within the section.

### **6.5.1 Level D (Includes Modification)**

Use of Level D is anticipated at this site. This level of protection affords only minimal isolation from dust over most of the body but does not provide much of an increase for respiratory protection beyond mild particulates, which generally includes a dust mask. Level D may not be worn in low-oxygen environments. It will be used during the majority of the planned

project activities. The AHAs will identify the major tasks requiring Level D protection. Level D may be modified to afford a slightly increased protection level.

Use Level D protection when:

- The atmosphere contains no known respiratory hazard.
- Work functions preclude splashes, immersion, or the potential for unexpected inhalation of, or contact with, hazardous concentrations of harmful chemicals.

At a minimum, Level D PPE shall consist of:

- Coveralls or Work Clothes
- Safety Shoes/Boots with Steel-toe/Steel-shank
- Work Gloves – Cotton or Leather Palm
- Safety Glasses
- Class 2 or better high-visibility safety vest
- A Hard Hat

#### **Level D (Modified)**

Level D (Modified) protection may be required during some of the planned project activities but may not be used in a low-oxygen environment. The AHAs will identify major tasks requiring Level D (Modified) protection. Each of the following items may be included outright or substituted for similar items above:

- Chemical Splash Shield and/or Chemical Goggles
- Chemical-Resistant Clothing (coveralls and long-sleeved jacket, coveralls, one- or two-piece chemical-splash suit, disposable chemical-resistant overalls)
- Chemical-Resistant Over-Boots or Chemical-Resistant Steel-toe/Steel-shank Boots
- Boot Covers
- Chemical-Resistant Inner Gloves (e.g., surgical nitrile)
- Chemical-Resistant Outer Gloves (Appropriate gloves for the hazard will be identified as required)
- Class 2 or better high-visibility safety vest
- Safety Glasses/Goggles/Face Shield
- Hearing Protection

#### **6.5.2 Level C**

Use of Level C protection is not anticipated at this site. This level of protection affords isolation from liquid splashes and solid contaminants over most of the body and provides a heightened level of respiratory protection. It allows workers to work in atmospheres containing some chemical vapors and particulates using an Air Purifying Respirator (APR). Because Air

Purifying Respirators (APRs) do not supply oxygen, however, this level may not be worn in low-oxygen environments. The AHAs will identify the major tasks requiring Level C protection if it is deemed necessary at any point.

Use Level C protection when:

- The types of air contaminants have been identified, concentrations measured, and an air purifying respirator is available that can remove contaminants.
- The substance has adequate warning properties and all criteria for the use of APR respirators have been met.

Level C protective equipment at a minimum shall consist of:

- Full-face APR with High-Efficiency Particulate Air (HEPA) cartridges for airborne particulates (P-100) and chemical-specific cartridge Acid Gas/Organic Vapor
- Protective Coveralls Poly-coated Tyvek with Welded Seams (or equivalent)
- Inner Gloves – Nitrile (double layer if not using outer gloves)
- Outer Chemical Gloves – Nitrile (Optional, depending on activity)
- Outer Work Gloves – Cotton or leather (Optional, depending on activity)
- Safety Boots –Steel-toe/Steel Shank
- Boot Covers (booties) or Rubber Over boots
- Hard Hat (Optional, depending on activity)
- Hearing protection as required for noisy operations

### **6.5.3 Level B**

This protection level is not anticipated at this site. This level of protection affords isolation from liquid splashes and solid contaminants for most of the body, but does provide the highest respiratory protection. It allows workers to work in atmospheres containing most chemical vapors and particulates using a Supplied Air Respirator (SAR) or a Self-Contained Breathing Apparatus (SCBA). The AHAs will identify the major tasks requiring Level B protection if it is deemed necessary at any point.

Level B is used when:

- The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection.
- The atmosphere contains less than 19.5% oxygen.
- The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the skin.

Level B protective equipment at a minimum shall consist of:

- Positive Pressure Supplied Air Respirator (SAR)—SCBA (or Cascade system with 5-minute egress)

- Hooded Chemical-Resistant/Protective Clothing—Polytyvek™ or Saranex
- Inner Gloves—Nitrile
- Outer Chemical Gloves—Nitrile (Optional, depending on activity)
- Outer Work Gloves—Cotton or leather (Optional, depending on activity)
- Safety Boots—Steel-toe/Steel Shank
- Boot Covers (booties) or Rubber Over-boots
- Hard Hat (Optional, depending on activity)
- Hearing protection as required for noisy operations

#### **6.5.4 Level A**

Use of Level A protection is not anticipated at this site. Level A provides the respiratory protection of Level B, but utilizes a fully encapsulating, gas-tight suit for additional skin protection against gasses, vapors, liquids, and solids. It allows workers to work in atmospheres containing nearly all chemical vapors and particulates using a Self-Contained Breathing Apparatus (SCBA). The AHAs will identify the major tasks requiring Level A protection if it is deemed necessary at any point.

Level A is used when:

- The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured or potential for high concentration of atmospheric vapors, gases, or particulates.
- Site operations and work functions involve a high potential for splash or immersion, or there is a potential for exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the skin.
- Conducting operations in confined and poorly ventilated areas, and the requirement to use Level A has not yet been ruled-out.

Level A protective equipment at a minimum shall consist of:

- SCBA or Cascade system with 5-minute egress
- Fully Encapsulating Chemical-Resistant Airtight Suit
- Inner Gloves – Nitrile
- Outer Chemical Gloves – Chemical-Resistant
- Outer Work Gloves – Cotton or leather (Optional, depending on activity)
- Safety Boots – Steel-toe/Steel Shank
- Chemical-Resistant Boots
- Hard Hat (Optional, depending on activity and within suit)

- Hearing protection as required for noisy operations
- Disposable protective suit, gloves, and boots (depending on suit construction, may be worn over totally-encapsulating suit)

### **6.5.5 PPE Upgrade/Downgrade**

There are no anticipated hazards that would require PPE beyond Level D. However, as site conditions change, so do the PPE requirements. Reevaluate the present or proposed PPE level if any of the following conditions are met:

- Commencement of a new work activity not previously identified
- Change of job tasks during a work phase
- Change of season/weather
- Contaminants other than those identified in the Health and Safety Plan
- Change in ambient levels of contaminants
- Change in work that affects the degree of chemical contact

## **6.6 Decontamination Procedures**

In general, everything, including personnel, that enters the EZ must either be decontaminated or properly discarded upon exiting the zone. Any material generated by the decontamination process must be stored in a designated area until it is arranged for disposal.

### **6.6.1 Equipment Decontamination**

The RM/SHSO is responsible to ensure equipment and personnel have been sufficiently decontaminated prior to exiting the Exclusion Zone. Document this inspection in the site log. Equipment decontamination consists of the following steps:

1. Sweep or scrape gross contamination from the item.
2. If necessary, power-wash the item using a solution to remove PCB. (*Note: PCB is not anticipated at this site.*)
3. Wipe test PCB-contaminated equipment and analyze the results to ensure they are at a “non-detect” level before demobilizing that piece of equipment from the site.
4. Inspect equipment to ensure there are no remaining contaminants prior to site removal.

### **6.6.2 Personnel Decontamination**

At a minimum there will be a doffing point at the entrance/exit to the HZ/EZ for discarding disposable PPE. Under no circumstances will disposable PPE be re-used. Workers must wash their hands using either D-level wipes or D-level hand soap. Decontaminate boots or

have a place to discard disposable over-boots when the only potential for contamination is from contact with the soil (e.g., conducting a site walk with a visitor).

### **6.6.3 Emergency Decontamination**

Level D (including Level D Modified) does not require personal decontamination beyond hand washing using a personal hygiene station; therefore, emergency decontamination is not applicable. Only conduct emergency decontamination for Level C and above if the event is not life-threatening. In the event of a life-threatening situation, such as a heart attack, decontamination is secondary to performing Cardiopulmonary Resuscitation (CPR) or life-saving aid of any type. Regardless, remove the injured worker from the EZ prior to removing PPE and commencing life-saving measures.

### **6.6.4 Disposing of Decontamination Wastes**

Dispose of all PPE and decontamination materials (e.g, rinsate, tubs, brushes, etc.) in accordance with federal, state, and local laws and regulations. Contaminated PPE and decontamination materials may require hazardous waste disposal based on the types and degree of contamination. Unless otherwise noted, spent PPE and contaminated materials may be containerized and/or included with excavated soils when transported by dump truck or roll-off.

## **7. MEDICAL SURVEILLANCE**

***(NOTE: This section does not apply to emergency medical response, which is described in Section 8. Emergencies, Accidents, and Injuries.)***

EQM and all team subcontractor personnel performing hazardous waste site work are required to participate in a medical surveillance program and undergo associated examinations in accordance with 29 CFR §1910.120(f), ***Hazardous Waste Operations and Emergency Response - Medical Surveillance***.

Medical examinations are performed to establish an employee's baseline health status and to determine if the employee's health status changes over time because of occupational exposure. In addition, medical examinations are used to determine whether an employee is capable of performing his/her duties while wearing PPE under adverse conditions (e.g., temperature extremes) that might be expected at a work site. Examinations must be performed by or under the supervision of a physician, who (at a minimum) is licensed in medicine, possesses specific training or expertise in occupational medicine, and has experience performing medical surveillance examinations.

All medical examinations must be completed and documented (e.g., Work Status Report) prior to assignment at the site. Current medical clearance documentation must be kept on site for all EQM and team subcontractor personnel.

### **7.1 Baseline Examination**

A baseline examination (sometimes referred to as an "initial" or "pre-employment" physical) is required prior to sending EQM personnel into the field to perform hazardous waste operations. The baseline examination establishes whether personnel are fit to perform their duties and to characterize the employee's health prior to beginning a field assignment. The baseline examination is conducted following parameters established by EQM Corporate Health and Safety and EQM's occupational physician consultant.

## **7.2 Annual Examination**

EQM personnel performing hazardous waste site work must receive a follow-up medical examination at least annually. Medical exams must be completed, and clearance provided, within the 12-month period prior to on-site activity. Not all the medical tests included in the baseline examination are repeated during each annual follow-up exam, unless there is an exposure concern or problematic symptoms are reported that indicate the need for further evaluation. The annual examination is conducted following parameters established by EQM Corporate Health and Safety and EQM's occupational physician consultant.

## **7.3 Site-Specific Monitoring/Examination**

Additional medical evaluations might be warranted if there are concerns that an individual may be (or has been) exposed to a specific chemical contaminant. OSHA chemical-specific regulations, 29 CFR 1910.1001 through 1052, outline the medical surveillance provisions for many substances. This series of OSHA regulations presents a wide range of medical testing and physical examination requirements that depend on the exposure duration and health status of the individual. Testing and examination elements are triggered by the past or potential exposure situation and left to the discretion and judgment of EQM's occupational physician consultant with input from EQM Corporate Health and Safety.

## **7.4 Episodic Examination**

Episodic examinations occur outside of the required annual exam period and are only performed if there is reason to believe that an individual has been over-exposed to a chemical, biological, or radiological agent, or to a physical stressor. Generally, an examination would be scheduled as soon as possible upon notification by an individual that he/she had:

- Been injured or exposed above permissible exposure limits or published exposure levels
- Developed signs or symptoms indicating possible exposure to hazardous substances or health hazards

The examination will be specific to the contaminants and the associated target organs or physiological system. The parameters of the episodic examination will be left to the discretion and judgment of EQM's occupational physician consultant with input from EQM Corporate Health and Safety.

In addition, if blood or other potentially infectious materials contact the eyes, mouth, mucous membranes, non-intact skin, or parenteral region, handle the individual in accordance with 29 CFR 1910.1030, Bloodborne Pathogens.

## **7.5 Subcontractor Requirements**

All subcontractor personnel performing hazardous waste site work are required to be included in an appropriate medical surveillance program and undergo medical examinations in accordance with 29 CFR §1910.120(f), ***Hazardous Waste Operations and Emergency Response - Medical Surveillance***. Medical examinations must be complete, and current medical clearance documentation must be available on site, with copies provided to EQM Corporate Health and Safety (when requested) prior to subcontractor personnel performing hazardous waste site work.

## **8. EMERGENCIES, ACCIDENTS, AND INJURIES**

It is essential that site personnel are prepared in the event of an emergency, which can take many forms:

- Illnesses or injuries
- Chemical exposure
- Fires and explosions
- Harmful contaminant spills, leaks, and releases
- Sudden and/or violent weather changes

The following sections outline the general procedures for emergencies. Post this information as appropriate. Post the directions, in Appendix E, from the EQM Field Office to the local emergency room in the Command Post Office, and ensure a copy is in site work trucks and transport vehicles.

All essential emergency contact information is in Section 3.2, *Emergency Contacts*. The RM/SHSO will disclose these numbers in the Tailgate Meetings, as necessary, to ensure that all personnel are aware of whom to contact during an emergency.

Note that EQM is not a “first response” organization. Therefore, in the event of a major spill or contaminant release, EQM personnel will; gather as much information about the spill as is practical, notify the RM and/or OSC about the spill/release, and then evacuate to a location a safe distance away and upwind from the incident, and allow the first responders to mitigate the emergency. Once the site is safe and the first responders have returned it to the OSC, EQM personnel should return to normal operations.

### **8.1 Emergency Response Responsibilities**

The RM has primary responsibility for responding to and correcting emergency situations. These duties include:

- Responding appropriately to protect personnel, including withdrawing workers from the EZ, completely evacuating and securing the site, and/or upgrading or downgrading the PPE level.
- Taking appropriate measures to protect the public and the environment including isolating and securing the site, preventing runoff to surface waters, and controlling the emergency to the greatest extent possible until it can be terminated.
- Ensuring the appropriate federal, state, and local agencies are informed, and emergency response plans are coordinated.

- In the event of fire or explosion, summon the local fire department immediately.
- In the event of a toxic materials air release, depending on the size of the release, inform the local authorities in order to assess the need for civil evacuation.
- In the event of a spill, alert the sanitary district to determine response measures.
- Ensuring appropriate decontamination, treatment, or testing for exposed or injured personnel.
- Determining the cause of the incident and take actions to prevent recurrence.
- Preparing and submitting all required reports.

The RM must report emergency situations immediately to the EPA OSC, take appropriate measures to protect the other site personnel, and then assist as necessary in responding to and mitigating the emergency.

## **8.2 Specific Response Plans**

Beyond the typical response actions applicable to all emergencies, the following address specific emergency types.

### **8.2.1 Medical Emergencies**

When a worker becomes ill or injured in the EZ to the point where he requires medical attention, remove him from the EZ, and then decontaminate him to the greatest extent possible and practical. At least perform a partial decontamination by completely disrobing the victim and redressing him in clean coveralls, or wrap him in a blanket, and then administer first aid while waiting for the ambulance. For a less-serious injury or illness that still requires medical attention, complete full decontamination and administer first aid prior to transporting the victim to the emergency room.

When administering first aid, if there is the possibility the injury will involve contacting blood, body fluids, or other potentially infectious material, the caregiver must wear surgical-type impermeable gloves. Immediately report the exposure to the RM, EPA OSC, and EQM Corporate H&S Manager, naming the injured person(s) and the person(s) administering first aid. EQM must offer the Hepatitis B vaccination and follow-up treatment to exposed individuals within 24 hours, or as soon as possible, after exposure. Exposed individuals may decline the vaccination and treatment but must sign a declination statement stating their intent.

Any person who transports an injured/exposed person to a clinic or hospital for treatment should take the directions to the hospital and information on the chemical(s) to which the injured/exposed person may have been exposed. Upon return, any vehicle used to transport contaminated personnel will be cleaned or decontaminated, as necessary.

### **8.2.2 Fire or Explosion**

In the event of a fire or explosion, immediately summon the local fire department. Upon arrival of the fire commander, the RM/SHSO will advise him of the fire's location, nature of the fire, and other hazardous materials on site. If it is safe, and if specifically trained, onsite personnel may:

- Use any fire-fighting equipment provided on site, and for which they have been trained to operate
- Remove or isolate flammable or other hazardous materials that may contribute to the fire

Personnel not specifically trained to use fire extinguishers or other fire-fighting equipment must evacuate to a safe distance and await further instructions. There is no expectation on EQM's part that direct personnel or subcontractors will engage in fire suppression, unless they have been specifically trained and tasked to do so.

### **8.2.3 Spills, Leaks, or Releases**

In the event of a spill or a leak, it is essential to contain the contaminants to keep them from spreading off site or into public sewers or waterways. Should such a situation occur, personnel trained in remediation/emergency response will:

- Locate the source of the spill and stop the flow if it can be done safely.
- Begin containment and recovery actions to keep the spilled materials from migrating out of the EZ or interacting with other sensitive materials.

### **8.2.4 Adverse Weather**

Adverse weather can take many forms such as flash floods, high winds, hurricanes, severe thunderstorms, tornadoes, tropical storms, extreme heat, drought conditions, and winter storms (e.g., snow, freezing rain, and sleet). Sudden changes in the weather, extreme weather

conditions, and natural disasters can create a number of hazards. Generally, adverse weather can create additional hazards such as:

- Making walking and working surfaces slippery, creating slips, trips, and falls
- Generating airborne dust and debris
- Damaging electrical equipment to create shock or electrocution potential
- Breaching gas lines to create fire and explosion potential
- Generally twisting up the work area, creating other physical hazards

Natural disasters can create many secondary hazards such as hazardous materials releases, structural failures, direct contact injuries, and fires, many of which can occur hours or even days after the disaster.

### **8.2.5 Weather Notification Definitions**

When adverse weather is predicted, monitor weather and/or news broadcasts (e.g., radio, internet, television, etc.) continuously to provide up-to-date information. Weather condition terminology includes:

- **Advisory** – weather condition that is less serious than a warning. An Advisory is for an event that may cause significant inconvenience, where a lack of caution could lead to a situation that may threaten life and/or property.
- **Watch** – This term is used when a hazardous weather or hydrologic event has increased injury risk significantly, but its occurrence, location, and/or timing is still uncertain. A Watch is intended to provide enough lead time so that those who need to set their plans in motion can do so.
- **Warning** – These are issued when a hazardous weather or hydrologic event is occurring, is imminent, or has a very high probability of occurring. Warnings are used for conditions posing a threat to life or property and are generally affiliated with evacuation or sheltering information.
- **Flash Flood** – This notice is issued to indicate current or developing hydrologic conditions that favor flash flooding in and close to the watch area. NOTE: Flowing or noticeable surface water does not have to be present prior to the watch or warning, and conditions can change quickly and without notice.
- **High Winds** – This warning is issued when there are sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or there are 58 mph winds, or greater, for any duration.
- **Lightning** – This involves a visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds, between the cloud and air, between a cloud and the ground, or between the ground and a cloud. Note that lightning can travel for over five miles from its origin, and it may not be in association with either a flash or by thunder.

- Severe Thunderstorm – These watches and warnings are issued when conditions favor, or when indicated by radar or by spotter reports, a thunderstorm producing hail 3/4 inch or larger in diameter and/or winds that equal or exceed 58 mph.
  - The size of a “Watch” will vary depending on the local geography and meteorological conditions, will usually last for four to eight hours, and are normally issued well in advance of the actual storm.
  - Severe Thunderstorm Warnings generally last for 1 hour and can be issued without a Severe Thunderstorm Watch already in effect.
- Tornado Watch/Warning – These are issued when conditions are favorable for the tornado development, or when radar indicates, or weather spotters report, a tornado close to the watch area.
  - A Tornado Watch area can vary depending on weather conditions, is usually issued for four to eight hours, and is normally issued well in advance of the actual storm.
  - A Tornado Warning can be issued without a Tornado Watch already being in effect and is usually issued for duration of around 30 minutes.
- Winter Storm Watch/Warning – These are issued when there is a potential for, or a storm is producing, heavy snow or significant ice accumulations. Watches are usually issued at least between 24 to 36 hours in advance. Warnings are generally issued when a winter storm begins producing, or is forecast to produce, heavy snow or significant ice accumulations. The criteria for these watches and warnings vary by geographic locations and the support systems within. “Significant” precipitation accumulations will vary from a single inch in the Deep South, to several feet in more northerly regions. Regardless of an individual’s experience, remember that local emergency response and support functions are likely to be hindered by their resources and experience with winter weather. Do not assume that all locations have similar winter response abilities.

Use the information provided by emergency and weather broadcasts to determine what actions project personnel must take. If an area is experiencing severe weather, the EPA OSC, in conjunction with the RM/SHSO, will decide what operations, if any, are safe to perform based on existing and anticipated weather conditions. The RM/SHSO will then notify personnel when to suspend operations and seek shelter. When notification is given that severe weather is approaching, secure the site (if time permits) and ensure personnel immediately take appropriate action.

### **8.2.6 Specific Weather Responses**

Follow these precautions by condition:

- Flash Flood – Seek higher ground.
- High Wind – Secure materials and equipment and seek shelter.

- **Lightning** – Alert all personnel if lightning appears imminent. Because lightning can travel miles from its origin, suspend outdoor work and seek shelter in substantial buildings, enclosed vehicles, or other predetermined location when lightning strikes within six miles from the site. To measure this distance, either activate a lightning detector, a smart phone application (e.g., The Weather Channel or Weather Bug Spark apps), or use the “flash to bang” rule (i.e., lightning to thunder) where a count of five seconds equals one mile. After taking shelter, wait a minimum of 30 minutes following the last lightning strike within six miles before resuming operations.
- **Severe Thunderstorm** – Seek shelter in substantial buildings, enclosed vehicles, or other predetermined locations. If no shelter is available, seek cover in clumps of bushes or within groups of trees. Avoid metal objects, towers, fences, and creek beds.
- **Tornado** – Vacate trailers/automobiles and seek shelter in the center of a secure building, or below ground level (e.g., basement, ditch, or culvert).
- **Winter Storm** – Seek shelter and avoid unnecessary travel.

### **8.3 Evacuation Routes and Resources**

The RM/SHSO will establish evacuation routes, and designate exit points for outside work areas prior to beginning onsite operations. In the event of an emergency, evacuate immediately, without regard for equipment, and by the following procedures:

- If making the notification, give three blasts on an air or vehicle horn, or communicate with the RM/SHSO and other site personnel via cell phone.
- Escape the immediate spill area and keep upwind of smoke and/or vapors.
- If full site evacuation is necessary, evacuate to the EQM Field Office and await further instructions.
- The RM/SHSO will conduct a head count to ensure all personnel have been evacuated safely.

As a precaution in case the EQM Field Office becomes contaminated in an emergency, the RM/SHSO will establish a secondary gathering point and inform all personnel about this secondary assembly point at the daily tailgate safety meetings.

### **8.4 Emergency Equipment Available Onsite**

The following emergency equipment is available on site:

- **Medical Equipment:** (Ensure that each piece of medical equipment is inspected, and the inspection is documented. Include the inspector’s name and the date inspected.)
  - First-aid Kits
  - Eye-Wash Station

- Hand-Wash Station
- Firefighting Equipment: (Ensure that each fire extinguisher is inspected monthly, and the inspection is documented, to include the inspector’s initials and the date inspected.)
  - Portable Fire Extinguishers
- Spill or Leak Equipment:
  - Absorbent booms/pads and dry absorbent
- Communications Equipment:
  - Private Telephones
  - Cell Phones: Various Personnel
  - Emergency Alarms/Horns
- Additional Emergency Equipment Onsite:
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_

## 8.5 Accident Reporting and Investigation

Investigate any significant HASP failures especially those resulting in any injury or property damage, or that involve vehicles. The RM/SHSO will perform the investigation with assistance from EQM’s Corporate H&S Manager. In addition, inform the EPA OSC of any incident requiring an investigation and its progress. The EPA OSC will determine if the incident is serious enough to warrant modifying or terminating certain field activities pending the results of the investigation. Summarize the results of the investigation in a report and maintain it on site for the duration of the project. Also make it available to the EPA OSC.

The RM/SHSO will report OSHA recordable accidents, as defined by 29 CFR §1904.12, to the EQM H&S Manager and the EPA OSC within 24 hours after their occurrence. As a follow-up, the RM/SHSO will complete an Accident Investigation Report and forward it to the EQM H&S Manager and the EPA OSC within 72 hours after the accident occurred. EQM agrees to participate in all inquiries made by the government representative into such accidents,

and to investigate all injuries or occupational illnesses, to determine root causes and corrective actions. In case of an injury that requires medical treatment, follow these steps:

1. The RM/SHSO will contact 1Source (855-517-6872) to evaluate the injury's seriousness.
  - a. If the injury is life-threatening, obtain immediate medical attention.
  - b. If the injury is non-life-threatening, follow 1Source's recommendations for treatment.
2. The RM/SHSO will:
  - a. Notify the government representative immediately.
  - b. Investigate the incident and fill out the appropriate Accident/Injury Report Form(s).
  - c. Complete and submit any necessary worker's compensation reports.
3. The EQM Corporate H&S Manager will:
  - a. Update the OSHA Form 300 Log if the injury is recordable.
  - b. Obtain a report from 1Source that either:
    - i. Clears the employee to resume regular duties
    - ii. Describes any modified work that is acceptable
    - iii. Removes the employee from work duty

If a team member is admitted to the hospital or incurs the loss of an eye, tooth, finger, or other body part, OSHA and other appropriate agencies must be notified within 24 hours of the incident. This reporting is a function of the EQM H&S Manager, who must be notified immediately should such an event occur. Along with this, OSHA requires notification within 8 hours of a heart attack or fatality. In any of these cases, EQM's H&S Manager will conduct an in-depth accident investigation in addition to the steps identified above.

The EQM Program Manager (PM) will immediately notify the appropriate government representative and the Contracting Officer (CO) in the event of an accident that results in death, serious injury, or substantial property damage. The government representative will determine if field activities should be immediately modified or terminated.

## **9. SITE CONTROL**

### **9.1 Work Zones**

The primary purpose for using site controls is to establish the hazardous area perimeter, to reduce migration of contaminants into clean areas, and to prevent unauthorized persons from access or exposure to hazardous materials. Dividing the various work and support areas into specific zones helps to delineate what activities may occur in each to ensure adequate protection. Each area should be clearly marked to identify their location, so that onsite personnel and visitors do not stray into areas where they are not permitted. Also, establish only one Entry/Exit Control Point (ECP) from the Support Zone (SZ) into the Contamination Reduction Zone (CRZ) to restrict access to unauthorized personnel. This project requires the typical EZ, CRZ, and SZ based on the nature of work and the associated potential hazards.

#### **9.1.1 Exclusion Zone (EZ)**

The EZ – which may also be called a “hot zone” (HZ) or “work zone” – is where all remedial activities take place. Entry to, and exit from, this zone is made through a designated ECP. Clearly identify and post appropriate warning signs (e.g., "Danger Authorized Personnel Only") that clearly identify the EZ. Decontaminate personnel and equipment exiting the EZ as described in Section 6.6 - *Decontamination Procedures*. The RM and/or OSC will establish the EZ by the building footprint and signage once on site.

#### **9.1.2 Contamination Reduction Zone (CRZ)**

The CRZ – or “warm zone” – will provide a location for removing contaminated PPE and final personnel and equipment decontamination. All personnel and equipment should exit the EZ via the CRZ and establish separate decontamination areas for personnel/personal equipment and heavy equipment. The CRZ is a transition area between contaminated and clean areas, and is generally identified by caution tape. The RM and/or OSC will establish the CRZ once on site.

### **9.1.3 Support Zone (SZ)**

The SZ involves the uncontaminated area – or “cold zone” – outside of the EZ and CRZ, and is within the geographic perimeters of the site. This area is used for staging materials, parking vehicles, office facilities locations, sanitation facilities, and receiving deliveries. Personnel entering this zone may include delivery personnel, visitors, security guards, etc., who will not necessarily be permitted in the EZ. All personnel arriving in the SZ will, upon arrival, report to the command post and sign the site entry/exit log. Establish the SZ location prior to site activity and no later than the start of mobilization by the RM and/or OSC.

## **9.2 General Field Safety Rules**

The following are the general field safety rules all personnel on site will follow:

- All visitors must report to the EQM Field Office and to the RM or SHSO.
- The EZ is restricted to essential personnel only.
- All operations are guided and administered through operational SOPs.
- Eating, drinking, and smoking is only permitted in designated areas.
- Employees must wash their hands and faces thoroughly upon leaving the EZ.
- Personnel must use all of the PPE and monitoring equipment described in this HASP during work activities.
- Personnel will only travel in vehicles where each occupant is provided a seat, and they must wear a seatbelt.
- Fire extinguishers will be available and included in vehicles, and in all areas with increased fire danger such as the refueling area.
- Maintain first-aid kits in all site vehicles – excluding heavy equipment – and in EQM site offices.
- During the operation of heavy equipment, a minimum of two personnel must be present; however, only necessary personnel need to be on or around the equipment.
- Employees may not interfere or tamper in any way with air monitoring equipment.
- Do not operate backhoes or other boom equipment within 10 feet of any electrical conductor.
- Use the “Buddy System”
  - The buddy system is mandatory any time personnel are working in the Exclusion Zone or remote areas, or when conditions present a personnel risk.
  - A buddy system requires at least two trained/experienced people who work as a team and maintain (at a minimum) audible and/or visual contact while operating equipment.

- When working within the EZ, the following specific safety rules apply:
  - Wear the appropriate level of PPE defined in the HASP
  - Implement buddy system and communication procedures
  - No smoking, eating, or drinking permitted
  - Do not engage in horseplay

### **9.3 Communication Procedures**

- Use cell phones for on-site communications.
- Work crews should remain in cell phone or visual contact while working on site.
- The site evacuation signal will be three blasts on an air or vehicle horn.

### **9.4 Traffic Control**

Access to the site is from public streets and alleys. The streets may be partially blocked by trucks and other equipment during load-out. Use signage, traffic cones, and flaggers (as appropriate) to inform drivers and to control traffic along public streets during work hours. Inform police and fire officials, as required, when partially blocking streets for long time periods.

#### **9.4.1 Methods for Handling Material at the Site**

Minimize the amount of truck-loading activities taking place on main streets and thoroughways and local traffic pattern disruption by utilizing on-site haul roads and staging areas, as practical. If trucks are loaded on the main streets, use flagmen to stop traffic while the vehicle is being loaded and as it pulls out into the main traffic. Use signage to inform local commuters about traffic activities in the area and notify police and fire departments when appropriate.

#### **9.4.2 General Haul Route**

The haul route map is in Appendix F - *Maps*, which depicts the primary haul route(s) both within the site, as well as to the designated TSDF. EQM's drivers and subcontractors will follow the haul route(s) as identified. This is particularly important if there are highway or neighborhood load or materials restrictions. Brief any changes to the route during the daily tailgate meetings. If using more than one TSDF, list all of them, along with the specific materials permitted for each. Ensure that all personnel and transporters are clearly aware of any TSDF restrictions and/or special requirements.

### **9.4.3 Weight Restrictions**

Due to this project's location and highway weight restrictions for the expected haul route, there are no frost laws or weight restrictions based on road type and proposed equipment. Check truck weights daily by using the load tickets from the TSDF, and then adjust loading as needed to stay within federal, state, or local bridge laws.

### **9.4.4 On-Site Traffic**

Establish site control by placing caution tape, barricades, or temporary fencing across sidewalks, driveways, and other public walkways to prevent pedestrians from entering the work area. In particular, designate this zone to keep individuals away from the excavator's bucket swing during open excavation. If an excavation remains open overnight, place construction fencing around the entire open excavation and maintain it until it can be backfilled. The RM/SHSO is responsible for preventing all site visitors from entering the EZ during active work activities.

### **9.4.5 Traffic Control Signage and Layout**

Traffic control is not anticipated at this time, other than possibly using signage stating "Trucks Entering/Exiting."

## **10. HAZARD COMMUNICATION PROGRAM**

Hazardous chemicals pose a wide range of health effects such as irritation, dizziness, sensitization, and carcinogenicity, and physical risks as in flammability, corrosion, and reactivity. The OSHA Hazard Communication (HAZCOM) Standard (29 CFR §1910.1200) is designed to ensure information about these hazards and associated protective measures are disseminated to personnel who may be exposed to them. EQM and all team subcontractors are responsible to maintain a copy of their respective HAZCOM programs on site, including a Hazardous Chemical List and the associated Safety Data Sheets (SDSs), to ensure compliance.

### **10.1 Hazardous Chemicals List**

EQM and each team subcontractor will separately maintain a list of those hazardous chemicals each will use on site during field activities, with the exclusion of the hazardous contaminants that are part of the cleanup/remediation activities. The list will generally include the chemical or common name of the chemical or chemical mixture and the manufacturer and will serve as an inventory of every hazardous chemical requiring an SDS. Obtain any necessary additional information concerning each chemical, mixture, or compound from the SDS.

Section 7.2 provides a list summarizing the most significant contaminants as they relate to the cleanup/remediation activities along with the SOPs that relate to them. The list should not be considered inclusive of all the significant chemical hazards posed by materials at the site, given the nature of typical cleanup/remediation activities. The section provides only the basic information for each contaminant at the time the project was proposed; if further information is needed, refer to outside analytical or reference documents as available.

### **10.2 Safety Data Sheets**

EQM and each team subcontractor will separately maintain SDS for all hazardous chemicals used during field activities. Appendix E – **SDS**, provides generic SDS for the most significant hazardous chemicals, mixtures, and compounds used to support the project. All SDS will remain available for review during the work shift. No SDS may be more than 3 years old.

As of June 2015, all SDSs will follow the new 16-section format:

- Section 1, Identification, includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
- Section 2, Hazard(s) Identification, includes all hazards regarding the chemical and required label elements.
- Section 3, Composition/Information on Ingredients, includes information on chemical ingredients, and trade secret claims.
- Section 4, First-Aid Measures, includes important acute/delayed symptoms/effects, and required treatment.
- Section 5, Fire-Fighting Measures, lists suitable extinguishing techniques, equipment, and chemical hazards from fire.
- Section 6, Accidental Release Measures, lists emergency procedures, protective equipment, and proper methods of containment and cleanup.
- Section 7, Handling and Storage, lists precautions for safe handling and storage, including incompatibilities.
- Section 8, Exposure Controls/Personal Protection, lists OSHA's Permissible Exposure Limits (PELs), Threshold Limit Values (TLVs), appropriate engineering controls, and personal protective equipment (PPE).
- Section 9, Physical and Chemical Properties, lists the chemical's characteristics.
- Section 10, Stability and Reactivity, lists chemical stability and possibility of hazardous reactions.
- Section 11, Toxicological Information, includes routes of exposure, related symptoms, acute and chronic effects, and numerical measures of toxicity.
- Section 12, Ecological Information\*
- Section 13, Disposal Considerations\*
- Section 14, Transport Information\*
- Section 15, Regulatory Information\*
- Section 16, Other information, includes the date of preparation or last revision.

\*Sections 12 through 15 are optional because other agencies regulate this information.

### 10.3 Labeling

All incoming hazardous chemical containers must be labeled with appropriate GHS markings/labels, to include:

- The identity of the contents
- Appropriate Department of Transportation (DoT) hazard label
- An NFPA or HMIS marking indicating the hazard's nature
- The manufacturer or importer's name and contact information

The RM/SHSO or the subcontractor using the material will inspect the containers to ensure the following:

- The contents are clearly labeled.
- The appropriate hazard warning is applied.
- The manufacturer or importer's contact information is clearly labeled on each container.

The RM/SHSO or the team subcontractor using the material will ensure all secondary hazardous chemical containers have either a copy of the original manufacturer's label affixed to it, or a compliant GHS HAZCOM label.

#### **10.4 Information and Training**

Under OSHA's HAZCOM Standard, employers must brief all personnel who work with, or will potentially be exposed to, hazardous chemicals on the following:

- Overview of the OSHA HAZCOM Standard.
- Either the individual hazardous chemicals or the grouped hazard classifications present at the site.
- The location and availability of the written HAZCOM Program.
- Any physical and/or health effects the hazardous chemicals pose.
- Methods and observations used to detect the presence or release of a hazardous chemical.
- Methods of preventing or eliminating exposure through engineering controls, work practices, and/or personal protective equipment.
- Emergency procedures to follow if exposed.
- An explanation of how to read labels and review SDS to obtain appropriate hazard information.
- The location of the hazardous chemicals list and individual SDS.

The information and training may be designed to cover either specific chemicals or the generic hazard categories (e.g., reactives, flammables, corrosives, organic peroxides, carcinogens, etc.). Detailed chemical-specific information will always be available to project personnel through SDS and container labels.

#### **10.5 Non-Routine Tasks**

Periodically, project personnel may be required to perform non-routine tasks that are hazardous. Prior to the start of work on such tasks, the RM/SHSO will provide information to

affected personnel about the hazardous chemicals that they may encounter during. This information will include, at a minimum:

- The specific health and physical hazards of the hazardous chemical(s)
- The methods of preventing or eliminating exposure through engineering controls, work practices, and personal protective equipment
- The requirements to use the buddy system
- Any specific emergency procedures

## **10.6 Multi-Employer Sites**

When EQM subcontractors use hazardous chemicals in such a way that their employees may be exposed, the RM/SHSO will:

- Provide the subcontractor(s) with access to the appropriate SDS.
- Inform the subcontractor(s) of any precautionary measures they need to take to protect employees during the site's normal operations and in foreseeable emergencies.
- Inform the subcontractor(s) of the labeling system used in the workplace, methods of preventing or eliminating exposure, emergency procedures to follow if exposed, how to read labels and review SDS to obtain information, and the location of the SDS file and the location of the hazardous chemical list.

## 11. TRAINING

The essential training requirements for any hazardous waste operation are outlined in 29 CFR §1910.120(e). However, there is also training outlined in other standards that may apply to onsite activities. These are as follows:

- §1910.38 – *Emergency action plans*
- §1910.132 – *General (PPE) Requirements*
- §1910.134 – *Respiratory Protection*
- §1910.147 – *The Control of Hazardous Energy (Lock-out/Tag-out)*
- §1910.178 – *Powered Industrial Trucks*
- §1910.1018 – *Inorganic Arsenic*
- §1910.1025 – *Lead*
- §1910.1200 – *Hazard Communication*
- §1926, Subpart C – *General Safety and Health Provisions*
- §1926, Subpart E – *Personal Protective and Life Saving Equipment*
- §1926, Subpart G – *Signs, Signals, and Barricades*
- §1926.52 – *Occupational Noise Exposure*

To obtain copies of the individual training certificate(s) for onsite personnel, the certificates will be onsite with the RM. If unable to obtain a copy from the RM, contact the EQM Health and Safety Office to get them. Note that some of the required training may be components of, or combined under, a single course.

## 12. REFERENCES

The following references apply to this HASP's development or they supplement the information herein.

- 29 CFR §1904, *Recording and Reporting Occupational Injuries and Illness*
- 29 CFR §1910 Subpart I, *Personal Protective Equipment*
- 29 CFR §1910.120, *Hazardous Waste Operations and Emergency Response*
- 29 CFR §1910.1200, *Hazard Communication*
- 29 CFR §1926, *Construction Standards*
- 49 CFR §171.8, *Hazardous Materials Definitions*
- EQM POL 300, *Incident Prevention Plan*
- EQM SOP 301, *Hazard Communication Program*
- EQM SOP 303, *Flammable Combustible Liquid Transfer*
- EQM SOP 309, *Hearing Conservation Program*
- EQM SOP 311, *Personal Protection Equipment*
- EQM SOP 315, *Electrical Safety*
- EQM SOP 316, *Excavation and Trenching*
- EQM SOP 318, *Cold-Heat Stress*
- EQM SOP 326, *Working Around Heavy Equipment and Machinery Excavators and Loaders*
- EQM SOP 329, *Fire Prevention and Protection*
- EQM SOP 332, *Respiratory Protection*
- EQM SOP 344, *Use of a Live Line Telescoping Tool*
- EQM SOP 347, *Manual Lifting*

## **APPENDIX A**

### **HEALTH AND SAFETY PLAN AMENDMENTS**



HEALTH AND SAFETY PLAN AMENDMENT: # \_\_\_\_\_

SITE NAME: \_

DATE: \_\_\_\_\_

TYPE OF AMENDMENT:

REASON FOR AMENDMENT:

ALTERNATE SAFEGUARD PROCEDURES:

REQUIRED CHANGES IN PPE:

\_\_\_\_\_  
EQM Response Manager

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
EQM Health and Safety Manager

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
EPA OSC

\_\_\_\_\_  
(Date)



## **APPENDIX B**

### **POLs, SOPs, and WIs**



Know what's **below**. **Call** before you dig.

**EXCAVATOR MANUAL**

811 or 1.800.382.5544  
[www.indiana811.org](http://www.indiana811.org)

# COLOR CODES FOR MARKING UNDERGROUND UTILITY LINES

**RED**

Electric Power  
Lines, Cables,  
Conduit and  
Lighting Cables

**YELLOW**

Gas, Oil, Steam,  
Petroleum or  
Gaseous Materials

**ORANGE**

Communication,  
Alarm or Signal  
Lines, Cables  
or Conduit

**BLUE**

Potable Water

**GREEN**

Sewers and  
Drain Lines

**PURPLE**

Reclaimed Water,  
Irrigation and  
Slurry Lines

**PINK**

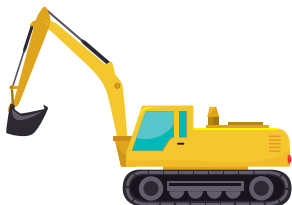
Temporary  
Survey Markings

**WHITE**

Proposed  
Excavation

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## PREFACE

This booklet provides basic information on safe excavation practices in Indiana. It is intended as an educational resource only. Please be advised of the following:

- This booklet is not a legal reference. You should consult your attorney, if necessary, for advice on interpreting the law.
- It does not contain the complete text of Indiana Code IC 8-1-26. Log onto the Indiana 811 website ([www.indiana811.org](http://www.indiana811.org)) for the full-text version of this law.
- The information in this booklet is subject to change without notice.

Throughout this manual, you will see this symbol.



Please pay special attention to the tips provided with these symbols to help in the process of a safe excavation.



**Indiana 811 does not locate or mark underground facilities. Locating and marking facilities is the responsibility of our member underground facility owners.**



## WHY DO I NEED TO CONTACT INDIANA 811 BEFORE I DIG?

It all begins with planning your work. A careful review of your plans and your work-area prior to the actual excavation can help save you and your company from unexpected downtime, loss of revenue and potential injury.

A safe excavation can be achieved by following the suggestions and processes outlined in this manual.

## FIVE STEPS TO SAFE DIGGING

**Plan  
Your  
Project**

**Contact  
Indiana  
811**

**Wait for  
The  
Marks**

**Respect  
The  
Marks**

**Dig  
With  
Care**

Click [HERE](#) to watch 5 Steps to Safe Digging.



**There may be other company regulations or policies for you to follow, so you should also check with your supervisor.**

## WHY INDIANA 811?

Indiana 811 is a private, nonprofit, statewide organization established by law (**IC 8-1-26**). It has the responsibility to manage the “call before you dig” process for Indiana.

Indiana 811 is a link between the excavator and the utility owner operators.

The Indiana 811 mission is to serve the needs of customers by providing a process to:

- Protect the public
- Protect the underground infrastructure
- Protect the environment

**Indiana 811  
DOES NOT  
MARK LINES**

Indiana 811 is only a call or click away:

- The Indiana 811 center operates 24 hours a day, 7 days a week answering calls from anyone who plans to dig in the state of Indiana.
- Professional excavators may submit requests for more than one address via Web Ticket entry at [www.indiana811.org](http://www.indiana811.org)
- Indiana 811 also has a single address web ticket entry for homeowners and excavators. Visit **[www.811NOW.com](http://www.811NOW.com)** to participate.



**Contact us two full working days before you dig. It's fast, it's free and it's the law!**

## THE PROCESS OF SAFE DIGGING

The first step to a safe excavation begins during the planning stages. By planning your work, understanding your work area and deciding when to start your dig, you are on your way to digging safely.

Plan before you make the call:

- Determine the route of your excavation on your site.
- Gather all your information.
- Premark the location with white paint, flags or both.

Once you have done these things, please contact Indiana 811 to schedule a locate of your digging project online via web Ticket Entry or 811 single address entry, or by calling 811 or 1-800-382-5544.



**By contacting Indiana 811 at least two full working days before you dig, you begin the process to a safe excavation.**

Your Excavator ID# will be assigned on your first call to Indiana 811 and is specific to you or your company. It is meant to assist you when calling in a locate request to Indiana 811.

Excavator ID#: \_\_\_\_\_

## WHAT HAPPENS DURING THE PROCESS?

When you click or call Indiana 811, you will need the following information regarding your digging project. You will want to have as much of this information ready as possible:

### INDIANA 811 LOCATE WORK ORDER

---

COUNTY

---

TOWNSHIP

---

LOCATION OF WORK-STREET ADDRESS

---

INTERSECTING STREETS/ROADS

---

DISTANCE FROM INTERSECTION

---

DIRECTION

---

EXTENT OF WORK FROM FRONT/REAR/BOTH SIDES

---

DATE OF EXCAVATION

---

START TIME OF EXCAVATION

---

TYPE OF WORK

---

CALLER'S NAME

---

CONTACT NUMBER

---

CONTRACTOR

---

FAX NUMBER

---

CONTACT PERSON/ADDITIONAL INFORMATION

---

TICKET NUMBER PROVIDED BY INDIANA 811

## WHAT HAPPENS AFTER I CONTACT 811?

After you have given all the appropriate information to Indiana 811, this is what happens next:

- The operator will read all information back to you.
- You must listen carefully and verify its accuracy.
- You will be given a list of members that Indiana 811 notifies.
- You will be told when your locate ticket expires.
- You will be given a reference number that is proof of your call. Record the number and keep it for the duration of your excavation or longer when applicable.
- The area to be located must be accessible to our member companies.
- Not all of our members utilize a contract locator. There may be several companies that respond to your locate request.



## SO...I'VE CONTACTED 811. WHAT DO I DO NOW? WAIT THE REQUIRED AMOUNT OF TIME.

**IC 8-1-26-16:** The notice required under subdivision (1) must be received at least (2) full working days, not including weekend or holidays, before the commencement of the work.

Within two full working days of your contact to Indiana 811, member facility operators with underground facilities at or near your excavation site will mark the approximate location of those facilities with color-coded paint or flags. Some notified member companies may clear the ticket by telephone or electronic communications. Make sure that you give accurate contact information when submitting the locate request.



## I'VE WAITED MY TWO FULL WORKING DAYS...NOW IT'S TIME TO RESPECT THE MARKS

- Marks may be paint, flags or both.
- Marks may specify conduit or service, or other descriptions.
- There may also be marks that designate an “all clear,” meaning no buried facilities are present in the dig area for that particular utility.
- Marks may be confusing. If you have any questions, you should contact the utility directly.



### Faded or Missing Marks

**IC 8-1-26-20:** Rain, snow, lawn mowing, traffic or other activities may cause you to lose your marks. Should this occur, notify Indiana 811 immediately and have your reference number ready to request a remark. An additional notice of two full working days is required for the remark, so plan accordingly.



**Requesting a remark does require an additional notice of two full working days for our members to respond to refresh their marks.**

## I SEE MY LOCATE MARKS. NOW, CAN I DIG WITH CARE?

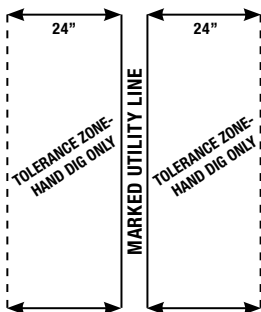
- YOU have planned.
- YOU have made the necessary calls.
- YOU have received your locate marks/flags.
- YOU are now ready to dig...

What do you do now?

### Working Within the Tolerance Zone

**IC 8-1-26-20:** The tolerance zone is a horizontal area, measured from the marks, where the excavator shall excavate in a safe and prudent manner, using hand tools (or other non-invasive tools) to protect the marked underground facility until it is exposed.

Indiana law requires that the excavator observe the tolerance zone during excavation: An area equal to the width of the underground facility plus 24 inches on each side of the buried utility.



Safe and prudent digging within the tolerance zone allows you to safely and fully expose the facility on all sides.

## WHAT IS AN EXCAVATION?

**IC 8-1-26-6:** As used in this chapter, “excavate” means an operation for the movement, placement or removal of earth, rock, or other materials in or on the ground by use of tools or mechanized equipment or by discharge of explosives, including augering, backfilling, boring, digging, ditching, drilling, driving, grading, jacking, plowing in, pulling in, ripping, scraping, trenching and tunneling.

**Excavations include, but are not limited to: demolition of buildings or other structures, even if you don’t expect to disturb the earth during demolition.**



## EXCAVATION METHODS

Approved methods of excavation within a specified tolerance zone include, but not limited to:

- Hand digging
- Pot holding
- Vacuum excavation



**Directional Boring or Horizontal Directional Drilling (HDD) excavators should always properly expose or support each utility facility at each crossing.**

**Always refer to your HDD Guidelines Book for suggestions when digging within the tolerance zone with this equipment.**

**Interstate Pipeline companies may have other requirements for their facilities.**



## EMERGENCY UTILITY REPAIRS

**IC 8-1-26-8:** As used in this chapter, “imminent danger to life, health, property or loss of service” means there is a substantial likelihood that loss of life, health, property or service will result before the procedures under sections 16 and 18 of this chapter can be completed.



**Only actual emergencies should be designated as such when a dig notification is phoned to Indiana 811. Examples of an emergency include a broken natural gas pipe or water main, or interruption of your existing services.**

**IC 8-1-26-19(C):** A person that knowingly provides false notice of an emergency excavation or demolition to the association under subsection (a) may be subject to a civil penalty in an amount recommended by the advisory committee and approved by the commission, not to exceed \$1,000.



## WHAT TO DO IF A DAMAGE OR “HIT” OCCURS

Take reasonable appropriate actions needed to protect persons or property and to minimize safety hazards until those agencies and departments and the utility arrive at the scene.

As soon as any damage is discovered, including gouges, dents or breaks to coating, cable sheathes, and cathodic protection anodes or wiring, report the type and location of the damage to the utility and permit the utility a reasonable amount of time to make necessary repairs.



**You should always have an updated list of emergency contact numbers for the excavation area including law enforcement, fire, gas and other utilities.**





## A LIST OF “TO DO’S” DURING EXCAVATION

- **“Do”** keep a reasonable clearance between any underground facility and the cutting edge or point of powered equipment.
- **“Do”** protect and preserve the color-coded markings until those markings are no longer needed for proper and safe excavation.
- **“Do”** call for a remark if the markings are destroyed or removed before excavation is complete and allow two full working days to remark the site.
- **“Do”** be sure someone other than the equipment operator, i.e. the spotter, is there to look for any sign of the underground facility.
- **“Do”** conduct the excavation near the underground facility carefully. Excavate by hand, if necessary, to be able to tell the exact location of the line and to prevent damage.
- **“Do”** protect and support exposed facilities during construction, and then take care while backfilling to maintain support to prevent damage. Be sure that backfill materials are free of any material that could damage the facility.
- **“Do”** request markings in segments as excavation progresses on projects that cover a larger area and progress from one area to the next over a period of time in order to coordinate markings with actual excavation.
- **“Do”** ensure the continuity of your locate request. If your job will last longer than 20 calendar days, you must renew it at least two full working days before it expires.



## A LIST OF “DON'TS” DURING EXCAVATION

- **“Don’t”** assume that a pipeline or cable runs straight between line markers.
- **“Don’t”** assume the depth of a utility. Never assume that an underground facility is the same depth throughout the entire route of the excavation.
- **“Don’t”** excavate within the tolerance zones with any other equipment, except what has been recommended in this guide.
- **“Don’t”** phone in emergency locates that aren’t really emergencies.
- **“Don’t”** refresh the utility locators' marks with your own paint. Call Indiana 811 for a remark.
- **“Don’t”** work on someone else’s locate ticket number.
- **“Don’t”** assume all utilities have responded to your request. Assess the proposed excavation area for indications of unmarked facilities.
- **“Don’t”** bend over a gas line or self repair.
- **“Don’t”** ignore minor scrapes and gauges to any line.

## THINGS TO REMEMBER

The Indiana 811 Center operates:

# 24/7/365

**24 HOURS A DAY/7 DAYS A WEEK/365 DAYS A YEAR**

Processing locate requests from anyone who intends to dig in the state of Indiana.

### MAILING ADDRESS

P.O. Box 219  
Greenwood, IN 46142

### CALL

811 or 1-800-382-5544

### ONLINE

[www.811Now.com](http://www.811Now.com) (for single address locate request)



**The two full working days notice for utilities to provide locate marks excludes Saturdays, Sundays and State and Federal holidays.**

**OSHA mandates change regularly. Please make sure that you are up-to-date on any changes.**



## **CLICK BEFORE YOU DIG!**

For years, a call to 811 has been your first step for ensuring a safe and successful dig. But now you have an even faster, more convenient way to prepare for your home or small contractor project.

Introducing 811Now— a new online system that allows you to conveniently file a single address locate request. No calling needed.

Now you can complete and submit our easy online form any time of the day or night. Plus, you can review all of your answers before submitting, ensuring the correct information is being dispatched... NOW!

Remember, you must submit your request at least two full working days before the planned excavation.

---

**For additional information and to make a single address request, please visit: [811Now.com](http://811Now.com)**

---

# **INCIDENT PREVENTION PROGRAM**

**P300**

---



1800 Carillon Boulevard  
Cincinnati, Ohio 45240  
800-229-7495  
[www.eqm.com](http://www.eqm.com)

June 2016

Revision 1

---

**Incident Prevention Program**

**SIGNATURE PAGE**

I have read and approved the EQM Incident Prevention Program.

Prepared by: \_\_\_\_\_  
EQM Director, Health and Safety Date

Approved by: \_\_\_\_\_  
EQM Human Resources Manager Date

Concurrence by: \_\_\_\_\_  
EQM CEO Date

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- Appendix A EQM EHS Policy
- Appendix B Basic Safety Rules
- Appendix C Emergency Action Plan Template
- Appendix D EHS Committee
- Appendix E Forms

## RECORD OF ISSUE/REVISION

[illegible]

## **1. PURPOSE**

The purpose of this Incident Prevention Program (IP2) is to provide an overview of the system Environmental Quality Management, Inc. (EQM) has implemented to prevent pain and suffering to our employees and their families resulting from a work-related injury or illness.

The benefits of the program are diverse:

- Improved morale and system ownership with increased emphasis on the safety of our employees.
- Job security, since many companies look at vendor incident rates, experience modification rates, and regulatory citations as factors for awarding bids.
- Increased funds for reinvestment into bonuses and recognition awards, versus using those funds to pay for increased insurance premiums.

## **2. SCOPE**

This IP2 applies to all EQM employees. A copy of this document is available on the server and is discussed in the New Hire Orientation (NHO) hand-out. Employees are required to sign the acknowledgement form after reading this policy. Any questions regarding this policy can be discussed with the Director of Health and Safety (HSO).

## **3. REFERENCES**

- Title 8, CCR Section 3203: Cal/OSHA
- Department of Labor and Industries, Washington State, Accident Prevention Program
- Federal OSHA Injury and Illness Prevention Program
- SOP 313 Hazard ID and Risk Assessment of Sites and Tasks
- WI300A Conducting Site Audits

## **4. DEFINITIONS**

- Near Miss - an incident that could have resulted in property damage or injury if conditions were slightly different.

## **5. RESPONSIBILITIES**

### **5.1 Director, Health and Safety: John Kominsky, CIH, CSP, CHMM, RSO**

The Director, Health and Safety, has the following responsibilities:

- Implements the provisions of this IP2.
- Audits and updates the health and safety system as necessary.
- Provides guidance to ensure safe work practices are followed, as requested.
- Confirms each employee's suitability for work based on physician recommendations.
- Conducts field health and safety audits, as applicable.
- Establishes exposure monitoring parameters based on expected hazards, as required.
- Establishes an Employee Exposure Monitoring Notification Program, as required.
- Assists in developing Site-specific Employee/Community Emergency Response Plans, based on expected hazards.

### **5.2 Senior Management (Division Managers and VPs)**

Management has the following responsibilities:

- Implements and maintains the IP2 in their work areas and answers worker questions about the Program.
- Ensures that all safety and health policies and procedures are clearly communicated and understood by all employees.
- Sets a good example by following established safety rules and attending required training.
- Ensures corrective actions and accountability measures are implemented.
- Ensures metrics are met as outlined by the EHS Committee.

### **5.3 Supervisors and Lead Personnel (Project Managers)**

Supervisors and Project Managers have the following responsibilities:

- Implement and maintain the IP2 in their work areas and answer worker questions about the Program.
- Enforce the rules fairly and uniformly.

In addition, employee supervisors have the following responsibilities:

- Inform workers of the provisions of our IP2.
- Evaluate the safety performance of all workers.

- Recognize employees who perform safe and healthful work practices.
- Provide training to workers whose safety performance is deficient.
- Hold employees accountable for failure to comply with safe and healthful work practices.
- Ensure that each employee you supervise has received an initial orientation before beginning work.
- Ensure that each employee you supervise is competent or receives training on safe operation of equipment or tasks before starting work on that equipment or project.
- Ensure that each employee receives required personal protective equipment (PPE) before starting work on a project requiring PPE.
- Do a daily walk-around safety-check of the work area. Promptly correct any hazards you find.
- Observe the employees you supervise working. Promptly correct any unsafe behavior. Provide training and take corrective action as necessary.
- Document employee evaluations.
- Set a good example for employees by following safety rules and attending required training.
- Investigate all incidents in your area and report your findings to management.
- Talk to management about changes to work practices or equipment that will improve employee safety.

#### **5.4 All Employees**

All employees have the following responsibilities:

- Use safe work practices in following all directives, policies, and procedures, and in helping to maintain a safe work environment.
- Report incidents immediately to management, including near misses, property damage, work stoppage, injury, or illness.
- Assist in identifying the root causes of incidents and assist with the implementation of corrective actions.
- Promptly report unsafe conditions or actions to your supervisor or safety committee representative.
- Report all injuries to your supervisor promptly, regardless of how serious.
- Report all near-miss incidents to your supervisor promptly.
- Always use personal protective equipment (PPE) in good working condition where it is required.
- Do not remove or defeat any safety device or safeguard provided for employee protection.
- Encourage co-workers by your words and example to use safe work practices on the job.

- Make suggestions to your supervisor, safety committee representative, or management about changes you believe will improve employee safety.

## **5.5 Environmental, Health and Safety (EHS) Committee**

The EHS Committee has the following responsibilities:

- Review the incidents and inspection results on the Corrective Action Plan.
- Review and track progress with annual metrics.
- Determine annual goals.
- Identify recognition programs.
- Approve division recognition programs.
- Review gap analysis and approve budget.
- Annually review and update the Safety Policy and submit it for executive management signature.
- Ensure the long-term EHS system vision is reviewed and updated annually as EQM continues the journey to safety excellence.

## **6. PROCEDURE**

Critical elements of the Incident Prevention Program include:

- Management leadership
- Employee participation
- Hazard identification
- Hazard prevention and control
- Education and training
- Program evaluation, improvement, and recognition
- Communication.

### **6.1 Management Leadership**

Management is the key to a successful EHS System. Safety and health must be embraced by top management and enforced throughout the organization. Managers must demonstrate safety by actively participating in health and safety activities, stopping work when unsafe conditions or practices occur, and supporting all personnel in proactively taking ownership for safety and health practices at all work locations. Each organization will recognize personnel who meet the criteria defined by the group for promoting safety within their team and for recognizing and correcting hazardous situations through near-miss reporting.

Managers are expected to:

- Implement, follow, and support this program.
- Partake in training and ensure their personnel are properly trained and utilize proper equipment and protective clothing before commencing a job.
- Support site managers when they deem a job is unsafe and should not be continued.
- Meet metrics for health and safety requirements as outlined by the EHS Committee.
- Assist field personnel in determining what needs to be accomplished to complete a job safely.
- Correct unsafe acts or conditions and hold those accountable through the discipline process outlined in EQM's Employee Handbook.
- Division managers are to designate a representative to sit on the EHS Committee.

## **6.2 Employee Participation**

Employee involvement is essential to sustaining health and safety. Employees are encouraged to take ownership of the IP2 program by:

- Identifying corrective actions to eliminate gaps in our current processes.
- Stopping work when unsafe practices are observed and ensuring safe work practices are implemented before continuing the job.
- Providing feedback to the HSO on methods to improve current processes, clothing, tools, or equipment.
- Developing and/or providing training to peers.
- Partaking in the EHS Committee.

## **6.3 Hazard Identification**

Proactive identification of hazards and implementation of corrective actions is critical in preventing incidents. Hazards are typically identified in the following ways:

- By identifying unsafe conditions or actions.
- During inspections.
- Through Incident Review and Reporting.
- By Task Hazard Analysis.

### **6.3.1 Identifying Unsafe Conditions or Actions**

Employees are encouraged to watch out for their own safety and the safety of those around them, including co-workers, subcontractors, other workers, and visitors. Any unsafe condition or action must be stopped immediately, and the concern discussed with the work team

to correct the situation. In the case of outside personnel, the supervisor of that area must be notified to work out a solution.

### **6.3.2 Conducting Inspections**

Management is committed to aggressively identifying hazardous conditions and practices that are likely to result in injury or illness to employees. All personnel shall take prompt action to eliminate any hazard. If it is safe to do so, the employee shall fix the hazard. If it is not safe to fix the hazard, or it is beyond the capability of the employee to fix the hazard immediately, the hazard shall be identified and the supervisor notified. As required, work will cease until the issue is resolved. Management and designated site safety officers will regularly check the workplace for hazards as described below.

- In the office:
  - Annual Site Survey—Once a year, at least two management personnel shall conduct a complete facility inspection and write down any safety hazards or potential hazards they find. The results of this inspection will be used to eliminate or control obvious hazards, target specific work areas for more intensive investigation, assist in revising the checklists used during quarterly safety inspections, and aid in the annual review of the effectiveness of our IP2.
  - Quarterly Safety Inspections—Members of the management team (selected on a rotating basis) shall conduct safety inspections quarterly and document their findings on the Quarterly Safety Inspection Form.
  - Periodic Change Survey—As applicable, the EHS Committee will assign a supervisor or form a team to conduct a Periodic Change Survey to look at any changes the committee makes and to identify safety issues. Changes include new equipment, changes to a production process, or a change to a building structure. The team will be comprised of maintenance, production, and safety committee representatives to examine changed conditions and make recommendations to eliminate or control any hazards that were or may be created as a result of a change.
- In Warehouses:
  - Annual Site Survey—Once a year, at least two management personnel shall conduct a complete facility inspection and write down any safety hazards or potential hazards they find. The results of this inspection will be used to eliminate or control obvious hazards, target specific work areas for more intensive investigation, assist in revising the checklists used during quarterly safety inspections, and aid in the annual review of the effectiveness of our IP2.
  - Monthly Safety Inspection—Rotating members of the management team will conduct monthly safety inspections and document their findings on the Monthly Inspection Safety form.
  - Weekly Safety Inspection—Warehouse personnel will inspect each warehouse weekly.

- Periodic Change Survey—As applicable, the EHS Committee will assign a supervisor or form a team to look at any changes the committee makes and to identify safety issues. Changes include new equipment, changes to a production process, or a change to a building structure. The team will be comprised of maintenance, production, and safety committee representatives to examine the changed conditions and make recommendations to eliminate or control any hazards that were or may be created as a result of a change.
- Job Site Inspections:
  - Program Managers or Site Safety Officers shall inspect job sites at the frequency outlined in the Site-specific Health and Safety Plan. The frequency will be based on the duration of the job as well as level of risk associated with the job. The Project Manager (PM) and HSO will determine the inspection frequency, based on contractual agreements.
- Other inspections will occur as follows:
  - When new substances, processes, procedures, or equipment that present potential new hazards are introduced into our workplace.
  - When new, previously unidentified hazards are recognized.
  - When occupational injuries or illnesses occur.
  - When permanent or intermittent workers are hired and/or reassigned to work on processes, operations, or tasks for which a hazard evaluation has not been previously conducted.
  - Whenever workplace conditions warrant an inspection.

### 6.3.3 Incident Review and Reporting

Incidents involve more than just an injury or illness due to a task. Incidents can also include near miss (aka near hits) property damage and motor vehicle accidents. All incidents shall be reported before the end of a shift, and investigated to identify the root cause and associated corrective actions. Corrective actions will be implemented, tracked, and evaluated for effectiveness. See Incident Management, SOP 310, for the specifics of this program.

Each office and site will have access to a first-aid kit. The locations of the kits will be posted in the office's Emergency Action Plan and in Site Health and Safety Plans.

Workplace accidents, hazardous substance exposures, and near-miss incidents will be reported by those involved and their direct managers. An investigation report will be completed along with the root cause of the incident and the associated Corrective Action Plan including the responsible party and target dates. This report will be sent to the HSO for comments.

Investigations include one or more of the following:

- Visiting the accident/exposure/near-miss accident scene as soon as possible.
- Interviewing affected workers and witnesses.
- Examining the workplace for factors associated with the accident/exposure/near-accident.

- Determining the causes of the accident/exposure/near-accident.
- Taking corrective action to prevent the accident/exposure/near-accident from reoccurring.
- Recording the findings and corrective actions taken on the Incident Management Form.

The HSO may conduct additional investigations. Once corrective actions are approved, the manager will be responsible for implementing and communicating the plan to the rest of the company.

#### **6.3.4 Task Hazard Analysis (THA)**

A Task Hazard Analysis (THA) will be conducted before each job. The supervisor of the job task or a member of the project team will conduct the analysis. Employees will be trained based on the results of the THAs.

THAs will be sent to the HSO. A THA library will be established to assist project teams with auditing typical task hazard analyses, updating THAs for the specific site in lieu of starting a new one for each site, and using any required PPE. The results will be reported to the safety committee. Each job task will be analyzed at least once every 2 years, whenever there is a change in how the task is done, or if a serious injury occurs during the task.

#### **6.4 Hazard Prevention and Control**

Unsafe or unhealthy work conditions, practices, or procedures at our work locations shall be corrected **in a timely manner** based on the severity of the hazards, and according to the following procedures:

- When hazards are observed or discovered, they shall be immediately corrected.
- When an imminent hazard exists that cannot be immediately abated without endangering employee(s) and/or property, all exposed workers will be removed from the area except for those needed to correct the existing condition. The workers needed to correct the hazardous condition shall be provided with the required protection.
- All corrective actions taken and the respective completion dates shall be documented on the Identified Hazards and Correction Record in Appendix E.

#### **6.5 Education and Training**

All personnel, including management, supervisors, safety officers, and field personnel, shall receive training and instruction on general and job-specific safety and health practices. Training and instruction shall be provided as follows:

- To all new workers.
- To all workers given new job assignments for which training has not previously been provided.
- Whenever new substances, processes, procedures, or equipment are introduced to the workplace and represent a new hazard.
- Whenever a new or previously unrecognized hazard is discovered.
- To supervisors to familiarize them with the safety and health hazards to which workers under their immediate direction and control may be exposed.
- To all workers with respect to hazards specific to each employee's job assignment.

This training will include (but is not limited to):

- An explanation of our IP2, Emergency Action Plan, and Fire Prevention Plan, and measures for reporting unsafe conditions, unsafe work practices, and injuries, and when additional instruction is needed.
- Provisions for toilets, and hand-washing and drinking water facilities.
- Provisions for medical services and first aid, including emergency procedures.
- Instruction on proper housekeeping, such as keeping stairways and isles clear, work areas neat and orderly, and promptly cleaning up spills.
- Prohibiting horseplay, scuffling, or other acts that adversely influence safety.
- Use of proper storage practices to prevent:
  - Stacking goods in an unstable manner.
  - Storing materials and goods against doors, exits, fire extinguishing equipment, and electrical panels.

Where applicable, training will be provided in the following areas:

- Prevention of musculoskeletal disorders, including proper lifting techniques.
- Use of appropriate clothing, including gloves, footwear, and personal protective equipment.
- Information on chemical hazards to which employees could be exposed, and other hazard communication program information.
- Proper food and beverage storage to prevent these items from becoming contaminated.

All personnel will receive new-hire training within 90 days of their start date and will be trained on site-specific evacuation procedures and the Emergency Action Plan (EAP).

### **6.5.1 EAP and Fire Prevention Plan**

Personnel should call 911 for medical and fire emergencies, unless an alternate procedure is listed in a Site-specific Health and Safety Plan. Small fires with minimal smoke may be put out with a fire extinguisher. The goal for office personnel is evacuation.

Personnel required to use fire extinguishers (e.g., personnel assigned fire watch for hot work activities) will have hands-on PASS training.

### **6.5.2 Hazard Communication**

Personnel will receive hazard communication training prior to starting work at each site or location. Office personnel will receive general hazard communication training in their employee orientation and as needed annually.

### **6.5.3 Other Training**

Specific instructions will be provided to all workers regarding hazards unique to their job assignment, to the extent that such information was not already covered in other training.

Education, awareness, and training are important components of an individual's health and safety at home and on the job. Therefore, each employee will receive a minimum annual training of 4 hours throughout the year.

## **6.6 Program Evaluation, Improvement and Recognition**

Each Division Manager holds monthly safety meetings to provide safety program information and corrective action strategies. Program evaluations are conducted at least every 2 years. Evaluations will also be conducted based on the results of incidents and inspections or employee concerns.

Recognition is provided at least annually in the form of certificates, letters to employee files, newsletters, or email communications.

## **6.7 Employee Communication**

Our system of communication is designed to facilitate a continuous flow of two-way safety and health information in a form that is readily understandable to all affected site personnel (management, supervisors, and employees). This communication includes:

- New worker orientation, including a discussion of site-specific safety and health policies and procedures.
- Follow-through by supervisors to ensure the effectiveness of training.
- Workplace-specific safety and health training.
- Daily safety meetings (tailgate meetings) held in the field for each site. Additional safety meetings are held monthly, quarterly, or more frequently as deemed necessary to deal with hazards, injuries, and illnesses.
- Effective communication of safety and health concerns between workers and supervisors, including language translation where appropriate.
- Posted and distributed safety information.
- A system for workers to anonymously inform management about workplace hazards. Managers, supervisors, and employees are required to report any hazardous conditions or activities noted. Hazards are noted through formal monthly or quarterly inspections and during daily routine operations. A safety suggestion box will be placed at each location where hazard notices can be deposited.

There is an open communication policy between management and staff on matters pertaining to safety. All input regarding safety is considered important, and employees are encouraged to actively participate in the company safety program. During safety meetings, employees should feel free to express any safety concerns individually to supervisors or in writing on the Safety Hazard Notice. All safety suggestions will be given serious consideration and each will receive a response. In turn, EQM will provide current safety news and activities, safety reading materials, signs, posters, and a bulletin board for easy access to information. Regular safety meetings will be held to give all employees an opportunity to receive safety training and voice personal opinions regarding safety and health matters.

## **7. RECORDS**

Division VPs will maintain a Summary Corrective Action Tracking Sheet. Specific site-related reports will be maintained in the site file and a copy kept by the Division VP.

The Comprehensive Division Summary Corrective Action Tracking List will be maintained electronically in Excel to track all inspections, incidents, and task analyses. The summary shall contain:

- Name(s) of person(s) responsible for the corrective action.
- Workplace hazards (i.e., unsafe conditions and work practices that have been identified).

- Corrective action(s) taken to correct the identified unsafe conditions and work practices.
- Target date for implementation.
- Actual closure date.
- 90-day effectiveness evaluation date.
- Evaluation closure date.

Each January, a new sheet will be created and any open items from the previous year will be transferred to the new tracking sheet. The previous year's sheet will be maintained for 1 year past the last action evaluation closure date.

Incident reports will be maintained on file with the HSO. Documented inspection reports will be maintained for 1 year unless otherwise stated by the client.

**APPENDIX A**  
**EQM EHS POLICY**

EQM places a high value on the health and safety of its employees. We are committed to providing a safe and healthful workplace for all employees. Incident prevention requires the involvement of all company personnel including management, supervisors, employees, and contractors in identifying and eliminating hazards that may develop during our work process.

**Safety Management**

- Provide our employees with the required job-related training and safety-related education.
- Achieve compliance, but strive to exceed applicable legal and regulatory requirements.
- Identify root cause of incident(s) and implement corrective actions.
- Ensure our subcontractors are committed to conducting all business operations safely and in compliance with all laws and regulations.

**Continuous Improvement**

- Audit to ensure successful incident prevention programs.
- Minimize or eliminate identified hazards.
- Conduct annual assessment of our EHS initiatives.

**Communication**

- Ensure all workers are aware of their right to refuse unsafe work.
- Ensure all workers are empowered to stop unsafe work and correct unsafe conditions or behaviors.

- Conduct routine meetings for communication and discussion of EHS issues.

**Environmental**

- Integrate recycling processes.
- Manage natural resources and improve energy efficiency.

**Recognition**

- Recognize and reward employees, teams, and divisions for excelling in safety-related activities.

Safety is a team effort – Let's all work together to keep this a safe and healthy workplace.

**2015 Goals**

- Each division to conduct monthly safety meetings.
- All employees to complete training as outlined in SOP 308.
- Update routine AHA to include risk.
- Complete safety equipment inventory and document associated inspections.

Title	Signature	Date
CEO:	_____	_____
VP EPA & GLNPOCS	_____	_____
VP EM/E&C:	_____	_____
VP R&C:	_____	_____
EQE:	_____	_____

**APPENDIX B**  
**BASIC SAFETY RULES**

The following is a list of basic safety principles that shall be core practices of all employees.

- Never do anything that is unsafe in order to get the job done.
- Follow safe driving practices.
- Correct unsafe conditions or actions if it is safe to do so. Notify management about the hazard and the corrective action taken.
- Report unsafe conditions that you cannot correct to your manager. Ensure the hazard is barricaded or signage is used to notify others of the condition until it is resolved.
- Do not remove or disable any safety device!
- Keep guards in place at all times when operating machinery.
- Never operate a piece of equipment unless you have been trained and are authorized to use it.
- Use personal protective equipment whenever it is required. Inspect all equipment prior to use.
- Obey all safety warning signs.
- Do not work while under the influence of alcohol or illegal drugs or use them at work. This is prohibited and may be grounds for dismissal.
- Do not bring firearms, weapons, or explosives onto company property. This is prohibited and may be grounds for dismissal.
- Smoke only in designated areas.
- Do not participate in horseplay, running, or fighting.
- Follow good housekeeping to prevent injuries.
  - Clean up spills immediately.
  - Replace all tools and supplies after use.
  - Do not allow scraps to accumulate where they will become a hazard.

**APPENDIX C**  
**EMERGENCY ACTION PLAN TEMPLATE**

Each office having more than 10 persons shall have a written Emergency Action Plan (EAP). Every job location without an existing EAP from the client must have an EAP.

Emergency Action Plans include:

- Evacuation Procedure including routes and rally points.
  - A method of accountability will be established.
  - A method for notifying personnel of emergencies will also be established.
- Fire Prevention Plan, if applicable to the site.
- Natural disaster / inclement weather procedures will vary for each location. Ensure applicable conditions are addressed such as:
  - Snow
  - Ice
  - Tornado
  - Hurricane
  - Earthquake
  - Flood
  - Lightning.
- Based on the location of the site, the following items are to be included:
  - Railroad car derailment/emergency (potential for chemical exposure or fire)
  - Chemical exposure due to nearby facility release.
- Other procedures to be included at all sites are:
  - Electric power loss
  - Phone outage
  - Medical emergencies (include routes to emergency facilities)
  - Bomb Threat Procedure
  - Pandemic flu.

**APPENDIX D**  
**EHS COMMITTEE**

Effective January 1, 2015, the EQM Corporate Health and Safety Committee will be responsible for identifying safety problems, developing solutions, reviewing incident reports, tracking metrics, and evaluating the effectiveness of our health and safety system.

The committee consists of full-time, permanent representatives from each division of EQM.

- Employees in each division will elect from among themselves a representative to be on the committee.
  - E&C, R&C, EPA/GLNPOCS, Office Personnel, EQE and Seattle Office
    - If there is only one volunteer or nomination, the employees will approve the person by voice vote at a short meeting called for that purpose.
    - If there is more than one volunteer or nomination, a secret paper ballot will be used to elect the representative.
- Elected representatives will serve for 18 months, with 50% of the team to be replaced every other year.
  - The Transition Plan will be completed for the 2015 team, and terms and durations may fall outside of 18 months.
- Permanent committee positions include:
  - Director of Health and Safety – Committee Chair
  - Human Resources Manager – Facilitator
  - Quality Director – Co-Chair

Duties of all health and safety committee members include:

- Develop and track annual metrics.
- Review EHS policy annually and update it as needed.
- Identify recognition programs for H&S initiatives excellence.
- Review monthly incident statistics.
- Communicate safety issues to employees you represent.
- Encourage safe work practices among co-workers.
- Identify individuals or teams for routine recognition.
- Develop corporate-wide programs to foster health, wellness, and safety for all members and their families, and develop/sponsor community awareness events.

The regularly scheduled meeting time is 10:30 am for 1 hour on the second Wednesday of each month. The meeting will be held in person at EQM and by webinar.

A committee member will be designated each month to keep minutes on the Monthly Safety Meeting Agenda/Minutes Form (Appendix E) which contains the basic agenda.

- The minutes will be emailed by COB the day of the meeting to all committee members.
- Once two committee members provide written (e-mailed) approval of the minutes to the Chair, the minutes will be put in pdf and distributed to all employees by email.
- All work sites where EQM has a job trailer or office will post the minutes on an employee bulletin board for 1 month.
- The minutes will be filed electronically on the N drive under Health and Safety and kept for at least 1 year.

All managers are required to have a monthly safety meeting with all employees.

- This meeting is to help identify safety problems, develop solutions, review incident reports, and provide training.
- Attendance and comments will be documented and electronically sent to the Director of Health and Safety by the last business day of each month.

**APPENDIX E**  
**FORMS**

## **P300 ACKNOWLEDGEMENT FORM**

In signing this form, I acknowledge receiving a copy of the Environmental Quality Management, Inc. (EQM) Incident Prevention Program (IP2), written June 2015. I have had the opportunity to discuss the Policy and have questions answered, and understand all of the provisions in the Policy.

It may be necessary to make changes to this Policy in order to best serve the needs of our organization. However, EQM management will make any changes deemed necessary in writing and communicate the modified policy to every employee.

By my signature below, I acknowledge I have received a copy of EQM's Incident Prevention Program Policy. I understand it is my obligation to read, understand, and comply with the procedures and provisions contained within this Policy.

\_\_\_\_\_  
Employee Name (printed)

\_\_\_\_\_  
Employee Signature

\_\_\_\_\_  
Date Signed

**PLEASE SIGN, SCAN, AND EMAIL TO DIRECTOR, QUALITY SYSTEMS**

## **Division/Department Monthly Safety Meeting Agenda/Minutes**

**Date:**

**Attendees:**

**Agenda:**

<b>Incident Review</b>	
<b>Corrective Action Plan Review</b>	
<b>Metric Review</b>	
<b>Program Update</b>	
<b>Training Update</b>	
<b>Outside Agency Update</b>	
<b>Other</b>	

## Identified Hazards and Correction Record

[illegible]

**NOTE:** Conditional Coding for Closed Date: Green within target date, Yellow 30 days out, Red exceeds target date. Audit Date – audit to be conducted within 60 days of actual closed date.

Target dates are set based on priority:

- 1 Immediate danger to life and death - cease work, correct within 7 days.
- 2 Recordable injury potential or property damage >\$5K - cease work or implement temporary corrective action /training, correct within 30 days.
- 3 Compliance issue or minor injury/property damage <\$5K - 60 days to correct.

## FBI BOMB PROGRAM

### BOMB THREAT CALL CHECKLIST

**EBCC-X**

**Questions to Ask**

1. When is bomb going to explode?
2. Where is it right now?
3. What does it look like?
4. What kind of bomb is it?
5. What will cause it to explode?
6. Did you place the bomb?
7. Why?
8. What is your address?
9. What is your name?

**Exact Wording of the Threat:**

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Sex of caller \_\_\_\_\_ Age \_\_\_\_\_ Race \_\_\_\_\_ Length of call \_\_\_\_\_

**BOMB THREAT QUESTIONNAIRE:**

**CALLER'S VOICE:**

<input type="checkbox"/> Calm	<input type="checkbox"/> Laughing	<input type="checkbox"/> Lisp	<input type="checkbox"/> Disguised
<input type="checkbox"/> Angry	<input type="checkbox"/> Crying	<input type="checkbox"/> Raspy	<input type="checkbox"/> Accent
<input type="checkbox"/> Excited	<input type="checkbox"/> Normal	<input type="checkbox"/> Deep	<input type="checkbox"/> Familiar
<input type="checkbox"/> Slow	<input type="checkbox"/> Distraught	<input type="checkbox"/> Ragged	<input type="checkbox"/> If voice is familiar,
<input type="checkbox"/> Rapid	<input type="checkbox"/> Slurred	<input type="checkbox"/> Clearing throat	<input type="checkbox"/> who did it sound like?
<input type="checkbox"/> Soft	<input type="checkbox"/> Nasal	<input type="checkbox"/> Deep breathing	<input type="checkbox"/>
<input type="checkbox"/> Loud	<input type="checkbox"/> Stutter	<input type="checkbox"/> Cracking voice	<input type="checkbox"/>

**BACKGROUND SOUNDS:**

<input type="checkbox"/> Street noises	<input type="checkbox"/> House noises	<input type="checkbox"/> Factory	<input type="checkbox"/> Local
<input type="checkbox"/> Crockery	<input type="checkbox"/> Motor	<input type="checkbox"/> Machinery	<input type="checkbox"/> Long distance
<input type="checkbox"/> Voices	<input type="checkbox"/> Office Machinery	<input type="checkbox"/> Clear	<input type="checkbox"/> Animal Noises
<input type="checkbox"/> Booth	<input type="checkbox"/> PA System	<input type="checkbox"/> Static	<input type="checkbox"/> Music
Other _____			

**THREAT LANGUAGE:**

<input type="checkbox"/> Well spoken (educated)	<input type="checkbox"/> Foul	<input type="checkbox"/> Incoherent
<input type="checkbox"/> Irrational	<input type="checkbox"/> Taped	<input type="checkbox"/> Message read by threat maker

**REMARKS:**


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Report call immediately to \_\_\_\_\_ Phone number \_\_\_\_\_

Fill out completely, immediately after bomb threat      Date      /      /  
 Phone number \_\_\_\_\_  
 Name \_\_\_\_\_ Position \_\_\_\_\_

EBCC-X Bomb Threat Call Checklist

 <b>Standard Operating Procedure</b>		Procedure No.	<b>SOP 301</b>
		Issue Date:	February 2011
Title: <b>Hazard Communication Program</b>			
Approved by:	J. Kominsky, CIH, CSP, CHMM, ROH Director Health and Safety	Revision No.	4

## Appendix A: Pictograms and Hazards

### 1. PURPOSE

The OSHA Hazard Communication Standard (HCS) is now aligned with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). This update to the Hazard Communication Standard (HCS) provides a common and coherent approach to classifying chemicals and communicating hazard information on labels and safety data sheets. EQM Standard Operating Procedure SOP 301 “Hazard Communication Program” has been updated to be consistent with the revised OSHA statute.

Major changes to the Hazard Communication Standard are:

- **Hazard classification:** Provides specific criteria for classification of health and physical hazards, as well as classification of mixtures.
- **Labels:** Labels are required that includes a harmonized signal word, pictogram, and hazard statement for each hazard class and category. Precautionary statements must also be provided.
- **Safety Data Sheets:** Safety Data Sheets (SDS) have a specified 16-section format.
- **Information and training:** Employers are required to train workers on the new labels elements and safety data sheets format to facilitate recognition and understanding.

The purpose of SOP 301 is to inform workers about the hazardous chemicals used at EQM work sites. It will show workers how to obtain appropriate Safety Data Sheets (SDSs) and information on Globally Harmonized System (GHS) for labelling. The goal is to educate employees to properly use, handle, store, and dispose of chemicals in order to reduce exposure and thus prevent injury or illness to personnel and prevent environmental contamination.

### 2. SCOPE

This document applies to all EQM personnel and subcontractors at all work locations.

### 3. REFERENCES

- 29 CFR 1910.1000
- 29 CFR 1910.1200
- 29 CFR 1926.59
- OSHA GHS Overview

- Globally Harmonized System of Classification and Labeling of Chemicals (GHS) 5<sup>th</sup> Edition

#### 4. DEFINITIONS

**Article**—A manufactured item that may contain a hazardous substance, but will not release any hazardous chemicals when used as intended per 29 CFR 1910.1200 and 29 CFR 1926.59.

**Chemical**—An element, compound, or mixture of elements and/or compounds.

**Classification**—Identification of relevant data regarding the hazards of a chemical, review of those data to determine the hazards associated with the chemical, and the decision on whether the chemical will be classified as hazardous according to the definition of hazardous chemical in this section. For health and physical hazards, classification includes the degree of hazard, where appropriate, by comparing the data with the criteria for health and physical hazards.

**Competent Authority**—Refers to OSHA.

**Container**—Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this section, pipes or piping systems, engines, fuel tanks, or other operating systems in a vehicle are not considered to be containers.

#### **Globally Harmonized System of Classification and Labeling of Chemicals**

**(GHS)**—International system for classifying chemicals and identifying hazards. OSHA aligned with the GHS in March 2012. Two significant changes in the revised standard require the use of new labeling elements and a standardized format for Safety Data Sheets (SDSs).

**Hazard Category**—The division of criteria within each hazard class; e.g., oral acute toxicity includes five hazard categories and flammable liquids includes four hazard categories. These categories compare hazard severity within a hazard class and should not be taken as a comparison of hazard categories more generally.

**Hazard Not Otherwise Classified (HNOC)**—An adverse physical or health effect identified through evaluation of scientific evidence during the classification process that does not meet the specified criteria for the physical and health hazard classes addressed in this section. This does not extend coverage to adverse physical and health effects for which there is a hazard class addressed in this section, but the effect either falls below the cut-off value/concentration limit of the hazard class or is under a GHS hazard category that has not been adopted by OSHA (e.g., acute toxicity Category 5).

**Hazardous Chemical**—Any pure chemical, chemical mixture, or product that is a physical hazard and/or a health hazard. Such chemicals may cause injury or death if inhaled, ingested, or absorbed by personnel near the substance.

NOTE: The following are specifically excluded from the OSHA Hazard Communication Standard:

- Hazardous waste, as defined in 40 CFR 260 (RCRA).

- Hazardous substance, as defined by CERCLA when that substance is the focus of a remedial or removal action conducted under CERCLA.
- Tobacco or tobacco products.
- Wood or wood products.
- Articles that will not release a hazardous chemical under normal conditions of use.
- Foods, drugs, or cosmetics for personal use.
- Consumer products (when used in the workplace in the same manner as normal consumer use, and duration or frequency of exposure is not greater than encountered in the general public).
- Nuisance particulates where the chemical manufacturer or importer can establish that they do not pose any physical or health hazard.
- Ionizing and non-ionizing radiation.
- Biological hazards.

**Hazard Class**—The nature of the physical, health, or environmental hazard (e.g., flammable solid carcinogen, oral acute toxicity).

**Hazard Statement**—The nature of the hazard(s) of a chemical including, where appropriate, the degree of hazard. For example: “Causes damage to kidneys through prolonged or repeated exposure when absorbed through the skin.” All applicable hazard statements must appear on the label. Hazard statements are specific to the hazard classification categories.

**Health Hazard**—A chemical for which there is statistically significant evidence, based on at least one study conducted in accordance with established scientific principles, that acute or chronic health effects may occur in exposed individuals. The term Health Hazard includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic system, and agents that damage the lungs, skin, eyes, or mucous membranes.

**Immediate Use**—A hazardous chemical under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

**Physical Hazard**—A chemical for which scientifically valid evidence indicates that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive), or water-reactive.

**Pictogram**—Black hazard symbol on a white background with a red frame. There are eight pictograms under this standard for application to a hazard category.

**Precautionary Statement**—Recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical or improper storage or handling.

**Safety Data Sheet (SDSs)**—[formerly known as Material Safety Data Sheet (MSDS)]. A written description of a hazardous chemical or chemical product that contains comprehensive technical

information about a particular substance and explains the risks, precautions, and remedies to exposure to hazardous chemicals.

**Signal Word**—The relative level of severity of a hazard that alerts the reader to a potential hazard on the label. There are only two signal words: Danger and Warning. Within a specific hazard class, “Danger” is used for the more severe hazard and “Warning” is used for the less-severe hazard. The label will have only one signal word no matter how many hazards a chemical may have. If one of the hazards warrants a “Danger” signal word and another warrants a “Warning,” only “Danger” should appear on the label.

## **5. RESPONSIBILITIES**

### **5.1 Project Management (includes Site Manager, Project Manager, Response Manager, Site Safety Officer)**

The Project Manager and/or Site Safety Officer is responsible for:

- Maintaining a copy of the Hazard Communication Program and implementing the requirements of the program.
- Ensuring current SDSs for hazardous chemicals that employees are using or are potentially exposed to are readily available to all employees at the field site.
- Providing training to employees covering the specific hazards of the chemicals in use at the field site and properly selecting/caring for the appropriate PPE to protect workers from the hazards of the chemicals in use at the work site.
- Monitoring the air concentration of hazardous chemicals in the work environment.
- Maintaining training records for each project/work site.
- Directing the cleanup and disposal of the Spill Control Team.
- Assessing the risks of non-routine tasks
- Ensuring all clients, contractors, and subcontractors are aware of the chemicals in use by EQM or its subcontractors.
- Coordinating the transfer of lists of chemicals, chemical hazards, etc., between EQM and its clients, contractors, and subcontractors to ensure the chemical safety of all persons on site.

### **5.2 Corporate Health and Safety Director (HSO)**

The Corporate Health and Safety Director is responsible for:

- Administering the Hazard Communication Program.
- Maintaining the written Hazard Communication Program.
- Establishing general hazard communication training requirements for new employees, and maintaining records of hazard communication training through the EQM training management system.

- Developing, revising, and implementing a hazard communication training program that covers chemical hazards an EQM employee may encounter at work.
- Assisting (when requested) in coordinating responses to all inquiries by employees regarding the use of, and/or potential exposure to, hazardous chemicals.

### **5.3 All Employees**

All employees will follow these minimum requirements:

- Adhere to all client and EQM hazardous chemical requirements while at EQM work sites.
- Use hazardous chemicals only for their intended use, follow all label and SDS precautions, and use chemicals in accordance with all site-specific requirements. Utilize the company provided protective equipment to minimize exposure.
- Notify immediate supervisor of unlabeled containers, torn damaged or illegible labels.
- Participating in training
- Store hazardous chemicals with other compatible chemicals, and keep them away from food items and smoking materials.
- Prior to using hazardous chemicals, refer to container labels or SDSs, or contact the Project Manager or Corporate Health and Safety Director, or their designee, if additional information on a hazardous chemical is needed.
- Refuse to work with hazardous chemicals until you have reviewed the SDS and/or container label and resolved any health and safety questions with the Project Manager or Corporate Health and Safety Director or their designee.
- Properly caring for personal protective equipment, including proper use, routine care and cleaning, storage, and replacement

Employees who do not comply with the provisions of this program will be held accountable in accordance with EQM's policy of progressive discipline.

## **6. PROCEDURE**

A copy of this written Hazard Communication Program will be available at all field sites and offices where hazardous chemicals are in use or stored. This written Hazard Communication Program will be implemented by the Project Manager (or designee) at all field sites when required. This document will be available upon request to all employees and regulatory agencies.

### **6.1 Hazardous Chemicals List**

To comply with 29 CFR 1910.1200, EQM will maintain a list of all hazardous chemicals on site and at each of its office locations. The list will generally include the chemical or common name of the chemical or chemical mixture, the manufacturer, and the approximate quantity on site at any given time. The list will serve as an inventory of every hazardous chemical requiring an SDS. Additional information on each chemical or chemical mixture may be obtained from the SDS.

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*Current version is accessed only through the Corporate Document Management System*

To comply with 29 CFR 1926.59, EQM and each team subcontractor will separately maintain a list of all hazardous chemicals brought on site and used by EQM and each subcontractor during field activities. The list will generally include the chemical or common name of the chemical or chemical mixture, the manufacturer, and the approximate quantity on site at any given time. The list will serve as an inventory of every hazardous chemical requiring an SDS. Additional information on each chemical or chemical mixture may be obtained from the SDS.

## 6.2 Safety Data Sheets

To comply with 29 CFR 1910.1200, EQM will maintain SDSs for all hazardous chemicals used by EQM at each of its office locations. To comply with 29 CFR 1926.59, EQM and each team subcontractor will separately maintain SDSs for all hazardous chemicals used by EQM and its team subcontractors during field activities; however, all SDSs will be located in the EQM command post office. SDSs for hazardous chemicals brought on site will be obtained and available to all EQM employees and subcontracted employees for review during their work shifts.

GHS Compliant SDSs will be in the following format:

- **Section 1: Identification.** Includes product identifier; manufacturer or distributor name, address, phone number, and emergency phone number; recommended use; and restrictions on use.
- **Section 2: Hazard(s) Identification.** Includes all hazards associated with the chemical and required label elements.
- **Section 3: Composition/Information on Ingredients.** Includes information on chemical ingredients and trade secret claims.
- **Section 4: First-aid Measures.** Includes important acute and delayed symptoms/effects, and required treatment.
- **Section 5: Fire-fighting Measures.** Lists fire-extinguishing techniques, equipment, and chemical hazards.
- **Section 6: Accidental Release Measures.** Lists emergency procedures, protective equipment, and proper methods of containment and cleanup.
- **Section 7: Handling and Storage.** Lists precautions for safe handling and storage, including incompatibilities.
- **Section 8: Exposure Controls/Personal Protection.** Lists OSHA's Permissible Exposure Limits (PELs), Threshold Limit Values (TLVs), appropriate engineering controls, and personal protective equipment (PPE).
- **Section 9: Physical and Chemical Properties.** Lists the chemical's characteristics.
- **Section 10: Stability and Reactivity.** Lists chemical stability and possible hazardous reactions.
- **Section 11: Toxicological Information.** Includes routes of exposure, related symptoms, acute and chronic effects, and numerical measures of toxicity.
- **Section 12: Ecological Information.** Regulated by Agencies other than OSHA. Therefore, this section is not enforced by OSHA.

- **Section 13: Disposal Considerations.** Regulated by Agencies other than OSHA. Therefore, this section is not enforced by OSHA.
- **Section 14: Transport Information.** Regulated by Agencies other than OSHA. Therefore, this section is not enforced by OSHA.
- **Section 15: Regulatory Information.** Regulated by Agencies other than OSHA. Therefore, this section is not enforced by OSHA.
- **Section 16: Other Information.** Includes the date of preparation or last revision.

Notes:

- Since other Agencies regulate this information in Sections 12 through 15, OSHA will not enforce these Sections (29 CFR 1910.1200(g)(2)).
- Compliant SDSs contain the information above listed in order using the headings as stated above. If no relevant information is found for any subheading within a section on the Safety Data Sheet, the chemical manufacturer, importer, or employer preparing the Safety Data Sheet shall mark it to indicate that no applicable information was found.

### 6.3 Obtaining SDSs

If an SDS is not available, or an employee cannot access an SDS, s/he should contact the Project Manager (or designee) for assistance. If the Project Manager (or designee) is not available, the employee should contact the Corporate Health and Safety Director for assistance. The missing SDS will be provided to the employee requesting it prior to his/her next work shift, provided EQM has received the SDS from the chemical supplier.

### 6.4 Annual SDS Audit and Chemical Inventory Procedure

Office locations shall maintain SDSs electronically or keep them in a binder in the area in which the chemicals are used or stored. Each office shall be audited annually to ensure it has the most current SDS on file. Updated SDSs shall be communicated to all team members who interact with or work near the chemical.

Site locations shall maintain physical copies of the most current SDSs on file. SDSs shall be audited at sites operating for over 1 year.

A chemical inventory shall be conducted annually at all office locations and sites that have been operating for over 1 year. Verifications must be made that SDSs are available for all chemicals on site.

A signed and dated note from the Office Manager or Project Manager shall be added to the front of the SDS notebook or scanned to the electronic SDS file stating an audit was completed, all SDSs are current, and all chemicals have an SDS available at the location.

If an employee is transported to a medical facility with an acute chemical exposure, the appropriate SDS will be sent or made available to the medical facility.

## 6.5 Labeling

All incoming containers of hazardous chemicals must be labeled with their contents, appropriate hazard warnings, and manufacturer (or distributor) contact information. The Project Manager (or designee) or the subcontractor using the material will inspect all incoming containers received on site to ensure the following:

- The contents of the container are clearly labeled.
- Containers are clearly labeled with the appropriate hazard warning.
- Containers are clearly labeled with the manufacturer's contact information.

Manufacturer (or distributor) labels on incoming containers will not be removed. Additional information will be placed on the container if the label does not contain the required information. The Project Manager (or designee) or the team subcontractor using the material will ensure all secondary containers of hazardous chemicals are labeled with either a copy of the original manufacturer's (or distributor's) label or a GHS compliant in-house label marked with the contents and appropriate hazard information. This also applies to holding tanks and/or process piping.

### 6.5.1 GHS Labels

Under GHS, there is no standard label format as there is with SDSs. However, certain standardized elements must appear on the label. Each label must include the following standardized items:

- **Pictogram**—Conveys health, physical, and environmental hazard information; is assigned to a GHS hazard class and category. See Appendix A for pictograms.
- **Signal Word**—"Danger" or "Warning" is used to emphasize a hazard and indicate the relative level of severity of the hazard assigned to a GHS hazard class and category. "Danger" means a more severe hazard. "Warning" is used for a less-severe hazard.

Only one signal word will be used and it will correspond to the class of the most severe hazard of the product. Some lower level hazard categories do not use signal words.

- **Hazard Statement**—Standard phrase assigned to a hazard class or category that describes the nature of the hazard.
- **Product Name/Identifier**—The GHS label for a substance should include the chemical identity of the substance (the name as determined by IUPAC, ISO, or CAS, or the technical name).
- **Precautionary Statements**—Precautionary statements have been linked to each GHS hazard statement and type of hazard. The four types of precautionary statements are:
  - Prevention
  - Response, in cases of accidental spillage or exposure
  - Storage
  - Disposal.

For hazardous mixtures/alloys, the label should include the chemical identities of all ingredients that contribute to acute toxicity, skin corrosion or serious eye damage, germ cell mutagenicity, carcinogenicity, reproductive toxicity, skin or respiratory sensitization, or Target Organ Systemic Toxicity.

- **Supplemental Information**—Supplemental label information is non-harmonized information on the container of a hazardous product that is not required or specified under the GHS. In some cases, this information may be required by a Competent Authority or it may be provided at the discretion of the manufacturer/distributor. The GHS provides guidance to ensure that supplemental information does not lead to a wide variation in information or undermine the GHS information. Supplemental information may be used to provide further details that do not contradict or cast doubt on the validity of the standardized hazard information. It also may be used to provide information about hazards not yet incorporated into the GHS. The labeler should have the option of providing supplementary information on the hazard statement that is related to the hazard, such as physical state or route of exposure.
- **First-aid Measures**—Statements regarding first aid for each route of entry shall be provided.
- **Supplier Information**—Manufacturer name, address, and contact number are included on the label.

## 6.6 Non-Routine Tasks

Periodically, employees may be required to perform non-routine tasks that may result in temporary exposure to hazardous chemicals. Prior to starting work on such tasks, affected employees will be provided information from the Project Manager (or designee) about the hazardous chemicals that may be encountered during the activity. This information will include, at a minimum, specific health and physical hazards associated with the hazardous chemical(s); the methods for preventing or eliminating exposure to hazardous chemicals through use of engineering controls, work practices, and personal protective equipment; use of the buddy system where required; and emergency procedures.

## 6.7 Multi-Employer Sites

When hazardous chemicals are used in such a way that employees of other employer(s) may become exposed to these chemicals, the Project Manager (or designee) will:

- Provide the other on-site employer(s) with access to SDSs for each hazardous chemical that the other employer(s)' employees may be exposed to while working.
- Inform the other employer(s) about precautionary measures that need to be taken to protect employees during the field site's normal operating conditions and in emergencies.
- Inform the other employer(s) of the labeling system used on site.

## 6.8 Recordkeeping

Records pertaining to the hazard communication program will be maintained by the Health and Safety Director at the corporate level and by the Site Safety Officer on temporary work sites. These personnel will also keep the following records:

- Chemical inventory list
- Hazardous material reviews
- Copies of phone call logs and letters requesting SDSs
- Employee training records

- Warnings issued to employees for not following the hazard communication program

## **7. RECORDS**

- SDSs will be maintained at EQM offices and on the corporate server.
- SDSs will be maintained at EQM temporary work sites.

## **8. TRAINING**

### **8.1 Initial Training**

Prior to starting work, all EQM employees will receive initial training on the OSHA Hazard Communication Standard and this SOP as part of the new hire orientation. ERRS and R&C personnel will receive additional training through 40-Hour OSHA Hazardous Waste Operations (29 CFR 1910.120) training. Other field employees may also receive training through OSHA 10- or 30-Hour General Industry Safety and Health training, and OSHA 10- or 30-Hour Construction Safety and Health training.

EQM employees are encouraged to identify any topics where they believe additional training or remedial training is needed above and beyond the prescribed levels.

### **8.2 Site-Specific Training**

Site-specific training will take place prior to the start of field work. With the aid of SDSs, the Project Manager (or designee) will be responsible for training all employees regarding site-specific hazards. Individual or small-group training will be conducted during normal working hours. The length of training will vary depending on the chemical hazards present.

NOTE: SDSs will be provided for any chemical brought on site. Due to the nature of our business, SDSs may not be available for all of the chemicals found at a cleanup site nor may all of the chemicals at a site be known. Site-specific training will be conducted to educate employees on the anticipated hazards, and conservative protective measures will be implemented to protect workers from harm.

### **8.3 Periodic Training**

Before a new chemical or chemical hazard is introduced, each employee in the affected work area will be given information and training on the new chemical hazard. Retraining will not be required if the new chemical contains hazards similar to a previously existing chemical for which training has already been conducted.

### **8.4 Training Content**

Employees who work with, or will be potentially exposed to, hazardous chemicals will receive information and training on the following:

- Overview of the OSHA Hazard Communication Standard.
- Hazardous chemicals found at the site.
- Location and availability of the written Hazard Communication Program.
- Physical and health effects of the hazardous chemicals.
- Methods and observations that may be used to detect the presence or release of a hazardous chemical.
- Methods of preventing or eliminating exposure to hazardous chemicals through use of engineering controls, work practices, and personal protective equipment.
- Emergency procedures to follow if you are exposed.
- Explanations of how to read labels and review SDSs to obtain appropriate hazard information.
- Location of the hazardous chemicals list and SDSs.

The information and training may be designed to cover either specific chemicals or categories of hazards (e.g., reactives, flammables, corrosives, carcinogens, etc.). Detailed chemical-specific information will always be available to employees through SDSs and container labels.

All training will be documented in the EQM training management system.

Trade secret information is not anticipated to be an issue with the EQM workforce. If commercial personnel are informed of trade secrets at the facility, they must consult the Corporate HSO to ensure all appropriate information is conveyed before work begins. EQM follows the guidelines established in our Confidential Business Information policy and signs non-disclosure agreements prior to the start of work as required.

## 9. REVISION HISTORY

The EQM Director, Health and Safety, or designee is responsible for reviewing this procedure and initiating revisions when necessary. This procedure shall be reviewed at least every 3 years and the HSO must approve any revision.

<b>Date</b>	<b>Purpose / Description of Revision</b>	<b>Page(s) Affected</b>	<b>Authorized by</b>
9/2015	Update to new format	All	L. Foley
6/2016	Audit/review and update content--incorporate GHS	All	J. Kominsky










**APPENDIX A**

**PICTOGRAMS AND HAZARDS**

# Hazard Communication Standard Pictogram

As of June 1, 2015, the Hazard Communication Standard (HCS) will require pictograms on labels to alert users of the chemical hazards to which they may be exposed. Each pictogram consists of a symbol on a white background framed within a red border and represents a distinct hazard(s). The pictogram on the label is determined by the chemical hazard classification.

## HCS Pictograms and Hazards

<b>Health Hazard</b>  <ul style="list-style-type: none"> <li>• Carcinogen</li> <li>• Mutagenicity</li> <li>• Reproductive Toxicity</li> <li>• Respiratory Sensitizer</li> <li>• Target Organ Toxicity</li> <li>• Aspiration Toxicity</li> </ul>	<b>Flame</b>  <ul style="list-style-type: none"> <li>• Flammables</li> <li>• Pyrophorics</li> <li>• Self-Heating</li> <li>• Emits Flammable Gas</li> <li>• Self-Reactives</li> <li>• Organic Peroxides</li> </ul>	<b>Exclamation Mark</b>  <ul style="list-style-type: none"> <li>• Irritant (skin and eye)</li> <li>• Skin Sensitizer</li> <li>• Acute Toxicity (harmful)</li> <li>• Narcotic Effects</li> <li>• Respiratory Tract Irritant</li> <li>• Hazardous to Ozone Layer (Non-Mandatory)</li> </ul>
<b>Gas Cylinder</b>  <ul style="list-style-type: none"> <li>• Gases Under Pressure</li> </ul>	<b>Corrosion</b>  <ul style="list-style-type: none"> <li>• Skin Corrosion/ Burns</li> <li>• Eye Damage</li> <li>• Corrosive to Metals</li> </ul>	<b>Exploding Bomb</b>  <ul style="list-style-type: none"> <li>• Explosives</li> <li>• Self-Reactives</li> <li>• Organic Peroxides</li> </ul>
<b>Flame Over Circle</b>  <ul style="list-style-type: none"> <li>• Oxidizers</li> </ul>	<b>Environment (Non-Mandatory)</b>  <ul style="list-style-type: none"> <li>• Aquatic Toxicity</li> </ul>	<b>Skull and Crossbones</b>  <ul style="list-style-type: none"> <li>• Acute Toxicity (fatal or toxic)</li> </ul>

For more information:


## Pictograma para la norma sobre la comunicación de peligros

A partir del 1.º de junio de 2015, la norma de comunicación de peligros (HCS, por sus siglas en inglés) exigirá pictogramas en las etiquetas para advertir a los usuarios de los peligros químicos a los que puedan estar expuestos. Cada pictograma representa un peligro definido y consiste en un símbolo sobre un fondo blanco enmarcado con un borde rojo. La clasificación del peligro químico determina el pictograma que muestra la etiqueta.

### Pictogramas y peligros según la HCS

<b>Peligro para la salud</b>  <ul style="list-style-type: none"> <li>• Carcinógeno</li> <li>• Mutagenicidad</li> <li>• Toxicidad para la reproducción</li> <li>• Sensibilización respiratoria</li> <li>• Toxicidad específica de órganos diana</li> <li>• Peligro por aspiración</li> </ul>	<b>Llama</b>  <ul style="list-style-type: none"> <li>• Inflamables</li> <li>• Pirofóricos</li> <li>• Calentamiento espontáneo</li> <li>• Desprenden gases inflamables</li> <li>• Reaccionan espontáneamente (autorreactivos)</li> <li>• Peróxidos orgánicos</li> </ul>	<b>Signo de exclamación</b>  <ul style="list-style-type: none"> <li>• Irritante (piel y ojos)</li> <li>• Sensibilizador cutáneo</li> <li>• Toxicidad aguda (dañino)</li> <li>• Efecto narcótico</li> <li>• Irritante de vías respiratorias</li> <li>• Peligros para la capa de ozono (no obligatorio)</li> </ul>
<b>Botella de gas</b>  <ul style="list-style-type: none"> <li>• Gases a presión</li> </ul>	<b>Corrosión</b>  <ul style="list-style-type: none"> <li>• Corrosión o quemaduras cutáneas</li> <li>• Lesión ocular</li> <li>• Corrosivo para los metales</li> </ul>	<b>Bomba explotando</b>  <ul style="list-style-type: none"> <li>• Explosivos</li> <li>• Reaccionan espontáneamente (autorreactivos)</li> <li>• Peróxidos orgánicos</li> </ul>
<b>Llama sobre círculo</b>  <ul style="list-style-type: none"> <li>• Comburentes</li> </ul>	<b>Medio ambiente</b> (No obligatorio)  <ul style="list-style-type: none"> <li>• Toxicidad acuática</li> </ul>	<b>Calavera y tibias cruzadas</b>  <ul style="list-style-type: none"> <li>• Toxicidad aguda (mortal o tóxica)</li> </ul>

Para más información:

 <b>Standard Operating Procedure</b>		Procedure No.	<b>SOP 303</b>
		Issue Date:	December 2006
Title: <b>Flammable/Combustible Liquid Transfer Corrosive Liquid Transfer</b>			
Approved by:	Mark Douglas, T&D Coordinator	Revision No.	4

## 1.0 OBJECTIVE

It is the intent of Environmental Quality Management, Inc. (EQ) to protect employees against exposure to, and fires involving, solvents and flammable or combustible liquids. All employees who may work with such materials must be familiar with and comply with the provisions of this procedure.

## 2.0 PURPOSE

This procedure outlines general precautions personnel should take during the handling of solvents and flammable or combustible liquids. Precautions and required personal protective equipment (PPE) for specific chemicals are included in Material Safety Data Sheets (MSDS). This procedure is an overview of 29 CFR 1910.106. If questions arise concerning flammables or combustibles or the labeling of flammable or combustible liquid containers, reference should be made to the above standard. In the event of a conflict between the referenced standard and the MSDS, the more stringent requirement will prevail.

## 3.0 DEFINITIONS

**Alcohols** are hydrocarbon derivatives in which one or more hydrogen atoms have been replaced by a hydroxyl group (oxygen-hydrogen). They are flammable, water soluble, and leave no film.

**Boiling point** is that temperature at which a liquid boils and is an indicator of the relative vapor concentration present over liquids at any given temperature. (The higher the boiling point, the lower the vapor concentration.)

**Flammable limits** denote the range, in percentage by volume, of the material with air which will burn.

**Flammable solvents** are classified according to flash points and boiling points.

**Flash point** is that temperature at which sufficient flammable vapors are evolved from a liquid to obtain ignition. (The lower the flash point, the more flammable the solvent.)

**Halogenated hydrocarbons** are organic compounds containing chlorine, fluorine, and/or other halogens. They are primarily non-flammable and leave no oily residue.

Depending on their boiling point, they are used cold or in heated vapor degreasers. When exposed to flames, hot surfaces, or welding arcs, vapors of these materials decompose into highly toxic and corrosive vapors, such as phosgene or hydrogen chloride.

**Hydrocarbon solvents** are compounds consisting solely of hydrogen and carbon atoms. They are flammable in varying degrees and may leave a combustible residue or oily film.

**Ketones** are hydrocarbon derivatives containing oxygen atoms. They are flammable, water soluble, and dissolve some materials not affected by hydrocarbons or alcohols.

**Positive ventilation** is venting provided by ducting and fans or blowers, as opposed to comfort or natural ventilation.

**Safety containers** are of welded seam construction with excess pressure relieving closure and wire mesh screens to prevent the propagation of flames into the container. Safety containers are painted red (some with one yellow stripe). The contents of the container must be plainly labeled. Containers must be of a type approved by the National Fire Protection Association or Underwriters Laboratory.

**TLV** is the acronym for threshold limit value. Atmospheric contaminants in the form of gas or vapor are generally expressed as parts per million (ppm) by volume denoting parts of the material in 1 million parts of air. Threshold limit values are the occupationally acceptable limits set by the American Conference of Governmental Industrial Hygienists to which most employees may be continuously exposed during their 8-hour working days without any adverse effect on their health.

## 4.0 HAZARDS

- Direct skin contact, inhalation, ingestion of contaminants.
- Potential for fire or explosion during transfer.
- Potential for spills during transfer.
- Potential for chemical reaction during transfer.
- Slip, trip, and fall around transfer hoses and equipment.

## 5.0 GENERAL PROCEDURES

- Use chemical-resistant coveralls such as Saranex or butyl rubber when working with flammable/combustible liquids or when in the vicinity of open liquids.
- Use Level B respiratory protection when opening tanks, when monitoring intake vacuum hoses at the tank, when monitoring vacuum hoses at the discharge point, when ambient organic concentrations exceed 5 ppm, or when engaged in other high hazard/contact activities.

- Level C may be sufficient for non-intrusive perimeter activities if ambient concentrations are less than 5 ppm.
- Keep fire extinguisher in readily accessible locations.
- Ground or bond the tank and transfer truck prior to beginning transfer operations.
- Clear the area of all open flames or other ignition sources, and all flammable and combustible materials.
- Use spark-proof tools and equipment.
- Keep absorbants and spill containment equipment nearby in the event of a spill or leak.
- Conduct air monitoring for organics, flammable/explosive vapors, and oxygen as appropriate. Air monitoring equipment can be left in the work area unattended and programmed to sound an alarm if dangerous levels are encountered.
- Have an emergency escape route planned and a contingency plan in case of an accident.
- Be sure that all tanks are characterized and adequately and appropriately marked to avoid bulking of incompatible tanks.
- Conduct the transfer with extreme caution, remembering that fittings striking surfaces may cause sparks.

## 6.0 FLAMMABLE AND COMBUSTIBLE LIQUIDS

Class I Flammable Liquids include those having a flash point below 100°F. Class II Combustible Liquids include those having a flash point at or above 100°F, but below 140° F. Class III Combustible Liquids include those having a flash point at or above 140°F, but below 200°F.

Handling and storage of flammable or combustible liquids in closed or approved safety containers and avoiding exposure of the liquid surface to air are of fundamental importance in preventing potential fires or employee exposure.

Signs for flammable or combustible liquids are as follows:

- Flash point of 20°F or below: "DANGER! EXTREMELY FLAMMABLE."
- Flash point from 20°F to 100°F: "WARNING! FLAMMABLE."
- Flash point from 100°F to 200°F: "CAUTION! COMBUSTIBLE."

## 7.0 SOLVENTS

- Skin contact should be avoided. All solvents remove protective oils from the skin on contact, increasing the possibility of dermatitis and infection. Some solvents may be absorbed through the skin to produce systemic effects.

- Repeated skin contact can cause a person to become sensitized to a given solvent.
- All solvents have varying adverse effects if ingested. Hydrocarbon liquids produce respiratory complications if allowed to enter the lungs.
- Vapor concentrations from a given solvent are difficult to predict, and depend on the method of dispensing, agitation, temperature, air movement, and confinement. In any case, the concentration will be directly proportional to the area of the surface wetted under a given set of conditions.
- Some of the solvent vapors may be detected by odor before the TLV is reached. This is not a reliable method for protection against overexposure, however, since some solvents paralyze the sense of smell.
- Miscellaneous solvent supplies in work areas shall be reduced to the minimum amount necessary for daily operation.
- Solvent containers for bench use shall be the smallest practical size and shall provide a method of dispensing without pouring (by wetting cloth, squeeze bottle, or plunger type safety container).
- All wiping cloths used for solvents shall be placed in a closed container immediately after use.
- All solvent wastes must be disposed of by an environmentally approved method.
- Spills shall be cleaned up immediately by personnel using respiratory protection. Clear the area of other persons as necessary.
- No solvent shall be used in such a manner as to permit skin contact with the liquid. In most instances, this means that gloves must be worn.
- Solvent-contaminated clothing must be removed at once.
- Respiratory protection is required when solvents are not used in positively ventilated equipment nor in an outside area.
- When using solvents inside a pit or confined area, regardless of quantity, personnel must wear adequate respiratory and contact protection and comply with confined space entry procedures.
- Containers of solvents shall be labeled with an appropriate warning label.
- The following precautions must be observed when opening full drums of solvents or chemicals:
  - When opening full drums, all personnel in the immediate area must wear chemical goggles and a face shield.
  - The person opening the drum should also use Saranex and wear gloves.
  - When removing the bung, the barrel must be in an upright position and a proper bung wrench used. The bung is to be loosened one turn; after internal drum pressure reaches atmospheric pressure, the bung may be removed. Never place your face above a bung when opening it.

## **8.0 FLAMMABLE/COMBUSTIBLE LIQUID TRANSFER**


- The transfer should take place in an area that can be ventilated prior to and after the transfer.
- Electrical equipment in the transfer area shall be inspected prior to liquid transfer.
- All ignition sources shall be eliminated and prohibited, and No Smoking signs erected.
- Containers shall be appropriately bonded/grounded prior to and during flammable/combustible liquid transfer.
- Air monitoring shall be performed during transfer as necessary.
- Appropriate fire extinguishers and escape route (do not block the route with the transfer operation) shall be available in the area.
- Personnel shall wear appropriate personal protection in relation to the material to be transferred.
- Personnel shall limit contact with materials as much as possible.
- Personnel shall exercise caution if pumping material. Hoses and pumps shall be appropriate for the material and shall have adequate capacity for the rate/amount pumped.
- Personnel shall elevate or otherwise protect hoses, cords, etc., to prevent falls. Good housekeeping and adequate lighting shall be used.

## **9.0 CORROSIVE LIQUID TRANSFER**

- Personnel shall don appropriate splash protection (may include chemical goggles and faceshield, apron, chemical-resistant gloves, etc.). Respiratory protection and appropriate cartridges shall be used when necessary.
- Personnel shall limit contact with materials as much as possible.
- Precautions shall be taken when connecting/disconnecting hoses.
- Ensure that hoses, pumps, and containers are compatible with each other as well as the material being transferred.
- Personnel shall ensure that the hose and pump capacity is adequate for the rate being used.
- Elevate or otherwise protect hoses and cords to prevent falls.
- Be alert for wet surfaces, and clean up spills as quickly as possible.
- Use adequate lighting in the work area and maintain a clean work area.

## 10.0 HANDLING AND DISPENSING

- Drums or other containers containing flammable and combustible liquids should be stored in compliance with 29 CFR 1910.106(d). All drums are to be electrically grounded. Drip trays are to be provided under drum spigots.
- A bond (metal-to-metal grounding strap) is to be established between the container and drum prior to filling a container from the storage drum. Drums are to be equipped with an approved safety faucet and flexible metal hose. A pressure-vacuum relief vent is required for drums containing flammable or combustible liquids.
- Except in unusual cases as approved by the site safety officer, the maximum amount of flammable or combustible solvent (used for cleaning purposes) at any work station is limited to one quart.
- Rags, kimwipes, etc., contaminated with flammable or combustible liquids are to be placed in a safety container equipped with a fusible link lid.
- The contents of all containers of flammable or combustible liquids must be properly identified.
- Spill containment is required for all drum dispensing areas.
- All manually handled flammable or combustible liquids shall be handled in approved safety cans of no more than 5 gallons capacity and have a spring closing and flush arrester designed to safely relieve internal pressure when subjected to heat or fire.
- When flammable or combustible solvents must be used in wash containers, such as for paint sprayer cleaning, the containers must be provided with self-closing or fusible link closures.
- Flammable liquids in portable containers in excess of the daily supply must be sorted in approved flammable liquid storage cabinets with the door closed and latched after each use.
- Containers of flammable or combustible liquids shall be labeled with an appropriate warning label.
- NO SMOKING signs are to be posted in areas where flammable or combustible liquids are stored, dispensed, or used.
- Additional information and requirements for handling and storage of specific flammable or combustible liquids are included in the MSDSs or site safety plans.
- A suitable storage area must be designated for flammables or combustibles used on temporary job sites.

 <b>Standard Operating Procedure</b>		Procedure No.	<b>SOP 309</b>
		Issue Date:	February 2011
Title: <b>Hearing Conservation Program</b>			
Approved by:		Revision No.	0

## Appendix A: Form(s)

### 1. PURPOSE

This Hearing Conservation Program (HCP) covers all operations and work areas where employees and other personnel may be exposed to hazardous noise levels.

It is the policy of Environmental Quality Management, Inc. (EQM) to protect the hearing of all employees exposed to an 8-hour time weighted average (TWA) at or above an Action Level of 85 decibels A-weighted (dBA). In addition, this program applies to all employees working in areas or with equipment that has noise levels at or above 85 dBA. In accordance with this policy, EQM has established an HCP.

### 2. SCOPE

This document represents EQM's HCP in compliance with the OSHA Occupational Noise Exposure Standards (29 CFR 1910.95 and 29 CFR 1926.52). The purpose of this HCP is to provide a continuous, effective means for preventing work-related noise-induced hearing loss. This will occur by evaluating potential noise hazards, communicating information concerning these hazards, and establishing appropriate protective measures for employees. The measures that will be utilized to protect employees include engineering and administrative controls, personal protective equipment, and employee training and education. In addition, medical surveillance will provide an indication of the effectiveness of the HCP.

EQM employees encounter elevated noise levels as part of the various tasks performed. EQM understands the importance of educating employees regarding the nature of potential risks and protective equipment that must be used to prevent exposure. An informed employee will act and operate with a high regard for safety.

### 3. REFERENCES

For further information on the requirements of the OSHA Occupational Noise Exposure Standard, refer to:

- 29 CFR 1910.95, Occupational Noise Exposure.
- 29 CFR 1910.1020, Access to Employee Exposure and Medical Records.
- 29 CFR 1926.52, Occupational Noise Exposure.

## 4. DEFINITIONS

**ACGIH**—American Conference of Governmental Industrial Hygienists.

**Action Level**—The administrative levels at which noise could become detrimental (hazardous) to personnel and require engineering, administrative, and/or personal protective equipment controls.

- A noise exposure or noise dose at or above 85 dBA for any duration of time.
- Continuous, intermittent, or impact noise levels above 140 dBC.

**Audiogram**—A chart, graph, or table resulting from an audiometric test showing an individual's hearing threshold levels as a function of frequency.

**Audiologist**—A professional, specializing in the study and rehabilitation of hearing, who is certified by the American Speech-Language-Hearing Association or licensed by a state board of examiners.

**Baseline Audiogram**—The audiogram against which future audiograms are compared.

**Decibel (dB)**—Unit of measurement of sound level.

**Decibels A-Weighted (dBA)**—Sound level in decibels read on the A-Weighted network. The A scale significantly attenuates the very low frequencies and approximates the human hearing range.

**Decibels C-Weighted (dBC)**—Sound level in decibels read on the C-Weighted network. The C scale significantly attenuates the very low frequencies.

**Hazardous Noise Area**—Any area where personnel could be exposed to:

- An 8-hour time weighted average (TWA) noise exposure or noise dose at or above 85 dBA.
- Continuous, intermittent or impact noise levels greater than 140 dBC.

**Hazardous Noise Equipment**—Any equipment capable of generating:

- Noise levels at or above 85 dBA.
- Continuous, intermittent or impact noise levels above 140 dBC.

**Hertz (Hz)**—Unit of measurement of frequency, numerically equal to cycles per second.

**Noise Dose**—A measure of the noise exposure to which a person is subjected in the workplace.

**Sound**—The sensation produced through the organs of hearing. Sound is usually produced by vibrations transmitted in a material medium, commonly air.

**Sound Level**—A weighted sound pressure level.

**Standard Threshold Shift (STS)**—A change in hearing threshold, relative to the baseline audiogram, of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear, taking into account any changes due to aging.

**Threshold Limit Values (TLV)**—Refer to sound pressure levels and durations of exposure that represent conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect on their ability to hear and understand normal speech. The TLVs are issued by the ACGIH.

**Time-Weighted Average (TWA)**—Noise exposure averaged over a designated period of time (example: 8-hour TWA).

## **5. RESPONSIBILITIES**

### **5.1 Project Manager / Response Manager / Site Manager**

The management is responsible for:

- Maintaining access to a copy of the HCP and implementing the requirements of the program.
- Conducting and documenting noise surveys of areas/activities where potential noise exposures may be at or above an 8-hour TWA of 85 dBA.
- Performing a sound-level survey in areas where a change in activity, process, equipment, or controls may have resulted in either an increase or a decrease in employee exposure.
- Notifying the Corporate Health and Safety Director and affected employees when monitoring indicates an exposure at or above the Action Level.
- Instituting engineering controls (when feasible) to reduce noise levels (e.g., use sound-absorbing materials, tighten up loose parts, maintain equipment, etc.).
- Instituting administrative controls (e.g., postings, work zones, time limits, personnel rotation, etc.).
- Identifying equipment and areas having noise levels at or above 85 dBA with appropriate hearing protection labels and signage.
- Briefing personnel on the proper use/care of hearing protection.
- Maintaining sound-level meters, noise dosimeters, and field calibration equipment in accordance with manufacturers' instructions.

### **5.2 Corporate Health and Safety Director**

The Corporate Health and Safety Director is responsible for:

- Administering the HCP.
- Maintaining the written HCP.
- Providing technical guidance when necessary to personnel conducting noise surveys and exposure monitoring.
- Providing employee access to noise survey and noise dosimetry records.
- Recommending appropriate engineering and/or administrative noise controls.

- Developing and implementing training program for all employees required to be in the HCP that includes initial and periodic training.
- Maintaining records of training through EQ's training management system.
- Overseeing baseline and annual audiometric testing for employees covered by the HCP.
- Ensuring the appropriate certification of those responsible for audiometric testing and interpretation of audiometric results.
- Providing recommendations for the proper selection and fit of hearing protection.
- Informing employees in writing within 21 days when there is a determination that an STS has occurred based on a comparison of the annual audiogram to the baseline audiogram.
- Assisting when requested in coordinating appropriate responses to all inquiries by employees regarding noise exposure.

### **5.3 Designated Site Safety Officers**

- Ensure noise survey monitoring is conducted as appropriate for site activities
- Ensure personnel monitoring is conducted as appropriate for site activities
- Notify team and individuals of results
- Stop work if hearing protection needs to be upgraded or other measures implemented
- Ensure monitors are calibrated pre- and post- use

### **5.3 All Employees**

All employees will adhere to the following minimum requirements:

- Comply with HCP requirements when identified as being exposed to noise levels equaling or exceeding the Action Level.
- Comply with client site hearing protection requirements.
- Wear hearing protection when working in an identified hazardous noise area, or when exposed to hazardous noise equipment.
- Inspect and properly wear approved hearing protection.
- Store reusable hearing protection in a convenient and sanitary manner.
- Do not loan or interchange provided hearing protection devices with other personnel.
- Guard against damage to hearing protection.
- Attend HCP training.
- Report all cases of unusually high noise levels to management.

Employees who do not comply with the provisions of this program will be disciplined in accordance with our company policy of progressive discipline.

## **6. PROGRAM ELEMENTS**

This written HCP will be maintained by the Corporate Health and Safety Director and implemented by the management at all EQM work sites. This document will be available upon request to all employees and regulatory agencies.

### **6.1 Noise Monitoring and Employee Notification**

A noise exposure evaluation will be conducted by the (or designee) using an ANSI-approved sound level meter to identify the areas where employee noise exposure may exceed 85 dBA. Additional exposure evaluations will be conducted if changes in production, equipment, processes, or controls suggest that noise exposures may have significantly increased.

Employee exposure may be more thoroughly evaluated by the management (or designee) when requested by the Corporate Health and Safety Director with an ANSI-approved noise dosimeter that measures all continuous, intermittent, and impulsive sound levels between 80-130 decibels on the “A-weighted” scale (slow response).

All sound level meters and noise dosimeters used to evaluate employee noise exposure will be inspected and calibrated before and after each use.

The management (or designee) will ensure that affected employees are permitted to observe the exposure evaluation procedures and are notified of the results.

Employees identified with exposure levels at or above an 8-hour TWA of 85 dB will be notified of the results of the evaluation and will be required to enroll in the HCP.

EQM adheres to the current American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) which establish an 8-hour TLV-TWA of 85 dBA and a 3 dB doubling rate.

### **6.2 Audiometric Testing**

EQM has an established audiometric testing and evaluation program free of charge for employees whose exposures may be at or above an 8-hour TWA of 85 dBA. Generally, all employees who perform field work are included in the audiometric testing program as a component of EQM’s comprehensive Medical Surveillance Program, regardless of noise exposure conditions.

EQM uses a third party occupational medical surveillance administrator. Our provider uses a network of credentialed health clinics to perform occupational exams in accordance with EQM’s Medical Surveillance Program. This ensures audiometric testing is performed by a licensed or certified audiologist, otolaryngologist, or other physician, or by a technician who is responsible to an audiologist, otolaryngologist, or physician.

Our provider ensures all audiograms obtained pursuant to this standard practice instruction meet the requirements of 29 CFR 1910.95, Appendix C: Audiometric Measuring Instruments.

The success of the HCP with regard to each individual employee is evaluated by comparing annual audiograms to the baseline audiogram. This procedure, among others, helps to determine the effectiveness of the hearing protection program and, as a result, ensures the protection of employee hearing.

### **6.2.1 Baseline Audiometric Testing**

All employees who perform field work are provided baseline audiometric testing as a component of medical surveillance baseline medical examination, regardless of whether potential noise exposures are anticipated to be at or above an 85 dBA TWA. This approach allows for a more conservative evaluation of employee exposures, given the diverse environmental work conditions.

EQM requires baseline audiometric testing immediately upon new-hire employment, which is well within the 6 months of an employee's first exposure to noise above the action level required by 29 CFR 1910.95(g). Employees will use hearing protection until a baseline audiogram is obtained. Employees will be informed that baseline audiometric testing must be preceded by at least 14 hours without exposure to noise levels above 80 dB. Employees may use hearing protection to meet this requirement.

### **6.2.2 Annual Audiometric Testing**

All at-risk employees who perform field work are provided annual audiometric testing as a required component of EQMs Medical Surveillance Program, regardless of whether the employees' noise exposures are at or above an 85 dBA TWA. As in the case of baseline audiometric testing, this approach to annual audiometric testing allows more thorough monitoring of employee health.

An annual audiogram may be substituted for the baseline audiogram when the audiologist or physician evaluating the program declares:

- An STS is persistent, or
- The hearing threshold in the annual audiogram indicates a significant improvement over the baseline audiogram.

### **6.2.3 Standard Threshold Shift (STS)**

If a comparison of the annual audiogram with the baseline audiogram by EQM's occupational medical surveillance administrator indicates that an STS has occurred, a retest within 30 days will be conducted, and the second test may be considered the annual audiogram. If an STS is confirmed, the employee will be:

- Informed in writing within 21 days of the determination.
- Referred to an audiologist, otolaryngologist, or qualified physician for further evaluation.
- Provided with both the baseline and the most recent audiogram of the employee and the required records on the audiometer and the audiometric test room.
- Fitted or refitted with adequate hearing protection, shown how to use it, and required to wear it.

If a work-related STS is confirmed or the retest cannot be completed within 30 days of the annual audiogram and the loss meets the 25 dB or more loss criteria specified in 29 CFR 1904.10, the STS is a recordable event and will be properly recorded as described in Section 6.6.1.

### **6.3 Engineering and Administrative Controls**

According to 29 CFR 1910.95(b)(1) “when employees are subjected to sound exceeding those listed in Table G-16, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of Table G-16, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table.”

The management, with the assistance of the Corporate Health and Safety Director, will determine what engineering or environmental changes can be made to reduce noise levels if noise monitoring surveys identify work areas with exposure levels at or above 100 dB TWA. In addition, consideration will be given to implementing appropriate administrative controls, such as rotating employees in and out of high noise level areas.

### **6.4 Hearing Protection and Attenuation**

Employees who work in areas identified by the noise survey as having levels of 85dBA TWA or higher must be equipped with appropriate hearing protection. The Corporate Health and Safety Director will determine the type of hearing protection that will afford the best protection. Employees will be offered a choice of several styles and types of hearing protection that provide the best protection for the type of noise exposure.

Hearing protection will be provided at no cost to employees, and a variety of suitable types will be available for their selection. Hearing protection will be evaluated for its ability to adequately reduce noise exposures in the workplace.

Hearing protection will be required and provided for all employees with noise exposure at or above 85 dBA. This approach will satisfy 29 CFR 1910.95 (i) requirements by encompassing those employees with noise exposure:

- Equal to or greater than an 85 dBA TWA and who have experienced an STS, or
- Equal to or greater than an 85 dBA TWA for 6 months or more and who have not obtained a baseline audiogram.

Hearing protection attenuation will be determined by adhering to 29 CFR 1910.95, Appendix B, Methods for Estimating the Adequacy of Hearing Protector Attenuation and guidelines specified in OSHA CPL 02-02-035, Guidelines for Noise Enforcement; Appendix A. Appendix B to 1910.95

Requires employers to determine employee TWA exposure with the use of hearing protectors. A method approved by OSHA that is typically used in industry:

- Determine the employee’s noise exposure in dBA, then calculate the noise reduction.
- Subtract 7 dBA from the noise reduction rating (NRR) of the hearing protector.

- Subtract this difference from the TWA noise exposure. This remainder equals the TWA under the hearing protector.

### **Example**

An employee is exposed to a TWA of 88 dBA. The NRR of an ear plug is 32 dB. Calculate the TWA under the protector.

- Employee exposure = 88 dBA
- $32 \text{ dB} \quad 7 \text{ dB} = 25 \text{ dB}$
- $88 \text{ dBA} \quad 25 \text{ dB} = 63 \text{ dBA}$

## **6.5 Training and Information**

### **6.5.1 Training**

EQM will institute a training program for all employees who are exposed to noise at or above an 8-hour TWA of 85 dBA, and will ensure employee participation in such program.

The training program will be repeated annually for each employee included in the HCP. Information provided in the training program will be updated to be consistent with changes in protective equipment and work processes. Each employee will be informed of the following:

- The effects of noise on hearing.
- The purpose of hearing protection.
- Advantages, disadvantages, and attenuation of the various types of hearing protection.
- Instructions on the selection, fitting, use, and care of hearing protection.
- The purpose of audiometric testing and an explanation of the test procedures.

### **6.5.2 Information**

The Corporate Health and Safety Director will ensure copies of the OSHA Occupational Noise Exposure Standards (29 CFR 1910.95 and 29 CFR 1926.52) are available to affected employees and any pertinent informational materials related to the standards that are available from OSHA.

## **6.6 Recordkeeping**

### **6.6.1 Injuries and Illnesses Log**

When there is a work-related STS and the employee's total hearing level is 25 decibels (dB) or more above audiometric zero (averaged at 2000, 3000, and 4000 Hz) in the same ear(s) as the STS, the loss is recordable and will be recorded on the OSHA Log of Work-Related Injuries and Illnesses (OSHA Form 300) as required by 29 CFR 1904.10.

### **6.6.2 Record Maintenance**

Employee noise exposure records will be maintained by Human Resource Director's personnel medical files and are available upon request to our employees or an OSHA representative. General

noise survey data will be communicated to employees during daily safety meetings and maintained within project files. Employee noise exposure records will be retained for at least 2 years. All audiometric test records will be maintained by EQM's occupational medical surveillance administrator, and retained in accordance with requirements specified in Access to Employee Exposure and Medical Records (29 CFR 1910.1020). Each record will include:

- Audiogram with the name and job classification of the worker, date of the audiogram, and the examiner's name.
- Measurements of the noise levels in the audiometric test booth and the date of the last acoustic or exhaustive calibration of the audiometer.

### **6.6.3 Transfer of Records**

If EQM ceases to do business, employee exposure monitoring records will be transferred to the successor employer and maintained by the successor employer. Should the company cease to function entirely, the records will be provided to the respective employees, or as required by current law. If EQM's contracted medical surveillance administrator ceases to do business, all audiometric test records will be transferred to a new occupational medical surveillance administrator of EQM's choice.

## **7. EQUIPMENT**

- Noise Dosimeter(s)
- Sound Calibrator(s)
- Sound Level Meter(s)
- For details on settings and requirements see the following link
- <https://www.osha.gov/dts/osta/otm/noise/exposure/instrumentation.html>

## **8. REVISION HISTORY**


The EQM Document Control Officer shall ensure this procedure is reviewed at least every three years and all revisions are tracked. If the Approver listed on the document is no longer responsible for the contents of this document, the VP of the Division will assign a new approver. The highlighted section may make more sense in the document control SOP. DCO is Jerry Day.

<b>Date</b>	<b>Purpose / Description of Revisions</b>	<b>Pages Affected</b>	<b>Authorized by</b>

## **APPENDIX A**

### **FORMS**

- Form 1
- Form 2

 <b>Standard Operating Procedure</b>	Procedure No.	<b>SOP 311</b>
	Issue Date:	February 2016
Title: <b>Personal Protective Equipment</b>		
Approved by:		Revision No. 0

- **Appendix A: PPE Assessment Form**
- **Appendix B:** Prescription Safety Glasses Policy
- **Appendix C:** Safety Footwear Policy

## 1. PURPOSE

It is the policy of Environmental Quality Management, Inc. (EQM) to protect its employees from personal injury and illness. When hazards cannot be controlled through engineering or administrative controls, EQM will implement the use of personal protective equipment (PPE).

## 2. SCOPE

This SOP is applicable to all EQM employees and contractors. Subcontractor employees must follow this procedure (at a minimum), unless the subcontractor's PPE requirements are more stringent.

## 3. REFERENCES

- 29 CFR 1910, Subpart I, Personal Protective Equipment.
- 29 CFR 1926, Subpart E, Personal Protective Equipment.
- ANSI Z41-1999, American National Standard for Personal Protection-Protective Footwear (or most current version).
- ANSI/ISEA Z87.1-2010, American National Standard for Occupational and Educational Personal Eye and Face Protection Devices (or most current version).
- ANSI/ISEA Z89.1-2009, American National Standard for Industrial Head Protection (or most current version).
- SOP 309, Hearing Conservation Program.
- SOP 332, Respiratory Protection Program.
- SOP 333, Working from Elevated Surfaces

**Note:** Additional SOPs may be applicable.

## 4. DEFINITIONS

**Affected employee**—Any employee performing work that requires the use of PPE in accordance with this policy.

**Approved**—PPE that has been certified as meeting specified design criteria published by a recognized consensus standards organization, i.e., ANSI, ASTM, NIOSH, or NFPA.

**ANSI**—American National Standards Institute, which oversees the creation, promulgation, and use of thousands of norms and guidelines that directly impact businesses in nearly every sector: from acoustical devices to construction equipment, from dairy and livestock production to energy distribution, and many more.

**ASTM**—Formerly known as the American Society for Testing and Materials, a globally recognized leader in the development and delivery of international voluntary consensus standards.

**Don**—Putting PPE on the body part that is to be protected so that the PPE maximizes the protection of the affected body part.

**Doff**—Removing PPE in such a way so as not to contaminate the employee.

**NIOSH**—National Institute for Occupational Safety and Health, the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness.

**NFPA**—National Fire Protection Association, which develops and provides consensus codes and standards, research, training, and education to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating.

**OSHA**—An acronym that can be used for either the Occupational Safety and Health Act or the Occupational Safety and Health Administration. In this SOP, it is used to refer to the Occupational Safety and Health Administration.

**Personal Protective Equipment (PPE)**—Any article of protective equipment worn by an employee to prevent injury or illness. Examples include eye and face protection, hand protection, protective clothing, foot protection, fall protection, and seatbelts for vehicle safety.

## 5. RESPONSIBILITIES

### 5.1 Management

The Project Manager / Response Manager / Site Manager (PM/RM/SM) is responsible for:

- Working with the client contact to determine if employees will be working in areas of the facility that require PPE and communicating the client PPE requirements to the employees.
- Ensuring all employees comply with this SOP, client-specified PPE requirements, and any special PPE requirements based on the work to be performed.

- Ensuring all employees working on a project have completed the required PPE training necessary for the project scope of work.
- Immediately stopping work and removing employees from the area if a situation occurs that may require different or additional PPE than originally determined.
- Communicating any work stoppage or PPE changes to the client.
- Complete a written and signed PPE Hazard Assessment for work tasks that are identified in the project scope of work.
- Ensure retraining of personnel as needed.
- Determining the adequacy, including proper maintenance, and sanitation of employee owned and provided PPE.
- Using performance management and progressive discipline when necessary to obtain the full compliance of employees with this SOP.

## **5.2 Corporate Health and Safety Director**

The Corporate Health and Safety Director is responsible for:

- Reviewing changes to the federal and state PPE regulations.
- Reviewing this SOP periodically for necessary changes and updating this SOP as required.
- Developing, revising, and implementing a PPE training program for employees to ensure employees understand the hazards and perform their work assignments in accordance with this SOP and the client's PPE requirements.
- Working with the job/site manager to provide PPE retraining as necessary for employees.
- Assisting the managers by specifying the appropriate PPE for the project scope of work.
- Assisting the managers with determining the adequacy, including proper maintenance and sanitation, of employee owned and provided PPE.

## **5.3 All Employees**

All employees will adhere to the following minimum requirements:

- Be aware of and comply with this SOP.
- Wear the appropriate level of PPE required for the task.
- Be aware of and comply with client-specific PPE requirements.
- Read and follow any client-provided guidelines or procedures related to PPE at their facility/site.
- Be aware of their activities and any changing work conditions to ensure that additional PPE is used as necessary based on those changes.
- Properly use (don, doff, adjust, and wear), care for, maintain, store and dispose of all PPE used during their EQM employment.

## **6. PROCEDURE**

### **6.1 Hazard Assessment**

Project leads will assess the work tasks to determine if hazards are present, or are likely to be present, that necessitate the use of personal protective equipment (PPE). If the use of PPE is necessary, the manager with the assistance of the Corporate Health and Safety Director will:

- Select the type of PPE that will protect the affected employee from the hazards identified in the PPE hazard assessment.
- Communicate selection decisions to each affected employee.
- Select PPE that properly fits each affected employee.
- Train on and require employees to use the selected PPE to protect themselves from the identified hazard.

The PPE hazard assessment will be documented and include a written certification by the EQM employee performing the PPE hazard assessment that the evaluation has been performed; the date(s) of the PPE hazard assessment; and which identifies the document as a certification of PPE hazard assessment. The original of the written PPE hazard assessment will be kept in the project/site files. Due to the nature of the majority of our work, short term project work, this document can be included as part of the Activity Hazard Analysis (AHA) or written into the site specific health and safety plan. In cases, where personnel are located on site for long term (in excess of one year), routine tasks will require a written PPE hazard assessment.

As listed in Section 6.6.6, EQM requires a minimum work uniform for all employees performing field work. The PM will specify, document, and communicate the PPE requirements to affected employees in circumstances where additional protection is required.

### **6.2 PPE Selection**

As stated in Section 6.1, the written PPE hazard assessment or AHA, will determine the types of PPE required to be worn by employees in a particular work area or job site. Specific items to be considered during the selection process are identified in Section 6.5, which explains the specific types of PPE covered by this SOP.

The selection process may identify multiple types of PPE that will provide adequate protection and provide the employee with choices in PPE to provide additional comfort to the employee. An example would be the ability of an employee to select either ear plugs or ear muffs as the hearing protection device to reduce noise exposure and prevent occupational hearing loss.

Selected PPE will be properly fitted to the employee to ensure it will provide the protection it is designed to provide the employee. During the fitting of the PPE, the employee will receive instruction in the proper donning, doffing, cleaning, inspection, and care of the PPE.

### **6.3 Payment for PPE**

Except as identified below, the protective equipment, including PPE, used to comply with 29 CFR 1910 Subpart I and 1926 Subpart E, will be provided by EQM at no cost to employees.

- EQM is not required to pay for non-specialty safety-toe protective footwear (including steel-toe shoes or steel-toe boots) and non-specialty prescription safety eyewear, because EQM allows and encourages employees to wear and use such items off the job-site to provide protection to the employee when performing non-job-related activities where similar hazards exist.
- If EQM provides metatarsal guards and allows the employee, at his/her request, to use shoes or boots with built-in metatarsal protection, EQM is not required to reimburse the employee for the shoes or boots.
- EQM is not required to pay for the following PPE items:
- Everyday clothing such as long-sleeve shirts, long pants, street shoes, and normal work boots.
- Ordinary clothing, skin creams, or other items, used solely for protection from weather, such as winter coats, jackets, gloves, parkas, rubber boots, hats, raincoats, ordinary sunglasses, and sunscreen.

EQM will pay for replacement PPE, except when the employee has lost or intentionally damaged the PPE.

When an employee provides adequate protective equipment he/she owns, EQM may allow the employee to use it and is not required to reimburse the employee for that equipment. EQM shall not require an employee to provide or pay for his/her own PPE, unless the PPE is identified as exempt from reimbursement or payment in this section.

### **6.4 PPE Use/Care/Maintenance/Disposal**

PPE is designed to protect a particular body part; however, it can only provide the protection when it is properly used and maintained. Each piece of PPE will be inspected by the employee for defects, cleanliness, and other issues that may impair its ability to protect the employee prior to each use. Defective or damaged PPE shall not be used. Section 6.5 presents information concerning the proper use, care, maintenance, and disposal of the various types of PPE.

### **6.5 Protective Equipment**

#### **6.5.1 Eye and Face Protection**

EQM ensures that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, or potentially injurious light radiation.

EQM requires the following with respect to the use of eye protection by employees:

- Eye and face protection will meet the current ANSI Z87.1 standard as the minimum requirement.
- Each eye and face protective device must be marked with the manufacturer's identification. Safety glasses with riveted or firmly attached side shields (thin slip-on side shields are unacceptable) are required for all employees entering EQM work sites including client facilities. Employees are prohibited from wearing fully tinted safety glasses inside buildings or as prohibited by the client. Only clear lenses and safety glasses designed for indoor/outdoor use will be permitted.
- Safety splash goggles and a face shield (designed for chemical splash) shall be worn when handling corrosive liquids.
- Safety dust goggles are to be worn in dusty environments.
- Safety glasses with side shields and face shields (designed for impact) shall be worn when grinding to protect the face from flying objects.
- A welding helmet with a filter lens that has a shade number appropriate for the work being performed for protection from injurious light radiation will be worn when doing welding or electrical arc welding.

See Appendix for Prescription Safety Glass purchase specifications. Note: Respirator inserts are provided by EQM. See Section 6.5.2.

### **6.5.2 Respiratory Protection**

EQM has developed and implemented SOP 332, Respiratory Protection Program, to protect employees from respiratory hazards. Please refer to that SOP for the detailed discussion and procedures associated with respiratory protection.

### **6.5.3 Head Protection**

EQM ensures that each affected employee wears protective head gear when working in designated construction areas and other areas where there is a potential for injury to the head from falling objects.

EQM requires the following with respect to the use of head protection by employees:

- Head protection will meet the current ANSI Z89.1 standard as the minimum requirement.
- Type I Hard Hats are intended to reduce the force of impact resulting from a blow only to the top of the head. This form of impact, for example, may result from a hammer or nail gun falling from above Type II Hard Hats are intended to reduce the force of lateral impact resulting from a blow which may be received off-center, from the side, or to the top of the head. This form of impact, for example, may result from contact with the sharp corner of a side beam
- Class E (Electrical) Hard Hats are designed to reduce exposure to high voltage conductors, and offer dielectric protection up to 20,000 volts (phase to ground). This amount of voltage

protection, however, is designated to the head only, and is not an indication of voltage protection allocated to the user as a whole.

- Class G (General) Hard Hats are designed to reduce exposure to low voltage conductors, and offer dielectric protection up to 2,200 volts (phase to ground). As is the case with Class E hard hats, this amount of voltage protection is designated to the head only, and does not account for voltage protection allocated to the user as a whole.
- Class C (Conductive) Hard Hats differ from their counterparts in that they are not intended to provide protection against contact with electrical conductors.

**Q.** What is the service life of my hard hat?

**A.** The hard hats are designed with high quality, wear-resistant materials but it WILL NOT last forever. The protective properties of the helmet WILL be degraded by exposure to many common work environments, such as temperature extremes, chemical exposure, sunlight and normal daily wear and tear. The following is a recommend replacement schedule:

- Hard Hat Suspension - replace after NO MORE THAN 12 months; Entire Hard Hat - replace after NO MORE THAN 5 years.

Remember that these are MAXIMUM useful service life guidelines. Wear or damage noticed during a regular inspection MUST be the determining factor for possible earlier replacement. In any case, ALWAYS replace the hard hat after it has withstood impact or penetration.

**Q.** There is a date code on the inside of my hard hat – is this when the service life starts?

**A.** A hard hat's service life starts when it is placed in service. This date should be recorded in the helmet, either on the ANSI label or with the use of a date of service label. The "date code" stamped on the inside of your hard hat refers to the date of manufacture, not the starting date for useful service.

**Q.** I have a suspension from a manufacturer other than the original manufacturer, can I use it?

**A.** NEVER attempt to interchange suspensions from one hat manufacturer to another. Use only the appropriate replacement parts from the original manufacturer. If you do not know who manufactured your hard hat you will need to replace the entire hard hat.

**Q.** Can I wear my hard hat backwards?

**A.** This depends on the manufacturer of your hard hat. If the suspension attachment points on your hard hat are the same from front to back, the suspension can be reversed and the cap worn with the brim facing the rear and still meet the requirements of the applicable protective headwear standard. Be sure that the suspension has been reversed so that the nape strap is in the rear. Many hard hat manufactures now offer swing-style suspensions that allow for you to quickly reverse the direction of your hard hat.

**Q.** Can I paint my hard hat?

**A.** Never paint a hard hat. Paint may chemically attack and damage the hard hat's shell, thereby reducing the degree of protection originally provided

- All employees will wear head protection in designated areas and where there is a possible danger or potential hazard of head injury.
- An employee's hairstyle should not interfere with the proper fit of a hard hat.
- Employees will not alter or modify the hard hat.

#### **6.5.4 Foot Protection**

EQM ensures that each affected employee wears protective footwear when working in designated construction and other areas where there is a potential for injury to the foot.

EQM requires the following with respect to the use of foot protection by employees:

- Safety footwear will meet the specifications of the current ANSI or ASTM Class 75 standard for footwear. Class 75 footwear will protect the foot from an impact of 75 foot-pounds and a compressive force of 2,500 pounds.
- Safety-toed shoes are required for employees entering client facilities unless the site client policy specifies a different level of foot protection.

ERRS and R&C personnel are required to have safety boots with a above the ankle protection.

- Rubber or chemical-resistant footwear with safety toes will be worn when working with chemicals.
- Open-toed and sandal-type footwear are prohibited in laboratories that store and use chemicals.
- Electrical-hazard-rated safety shoes will be worn by employees performing tasks dealing directly with electrical systems.
- Electrostatic dissipative footwear will be worn when static electricity is a concern.

See Appendix for purchase specifications.

#### **6.5.5 Electrical Protection**

Electrical PPE beyond electrostatic dissipative footwear is designed for use by individuals working with active electrical wiring and electrical equipment. This category of PPE includes insulating blankets, gloves, sleeves, matting, and insulating line hose. Only properly certified and qualified personnel are allowed to work on electrical circuits. Lockout/Tagout will be used prior to working on any electrical equipment.

#### **6.5.6 Hand Protection**

EQM ensures that each affected employee wears hand-protective PPE when working in areas where there is a potential for injury to the hands.

EQM requires the following with respect to the use of hand protection by employees:

- Gloves will be specified and worn based on the potential hand/arm hazard.
- Gloves comprised of thermal-resistant material to protect against burns will be worn when handling hot or extremely cold objects.
- Abrasive-resistant gloves will be worn when handling rough materials.
- Cut-resistant gloves will be worn when working with sharp or around sharp objects. Never place the non-cutting hand in the path of any sharp objects.

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- Chemical-protective gloves will be worn when handling hazardous chemicals and corrosives, depending on what the substance is and its requirements.
- Welder's gloves will be worn when welding to protect against heat, sparks, and flash burns.
- Surgical-type disposable gloves will be worn by emergency response teams when there is a potential for exposure to infectious blood or body fluids.

#### **6.5.7 Body Protection**

EQM ensures that each affected employee wears body-protective PPE when working in areas where there is a potential for injury to the body.

- Fire-protective clothing will be worn by welders and in areas where there is exposure to sparks and molten metal.
- Employees handling toxic or corrosive chemicals will wear chemical-protective clothing.
- Employees responding to emergency response activities will wear chemical-protective clothing designed for protection against the level of hazard present.

#### **6.5.8 Hearing Protection**

EQM has developed and implemented SOP 309, Hearing Conservation Program, to protect employees from excessive noise exposure. Please refer to that SOP for the detailed discussion and procedures associated with hearing protection.

#### **6.5.9 Fall Protection**

EQM has developed and implemented SOP 333, Working from Elevated Surfaces and Fall Protection, to protect employees when working at heights and exposed to falls. Please refer to that SOP for the detailed discussion and procedures associated with fall protection.

#### **6.5.10 Working Over or Near Water Protection**

EQM ensures that each affected employee working on or near water, where the danger of drowning exists, is provided with a U.S. Coast Guard approved life jacket or buoyant work vests. Please refer to SOP 320, Floating Plant and Marine Activities, for additional information on this topic.

#### **6.5.11 Seat Belts**

EQM ensures that each affected employee on company business wears seat belts and shoulder belts (where available) in the vehicle when operating a vehicle or when a passenger in a vehicle.

EQM requires the following with respect to the use of seat belts by employees:

- All company-owned vehicles and any vehicle operated for company business, consisting of personal vehicles, heavy equipment, rental vehicles, and chauffeured vehicles, will be equipped with seat belts.

- This requirement is not applicable to vehicles such as bicycles, all-terrain vehicles, scooters, golf carts, and any other vehicles without roll-over protective devices.
- Seat belts will be installed on special-purpose vehicles as required by other company policies.
- Seat belts will be worn by employees when a vehicle is in motion. This rule also applies to non-company employees operating vehicles being used for company business.
- Seat belts will be worn by employees occupying non-company vehicles operated by non-employees on company business.
- Seat belts will be adjusted to provide maximum protection. The lap belt will cross the pelvic area, not the abdomen. The shoulder harness will fit across the collarbone area. The shoulder harness will fit snugly, but will allow freedom of movement. For automatic seat belts, the lap belt must also be fastened. Seat belts will be worn in vehicles that have airbags.

### **6.5.12 High Visibility Vests**

Personnel working near roadway traffic or heavy equipment traffic shall wear high visibility vests.

Vests shall comply with ANSI/ISEA and be a minimum of Class 2 garment.

## **6.6 Hazardous Waste Operations and Emergency Response Site Protective Equipment**

Affected employees working on sites covered by OSHA 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, will wear the appropriate level of PPE based on the hazards at the site. Typically, the U.S. EPA terminology for the ensembles of protective equipment worn at these sites will be used (i.e., Levels A, B, C, and D). The ensembles of protective equipment are summarized below.

### **6.6.1 Level A**

Level A protection provides the same level of respiratory protection as Level B protection, but at a higher level of skin protection. Level A skin protection requires a fully-encapsulating suit (one-piece garment) that provides “gas-tight” integrity.

Level A protection shall be used when:

- An extremely hazardous substance requires the highest level of protection for skin, eyes, and the respiratory system;
- Substances with a high degree of hazard to the skin are known or suspected;
- Chemical concentrations are known to be above IDLH levels; and/or
- Biological hazards requiring Level A protection are known or suspected.

### **6.6.2 Level B**

Level B protection provides the same level of skin protection as Level C protection, but at a higher level of respiratory protection.

Level B protection shall be used when:

- The substance(s) has been identified and requires a high level of respiratory protection but less skin protection than Level A;
- Concentrations of chemicals in the air are IDLH or above the maximum use limit of an air-purifying respirator;
- Oxygen-deficient or potentially oxygen-deficient atmospheres (<19.5%) are possible; and/or
- Identification of gases and vapors is incomplete, but not suspected to be harmful to skin or capable of being absorbed through intact skin.

Level B PPE, at a minimum, shall consist of the following items:

- Positive-pressure, full-face Self-Contained Breathing Apparatus (SCBA), or positive-pressure Supplied Air Respirator (SAR) with escape.
- Hooded chemical-resistant clothing (overalls and long-sleeved jacket, coveralls, one- or two-piece chemical-splash suit, disposable chemical-resistant overalls).
- Chemical-resistant over-boots or chemical-resistant steel-toe/steel-shank boots.
- Chemical-resistant inner gloves (e.g., disposable nitrile).
- Chemical-resistant outer gloves (e.g., nitrile, viton, PVA, PVC).
- Sealed arm/leg/zipper joints with tape (as required).
- Hard hat.

### **6.6.3 Level C**

Level C PPE provides a higher level of respiratory and skin protection against chemical hazards compared to Level D PPE.

Level C protection shall be used when:

- Air contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin;
- The types of air contaminants have been identified, concentrations measured, and an air-purifying respirator is available that can remove contaminants; and/or
- The substance has adequate warning properties and all criteria for the use of an air-purifying respirator have been met.

Level C PPE, at a minimum, shall consist of the following items:

- Chemical-resistant over-boots or chemical-resistant steel-toe/steel-shank boots.
- Chemical-resistant inner gloves (e.g., disposable nitrile).
- Chemical-resistant outer gloves (e.g., nitrile, viton, PVA, PVC).
- Sealed arm/leg/zipper joints with tape, as required.
- Hard hat.
- Full-face, air-purifying respirator with appropriate cartridges.

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- Hooded chemical-resistant clothing (overalls and long-sleeved jacket, coveralls, one- or two-piece chemical-splash suit, disposable chemical-resistant overalls).

#### **6.6.4 Level D (Modified)**

Level D (Modified) PPE includes Level D PPE and a selection of one or more of the following items:

- Chemical-resistant over-boots or chemical-resistant steel-toe/steel-shank boots.
- Boot covers.
- Chemical-resistant inner gloves (e.g., disposable nitrile).
- Chemical-resistant outer gloves (e.g., nitrile, viton, PVA, PVC).
- Safety goggles/face shield.
- Hearing protection.
- Chemical-resistant clothing (overalls and long-sleeved jacket, coveralls, one- or two-piece chemical-splash suit, disposable chemical-resistant overalls).

#### **6.6.5 Level D**

Level D protection shall be used when:

- The atmosphere contains no known respiratory hazard; and
- Work functions preclude splashes, immersion, or the potential for unexpected inhalation of, or contact with, hazardous concentrations of harmful chemicals.

Level D protection equipment, at a minimum, shall consist of:

- Coveralls or work clothes.
- Safety shoes/boots with steel-toe/steel-shank.
- Work gloves – cotton or leather palm.
- Safety glasses.
- Hard hat.

#### **6.6.6 Minimum Work Uniform**

The minimum work uniform for EQM employees performing field work including work at EQM client industrial facilities includes:

- Coveralls or work clothes appropriate to the work to be performed.
- Safety shoes/boots in compliance with Section 6.5.4 of this SOP.
- Safety glasses in compliance with Section 6.5.1 of this SOP.
- Hard hat in compliance with Section 6.5.3 of this SOP.
- Certain work sites and activities may require use of high visibility vests.

## 6.7 Training

EQM employees are provided with initial PPE training prior to assignment to any activities where PPE is required. The training is tracked and documented in EQM's training management system. Additional PPE training is provided if:

- There is a significant change in workplace conditions;
- There is a significant change in types of PPE used; or
- The employee's knowledge or use of assigned PPE indicates the employee has not retained the understanding of this policy.

The PPE training ensures the employee knows:

- When PPE is required;
- What PPE is required;
- How to properly adjust, don, wear, and doff PPE;
- The limitations of the specific PPE; and
- The maintenance, life expectancy, care, and disposal of the various PPE.

During the fitting of the PPE, the employee will receive instruction in the proper donning, doffing, cleaning, inspection, and care of the specifically fitted PPE.

## 7. RECORDS

- Employee Training will be maintained in EQM's electronic learning management system.

## 8. FORM(S)

Appendix A. PPE Assessment

Activity Hazard Analysis (refer to doc)

## 9. REVISION HISTORY

The EQM Document Control Officer shall ensure this procedure is reviewed at least every three years and all revisions are tracked. If the Approver listed on the document is no longer responsible for the contents of this document, the VP of the Division will assign a new approver. The highlighted section may make more sense in the document control SOP. DCO is Jerry Day.

Date	Purpose / Description of Revisions	Pages Affected	Authorized by

**APPENDIX A**  
**PPE ASSESSMENT FORM**

**APPENDIX B**  
**PRESCRIPTION SAFETY GLASSES POLICY**

Employees shall wear protective eye equipment when working in areas where there is a danger of eye injuries due to flying objects. This policy applies to, but is not limited to, R&C, ERRS/GLNPOCS, Emission Measurement, and E&C on-site personnel.

The requirements pertaining to safety glasses are determined by Task Hazard Analyses or by client requirements.

Safety eyewear must meet the following criteria:

- ANSI Z87.1 (most current year) must be stamped on the frame.
- ATTACHED side shields are required.
- Task assessments will be completed to determine if more protective measures are required such as face shields or safety goggles.

Approved employees will be reimbursed every 2 years for eyewear purchases. For reimbursement, employees **must** provide a detailed receipt on their expense report listing the specific item purchased. Personnel who need prescription eyewear to complete daily activities not associated with EQM tasks will be eligible for prescription safety glasses when conducting EQM tasks. Currently, Wal-Mart Vision Centers are the only approved vendor. WAEs will be reimbursed for eyewear purchases based on their time worked for EQM vs calendar time; 1099s cannot be used for reimbursement.

### **Allotment for Safety Glasses**

The following allotments have been established for employee purchases of safety glasses.

- GLNPOCS, R&C, and Emission Measurement Personnel: \$240
  - Allotment includes:
    - o Frame, progressive (as needed) transition lenses.
    - o Attached side shields and polycarbonate lenses.
- E&C Field, ERR, and EQE Personnel: \$175
  - Allotment includes:
    - o Frame, progressive (as needed) lenses. (Transition lenses are not permitted due to percentage of indoor work.)
    - o Attached side shields and polycarbonate lenses.

This program is NOT intended for personnel who occasionally (less than quarterly) work on site. If circumstances require the use of prescription safety glasses, pre-approval must be obtained from the employee's manager. Office staff require manager approval for purchase of prescription safety glasses.

If an employee's glasses are damaged during the course of business while s/he is following proper practices, the Department VP may approve reimbursement outside of the normal 2-year schedule.

An employee's failure to wear proper protective eyewear, including safety glasses without side shields, as required by this policy will be treated in accordance with EQM's Disciplinary Action Procedures.

### **Implementation Schedule**

The 2-year rotation for purchases of prescription safety glasses begins in 2015. Allocation is based on the following time frame. Early allocation is permitted with Manager's approval.

- 2015, Qtr. 2—Last names starting with A-H
- 2015, Qtr. 3—Last names starting with I-P
- 2015, Qtr. 4—Last names starting with Q-Z

An employee's purchase of safety glasses should be based on his/her newest prescription. Thus, personnel may need to consider the timing of their next eye exam. If the results of an eye exam call for a new prescription and the employee just purchased a pair of safety glasses under the old prescription, s/he will NOT be approved for a new pair.

Prescription inserts will be provided for personnel wearing full-face respirators. Currently, Industrial Vision Corporation is the only approved vendor.

**Reimbursement requires the use of the proper accounting code (0600-125) and a detailed receipt. A copy of the receipt, including name and employee number, must be sent to QA for entry into Cybertrain.**

**APPENDIX C**  
**SAFETY FOOTWEAR POLICY**

Employees shall wear protective footwear when working in an area where there is a danger of foot injuries due to falling or rolling objects, objects piercing the soles of shoes, or electrical hazards. This policy applies to, but is not limited to, R&C and ERRS/GLNPOCS laborers, heavy equipment operators, response managers, site health and safety officers, on-site field clerks, on-site Emission Measurement and E&C personnel, EQE, and all subsidiaries as required.

Safety footwear must meet the following criteria:

- ASTM F 2412-05 and ASTM F 2413-05 will be stamped on the footwear.
- Slip-resistant shoes must be tested and certified slip resistant by the manufacturer.
- All footwear must have safety toes and puncture-resistant soles.
- Electrical-hazard-rated boots or metatarsal protection may be required based on specific job tasks.

Based on Task Hazard Analyses, appropriate footwear will be identified for the job and work tasks performed. Slip-resistant shoes are required for tasks regularly performed in wet or slippery locations. Certain conditions and tasks will require the use of boot covers or chemical-resistant steel-toe boots.

Each employee will be reimbursed up to \$175, including taxes, for safety boots. Reimbursements will be made only for footwear purchases (not accessories such as socks, cleaners, etc.). Employees **must** provide a detailed store or vendor receipt on their expense report listing the specific item purchased. Pre-approval is required by the employee's manager prior to footwear purchases outside of the normal cycle listed in this document. Initial purchase approval is required for all personnel who are not included in the annual cycle. Approval may require visual or photo documentation and is based on the manager's discretion.

WAEs will be reimbursed for footwear purchases based on their actual time worked for EQM vs calendar time. Verification of actual time worked can be obtained from the HR Manager.

1099s cannot be used for reimbursement unless specific footwear is required for a site. CyberTrain will be set up based on the actual purchase date.

## **Reimbursement Schedule**

The footwear reimbursement schedule is as follows:

- ERRS, GLNPOCS, R&C, and Emission Measurement Personnel
  - Annual: laborers, heavy equipment operators.
  - Every 2 years: Response Managers, Field Management Staff, Project Managers, Site Health and Safety Officers, Emission Measurement Personnel.
  - Every 3 years: Field Clerks.
- E&C/EQE Personnel
  - Every 3 years: Personnel who conduct site visits, site assessments, and field work.

If an employee's footwear becomes damaged during the course of business while s/he has been following proper practices, the Department VP can approve reimbursement outside of the schedule provided above.


## Implementation Schedule

The implementation schedule for footwear purchases is as follows:

- Annual footwear purchases begin in 2015. Allocation is based on the following schedule, but early allocation is permitted with Manager approval.
  - Qtr. 2—Last names starting with A-H
  - Qtr. 3—Last names starting with I-P
  - Qtr. 4—Last names starting with Q-Z
- The 2-year rotation for footwear purchases begins in 2015. Allocation is based on the following schedule, but early allocation is permitted with Manager approval.
  - 2015, Qtr. 2—Last names starting with A-F
  - 2015, Qtr. 3—Last names starting with G-L
  - 2016, Qtr. 2—Last names starting with M-S
  - 2016, Qtr. 3—Last names starting with T-Z
- The 3-year rotation for footwear purchases begins in 2015. Allocation is based on the following schedule, but early allocation is permitted with Manager approval.
  - 2015—Last names starting with A-H
  - 2016—Last names starting with I-P
  - 2017—Last names starting with Q-Z

An employee's failure to wear safety footwear as required by this policy will be treated in accordance with EQM's Disciplinary Action Procedures.

**Reimbursement requires the use of the proper accounting code (0600-125) and a detailed receipt. A copy of the receipt, including name and employee number, must be sent to QA for entry into Cybertrain.**

 <b>Standard Operating Procedure</b>	Procedure No.	<b>SOP 313</b>
	Issue Date:	February 2016
Title: <b>Hazard Identification and Risk Assessment</b>		
Approved by:		Revision No. 1

## Appendix A: Form

### 1. PURPOSE

It is the policy of Environmental Quality Management, Inc. (EQM) to prevent injuries and incidents from occurring at its various job sites. Identification of hazards in the workplace and assessing the overall risks posed is an important step in injury prevention. The hazard identification process is designed to identify all possible situations where EQM employees may be exposed to injury and/or illness in the workplace. Once the hazards have been identified, a risk assessment will be performed to help determine the likelihood of an injury or illness actually occurring. Risk controls will be implemented as required. The assessment system EQM utilizes is referred to as Activity Hazard Analysis (AHA).

This Standard Operating Procedure (SOP) encompasses the specific requirements of hazard identification and risk assessment. Affected EQM employees will participate in the overall process of identifying potential job hazards, developing the appropriate control measures, and understanding the various residual risk factors present within their job assignments.

### 2. RESPONSIBILITIES

#### 2.1 Project Manager/Site Manager/Response Manager

Management is responsible for:

- Reviewing the scope of work to be performed by employees and ensuring that adequate resources are available to safely manage the hazards identified at the various project sites where EQM performs work.
- Ensuring that all requirements contained within this SOP are supported and adequately enforced.
- Ensuring that EQM employees assigned to a project fully understand and are provided a specific opportunity to participate in the hazard identification and risk assessment process.
- Ensuring that EQM employees assigned to a project are properly trained in hazard identification and risk assessment process.

#### 2.2 Corporate Health & Safety Director

The Corporate Health & Safety Director is responsible for:

- Reviewing this SOP periodically for necessary changes and for updating it as needed.

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- Developing, revising, and providing a training program for all employees in the hazard identification and risk assessment process.

## **2.3 All Employees**

All EQM employees must meet the following minimum requirements:

- Adhere to all requirements contained in this SOP.
- Actively participate in the hazard identification and risk assessment process related to their job assignments.
- Recognize the role each person has in the recognition of hazards in the work place and be willing to voice his/her observations so that measures are taken to minimize the risks.
- Receive all required training as outlined in this SOP.

Employees who do not comply with the provisions of this SOP are subject to discipline as specified in the EQM policy of progressive discipline.

## **3. PROCEDURE**

### **3.1 Hazard Identification**

Hazards in a workplace arise from a variety of sources. These include but are not limited to weather, equipment or structural design, type of tasks being performed, installation, maintenance or repair, and exposure to hazardous substances and/or a hazardous process. The hazard identification process used by EQM is designed to identify all of the possible situations where employees may be exposed to potential injury or illness.

Affected EQM employees and subcontractors will be involved in the hazard identification process. It is expected that EQM employees and/or subcontractors whose job tasks are associated with these workplace hazards will provide input to the hazard identification process.

AHAs have been created for routine tasks that EQM employees complete. The general AHA will be updated with site specific information when employees arrive at the site. The information will be discussed with all personnel at the site conducting the activities. Updated AHAs will be added to the site specific safety plan.

For tasks in which an existing AHA is not available, the personnel involved in the task will create the AHA using the EQM template. The AHA will be reviewed by employees participating in the task and approved by management. New AHAs will be added to the site specific safety plan as well as the EQM AHA database.

EQM employees and subs will review the AHA during the pre-job task in order to become aware of the task hazards and controls implemented to reduce the risk of the inherent hazards.

For personnel located at facilities, hazard identification process will be repeated periodically when new job tasks are added to a project or when new hazards are introduced to a given work site.

In order to ensure that hazard identification is carried out on a frequent basis, the following criteria should be used to trigger an assessment:

- A change made to a job site's location
- A task involving manual handling of equipment
- A change in equipment/process from its original AHA
- When new information becomes available about a certain hazard
- When there is a workplace injury/illness associated with a previously identified hazard

### 3.2 Risk Assessment

Once specific hazards have been identified, the list should be included in the risk assessment that will determine the likelihood of those hazards contributing to an injury or illness.

The risk assessment phase must include the following:

- Whether any person would be exposed to the identified hazards under various scenarios, such as startup, routine operation, inspection, and maintenance
- What existing measures are in place to protect the health and safety of workers being exposed

What is the severity of injury or environmental event if the hazard resulted in an event. This will be considered with existing controls in place.

- How adequate these measures are to protect workers from these incidents actually occurring

The Probability/severity matrix will be used to determine the risk. The probability is:

- **Frequent**—Expected to occur when the task is conducted
- **Likely**—expected to occur at least once per year
- **Occasional**—Occurs every couple years
- **Seldom**—may occur over extended time (>5 years)
- **Unlikely**—not expected to ever occur

Severity is:

- **Catastrophic**—Disfiguring injury or fatality, property damage in excess of \$75K; environmental impact meeting or exceeding reporting criteria.
- **Critical**—Recordable injury may include lost or restricted days, property damage less than \$75K; environmental impact but does not include a fine.
- **Marginal**—First aid treatment is required, property damage less than \$2,000, no environmental damage
- **Negligible**—No treatment is required, no property damage or environmental release/damage

Utilizing the matrix, the AHA team can determine the Risk Assessment Code (RAC). This may be updated once the personnel evaluate the site specific conditions. The overall AHA RAC is based on highest risk level identified for any hazard within with job task.

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Risks at the L or M level can be completed based on current controls. H level risk requires Management and Corporate health and safety Director review. E level risk tasks are not to be completed.

It is necessary to consider the adequacy of existing control measures and determine if there is the potential that an employee would be exposed to that hazard.

Existing control measures must not be regarded as adequate simply because an incident has not occurred. This is especially true in those situations where only administrative controls (e.g., signage) or personal protective equipment (PPE) are used.

### **3.3 Risk Control**

New control measures must be introduced when the current measures in place are determined to be inadequate and there is a likelihood that an injury or illness can be reasonably expected to happen.

- If there are suitable and available means identified that can reduce the hazard and/or risk
- The cost of eliminating the hazard and/or risk.

The process used to identify new risk control measures must be done with individuals knowledgeable of risk evaluation protocol.

EQM will utilize the following hierarchy in selecting the control measures to ensure identified hazards are addressed and mitigated at each job site:

- Elimination or substitution of the hazards where feasible and appropriate.
- Use of engineering controls where feasible and appropriate.
- Work practices and administrative controls that limit worker exposures such as:
  - Isolating people from the source of potential exposure
  - Changing equipment for tasks that involve manual handling of materials
  - Use of personal protective equipment.

Once a decision is made to implement alternate risk control measures, an implementation plan must be developed to include:

- Specific actions
- Timetable for implementation
- Those responsible for execution of the actions.

If an immediate risk to health or safety is discovered during this evaluation process, the activity in question must be stopped until measures are taken to remove or eliminate the risk.

**NOTE!** All employees have the right and are encouraged to stop work they do not feel is safe, have questions about the process, feel conditions have changed or any other condition that warrants their concern. The employee will immediately notify the supervisor and ensure any hazard or concern is addressed before returning to the task.

### 3.4 Recordkeeping/Documentation

All records must be maintained to fully document the historical actions of hazard identification and risk assessment.

The following documents should be kept:

- When/where the hazard identification was completed
- Summary of hazards identified
- Summary of risks (if any)
- Type of risk assessment methodology used
- Any new measures identified
- Any measures that are not reasonably practical to implement
- Timeline for implementation
- Names of participants in the hazard identification, risk assessment, and risk control processes.

## 4. TRAINING

All EQM employees working on projects or at job sites must be trained in the basic elements of hazard identification and risk assessment.

EQM will provide training and information for new employees, before or at the time of initial assignment to a job involving exposure to a hazard. EQM will provide periodic training as often as necessary to ensure that employees are adequately trained and informed. EQM will provide additional training when safety & health information or a change in workplace conditions indicates that a new or increased hazard exists.

All training documentation will be kept in our Learning Management system

## 5. REVISION HISTORY

The EQM Document Control Officer shall ensure this procedure is reviewed at least every three years and all revisions are tracked. If the Approver listed on the document is no longer responsible for the contents of this document, the VP of the Division will assign a new approver. The highlighted section may make more sense in the document control SOP. DCO is Jerry Day.

Date	Purpose / Description of Revisions	Pages Affected	Authorized by

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## **APPENDIX A**

### **FORM**

- Activity Hazard Analysis (AHA) template

<b>JOB TASK:</b>		<b>BASIC RISK ASSESSMENT CODE (RAC):</b>																																						
<b>RECOMMENDED PROTECTIVE CLOTHING AND EQUIPMENT</b>		<div style="display: flex; align-items: flex-start;"> <div style="font-size: 0.8em; margin-right: 5px;"> E = Extremely High Risk  H = High Risk  M = Moderate Risk  L = Low Risk </div> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr> <th colspan="2" rowspan="2"></th> <th colspan="5">Probability</th> </tr> <tr> <th>Frequent</th> <th>Likely</th> <th>Occasional</th> <th>Seldom</th> <th>Unlikely</th> </tr> <tr> <td rowspan="4" style="writing-mode: vertical-rl; transform: rotate(180deg); font-weight: bold;">Severity</td> <td>Catastrophic</td> <td>E</td> <td>E</td> <td>H</td> <td>H</td> <td>M</td> </tr> <tr> <td>Critical</td> <td>E</td> <td>H</td> <td>H</td> <td>M</td> <td>L</td> </tr> <tr> <td>Marginal</td> <td>H</td> <td>M</td> <td>M</td> <td>L</td> <td>L</td> </tr> <tr> <td>Negligible</td> <td>M</td> <td>L</td> <td>L</td> <td>L</td> <td>L</td> </tr> </table> </div>				Probability					Frequent	Likely	Occasional	Seldom	Unlikely	Severity	Catastrophic	E	E	H	H	M	Critical	E	H	H	M	L	Marginal	H	M	M	L	L	Negligible	M	L	L	L	L
		Probability																																						
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	Marginal	H	M	M	L	L																																		
	Negligible	M	L	L	L	L																																		
<b>HAZARDS</b>		<b>CONTROLS (NOT ACTIONS) TO ELIMINATE OR MINIMIZE HAZARDS</b>																																						
<b>EQUIPMENT TO BE USED</b>	<b>INSPECTION REQUIREMENTS</b>	<b>TRAINING REQUIREMENTS</b>																																						
•	•	•																																						
<b>SITE-SPECIFIC HAZARD INFORMATION</b>																																								
Date:		Job Name:																																						
Prepared by:			Reviewed by:																																					
Add'l PPE/Eq:																																								
<b>HAZARDS</b>		<b>CONTROLS TO ELIMINATE OR MINIMIZE HAZARDS</b>																																						
		<b>Updated Risk Assessment Code:</b>																																						
<b>COMMENT(S):</b>																																								

 <b>Standard Operating Procedure</b>		Procedure No.	<b>SOP 315</b>
		Issue Date:	February 2013
Title: <b>Electrical Safety</b>			
Approved by:	John Kominsky, Corporate H&S Director	Revision No.	4

## 1.0 OVERVIEW

It is the policy of Environmental Quality Management, Inc. (EQ) to prevent injuries to all employees and ensure their safety at work. This Standard Operating Procedure (SOP) deals with the hazards associated with electricity and the associated electrical systems that are present in the workplace environment. EQ personnel performing work on electrical systems and equipment will follow standards set by the National Electrical Code (NEC) and the Occupational Safety and Health Administration (OSHA) in selecting materials and methods of installation and maintenance. Only qualified personnel are authorized to work on electrical systems and equipment.

## 2.0 RELATED DOCUMENTS

This procedure specifies the requirements for electrical equipment and methods as described in:

29 CFR 1910 – Subpart S-Electrical  
NFPA 70 – National Electrical Code  
SOP 317 – Hazardous Energy Control Program (Lockout/Tagout)

## 3.0 RESPONSIBILITIES

### 3.1 Project Manager/Site Manager/Response Manager

The Project Manager/Response Manager/Site Manager is responsible for

- Reviewing the scope of work to be performed by employees and identifying those tasks that present potential electrical hazards at a job site.
- Enforcing all requirements contained within this SOP.
- Ensuring that defective equipment is taken out of service, tagged out of service, and repaired prior to its return to service.
- Ensuring that equipment used at project sites meets all criteria outlined within the scope of this SOP.
- Ensuring that only qualified electricians perform tasks on energized equipment.

### **3.2 Corporate Health & Safety Director**

The Corporate Health & Safety Director is responsible for:

- Reviewing this SOP periodically for necessary changes and updating it as needed.
- Developing, revising, and providing a training program for employees regarding the potential electrical hazards at all project sites
- Ensuring that a Site Safety Plan is developed for use at each project location

### **3.3 All Employees**

All EQ employees are responsible for:

- Adhering to all requirements contained in this SOP.
- Reporting any unsafe or hazardous conditions or acts that may cause injury to either themselves or any other employees.
- Receiving all required training as outlined in this SOP.
- Avoiding activities that could result in injury to themselves and/or others at the job site

Employees who do not comply with the provisions of this SOP are subject to progressive discipline in accordance with EQ policy.

## **4.0 PROCEDURE**

### **4.1 General Requirements**

No electrical work should be performed on any electrical system until it has been fully de-energized. The Lockout/Tagout procedure (HS-Fld-5 – Hazardous Energy Control Program) must be utilized so that field checks can verify all electrical power supply has been properly isolated and secured.

All employees performing working on or near exposed de-energized components are to perform their assigned work as though those systems are still in a “live” state with electrical power.

Only qualified electricians will be permitted to work on electrical equipment or permanent electrical wiring. All other employees must maintain a minimum 10-foot distance from electrical equipment that is subject to repair or maintenance at a job site.

Proper clearance and grounding procedures must be used.

When work is being performed underneath electrical lines, a minimum clearance of 10 feet must be maintained to avoid contact with any mechanical equipment or vehicle traffic.

All electrical circuits and equipment shall be de-energized and lockout/tagout accomplished before maintenance or repair work is started.

Single-phase electric hand tools and other single-phase portable electrical equipment must be approved by a recognized testing agency such as Underwriter's Laboratories.

Before each use, portable electrical appliances are to be examined for obvious deficiencies in the appliance, cord, and plug. If any deficiency is noted, the appliance is to be taken out of service, tagged, and then removed for either repair or replacement.

Extension cords are to be kept clean, dry, free of kinks, and protected from oil, hot or sharp surfaces, and chemicals. Extension cords used outdoors shall be Ground Fault Circuit Interrupter (GFCI) protected.

Extension cords must be inspected prior to each use for damage. Damage such as kinks, cuts in the insulation, or exposure of the conductor insulation resulting from the cord pulling out of the end pieces will result in the extension cord being removed from service and tagged for repair.

All extension cords shall be free from damage and are not to be placed across aisles, walkways, stairs, steps, through doors, through holes in the wall, or in areas where the cord may be damaged or become a tripping hazard.

## **4.2 PORTABLE ELECTRICAL EQUIPMENT**

Double-insulated portable industrial type electric tools meeting the requirements of the Underwriters Laboratory are authorized for use (ground wire not required). Where such equipment is employed, the equipment must be distinctly marked.

Portable electrical tools not provided with special insulating or grounding protection are not intended for use in damp, wet, or conductive locations (persons standing on the ground or on metal floors).

All portable electrical appliances and equipment where the non-current-carrying metal parts are exposed to contact by personnel shall be grounded by a continuous conductor of adequate capacity from the device to a grounded receptacle. The Site Safety Officer shall resolve any question that arises as to whether or not a particular appliance should be grounded.

Receptacles shall be grounded in one of two ways:

- A built-in ground wire of green color may be attached to the ground pole of the receptacle.

- The conduit system, if installed in an approved manner, may be relied upon for grounding of a receptacle serving single-phase appliances with ratings up to 230 volts.

At outside locations, all single-phase 15- and 20-ampere receptacle outlets operating at 230 volts or less that are not a part of the permanent wiring of the building or structure must have GFCI for personnel protection. The GFCI should be located at the power source so that all extension cords and tools are protected by the GFCI.

The outlet box for portable extension cords for outdoor use shall be of weatherproof type construction and maintained in good condition.

### **4.3 ELECTRICAL GUARDING**

Suitable access and working space shall be provided and maintained in the vicinity of all electric equipment to permit ready and safe operation and maintenance of such equipment.

The working space in the direction of access to energized parts in switchboards, control panels, fused switches, circuit breakers, panel boards, motor controllers, and similar equipment that require examination, adjustment, servicing, or maintenance while energized shall not be less than 36 inches deep (30 inches for installations built prior to 1981) and the side shall be 30 inches or the width of the equipment, whichever is greater.

The working space shall not be used for storage purposes. The "keep clear" area may be identified with suitable floor markings and/or posting of signs or decals on the equipment.

Energized parts of electrical equipment operating at 50 volts or more shall be guarded against accidental contact by the use of approved cabinets or enclosures.

The entrance to rooms and other guarded locations containing exposed energized parts shall be marked with a conspicuous warning sign forbidding unqualified persons to enter.

Project work can impact work place lighting and create visibility hazards. Employees may not enter spaces containing exposed energized parts unless illumination is provided that enables employees to work safely. Temporary (but adequate) lighting must be provided that will allow employees to perform work and to safely recognize equipment that is still energized.

Temporary covers, warning signs, and/or barricades are to be used when necessary to remove covers of electrical panels during construction, during major refurbishment, or to provide temporary power to an area.

Employees performing electrical work must wear non-conductive clothing or don insulated coveralls over personal clothing to avoid potential electrical shock. That is, apparel shall not be worn unless rendered non-conductive by covering, wrapping, or other insulating means.

All openings in boxes, enclosures, or fittings shall be effectively guarded or closed to afford protection substantially equivalent to that of the wall of the box, enclosure, or fitting.

All ladders that are used in project work must be equipped with non-conductive side rails.

All electrical components over 230 volts shall have signs stating "High Voltage" and the voltage of the electrical components.

If work is to be performed under overhead lines, the lines shall be de-energized and grounded, or other protective measures shall be provided before work is started. If the lines are to be de-energized, arrangements shall be made with the person or organization that operates or controls the electric circuits involved to de-energize and ground them. If protective measures, such as guarding, isolating, or insulating are provided, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

When an employee works in a confined or enclosed space (such as a manhole or vault) where electrical hazards may exist (e.g., exposed energized parts), the employer shall provide, and the employee shall use, protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and the like shall be secured to prevent their swinging into an employee and causing the employee to contact exposed energized parts.

Unwanted contact with electrical distribution systems shall be avoided by maintaining safe distances or clearances that are based on the rated power ranges of the equipment. Therefore, qualified employees will maintain the recommended safe distances shown in Table S-5 from 29 CFR 1910 Subpart S.

**Table S-5. Approach Distances for Qualified Employees**

<b>Alternating Current Voltage Range (phase to phase)</b>	<b>Minimum Approach Distance</b>
300 V and less	Avoid contact.
Over 300 V, not over 750 V	1 ft. 0 in. (30.5 cm).
Over 750 V, not over 2 kV	1 ft. 6 in. (46 cm).
Over 2 kV, not over 15 kV	2 ft. 0 in. (61 cm).
Over 15 kV, not over 37 kV	3 ft. 0 in. (91 cm).
Over 37 kV, not over 87.5 kV	3 ft. 6 in. (107 cm).
Over 87.5 kV, not over 121 kV	4 ft. 0 in. (122 cm).
Over 121 kV, not over 140 kV	4 ft. 6 in. (137 cm).

## **5.0 EXTENSION CORD REQUIREMENTS**

Extension cords are designed for and will be used for TEMPORARY USE ONLY! All other electrical connections will be made permanent by proper construction methods. Use of indoor extension cords greater than 50 feet in length is to be discouraged. All extension cords shall include a grounding conductor within the cable jacket and shall be equipped at each end with either explosion-proof or non-explosion-proof three-wire grounded receptacles and plugs (but not with one of each), depending on the location and intended use. (No "hybrid" ungrounded or external ground wire extension cords are permitted.)

If a cord is damaged, it shall be shortened or replaced by an electrician - never patched with electrical tape. Cords shall be protected against contact with oil, hot surfaces, and chemicals. Cords must not be hung over nails or other sharp edges or placed where vehicles may run over them.

## **6.0 ELECTRICAL FUSE REQUIREMENTS**

Circuits must be de-energized by lockout and tagout procedures (as specified in HS Fld-5 Hazardous Energy Control Program) before attempting to replace fuses.

Bridging of fuses or circumventing the normal operation of circuit breakers is prohibited.

Blown fuses shall **not** be replaced with fuses having a higher amperage or voltage rating. Fuses should be replaced in kind to maintain proper circuit protection.

A fuse puller should be used to remove fuses.

## **7.0 ENSURED ELECTRICAL GROUNDING REQUIREMENTS**

This program provides the minimum requirements for an ensured equipment grounding conductor program and reflects the requirements of 29 CFR 1910.304. It also applies to circuits and equipment not attached to a permanent building or structure.

EQ and its contractors will implement either a written ensured equipment grounding conductor program or use GFCIs when using temporary wiring (cords and plugs) in field work using any temporary electrical power source.

Cords and equipment will be inspected prior to each use for damage or missing parts. Equipment found to be defective will be taken out of service and repaired.

The Ensured Equipment Grounding Conductor Program will include the following:

- The written program.
- Designation of a competent person(s) to implement the program.
- Visual inspection of cords on a daily basis for deformed and missing pins, insulation damage, and indications of possible internal damage. Equipment found damaged or defective will be removed from service and repaired or expended.
- Cords and electrical circuits will be tested for the following:
  - Electrical grounding continuity
  - Correct attachment of grounding conductor
- Tests on cords outlined above shall be performed before the first use, before being returned to use after repair, after possible damage (such as being run over by a vehicle), and at least every 3 months.
- The tests outlined above must be recorded, and cords that have been tested identified.

## **8.0 TRAINING**

All EQ employees are required to be trained prior to working at job sites where potential electrical hazards are known to exist.


The training program must include the following:

- Full description of electrical hazards at the job site
- Evaluation of the methods to be used to avoid electrical hazards
- Recognizing those aspects of a project that require qualified electricians to perform those tasks
- Specific job tasks as outlined in the Site Safety Plan
- Selection and use of appropriate protective equipment.

All new employees must receive training prior to the start of any work where potential electrical hazards are present at a job site.

Refresher training is required whenever an employee demonstrates a need for retraining.

All training documentation will be kept by the Corporate Safety & Health Director.

 <b>Standard Operating Procedure</b>		Procedure No.	<b>SOP 316</b>
		Issue Date:	December 2006
Title: <b>Excavation and Trenching</b>			
Approved by:		Revision No.	3

## 1.0 PURPOSE AND SUMMARY

This procedure presents the federal requirements for excavation safety. Excavation operations pose unique and serious hazards. With very few exceptions, protective systems must be designed and installed to protect employees who enter excavations of 5 feet or more in depth. Accepted protective systems include sloping, shoring, and shielding. The protective system must be designed by a registered professional engineer (civil), and plans must be available for inspections on site. In addition to these federal requirements, some states and localities may require notification of trenching/excavation operations prior to beginning work.

## 2.0 DEFINITIONS

**Accepted Engineering Requirements**—Those requirements or practices which are compatible with standards required by a registered professional engineer.

**Angle of Repose**—The greatest angle above the horizontal plane at which a material will lie without sliding.

**Benching**—A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

**Competent Person (Federal OSHA, 29 CFR 1926.32(f))**—A person, such as a supervisor or engineer, who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees and who has the authority to take prompt corrective measures to eliminate them. Nomenclature for responsibilities equivalent to a competent person varies from state to state. For example, in California, the individual with excavation/trenching installation and supervision responsibilities is a "qualified person."

**Confined Space:** Enclosure having limited means for entry and exit, by reason of location, size, or numbers of openings; and unfavorable natural ventilation that could contain or produce dangerous air contaminants, flammable atmospheres, and/or oxygen deficiency.

**Design Engineer**—An individual, currently registered as a civil engineer in the applicable state, who, in all other respects, meets the requirements of a pertinent State OSHA Program, or Federal OSHA in terms of his or her ability to design shoring, sloping, benching, or alternate trench/excavation systems.

**Excavation**—Any man-made cut, cavity, trench, or depression in an earth surface, including its sides, walls, or faces, formed by earth removal.

**Project Manager**—An individual who is responsible to coordinate and direct the activities of both the Design Engineer and Project Supervisor. The Project Manager is responsible to assure that all pre-excavation requirements are met: site preparation, health and safety office notification, OSHA and internal project permitting, and employee training.

**Project Supervisor**—A person, such as a supervisor or engineer, who is familiar with the installation of shoring or sloping/benching systems and the attendant hazards of excavation or trenching operations. Project supervisors shall meet the particular requirements of State OSHA programs, or where applicable, the requirements of a Federal OSHA competent person. Project Supervisors shall assure that excavation/trenching work practices are properly followed.

**Sheeting**—The members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

**Shield**—A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Shields may be pre-manufactured or job-built in accordance with 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

**Shoring**—A structure such as a metal hydraulic, mechanical, or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

**Sloping**—A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

**Spoil**—The earth material that is removed in the formation of an excavation or trench.

**Support System**—A structure such as underpinning, bracing, or shoring which provides support to an adjacent structure, underground installation, or the sides of an excavation.

**Tabulated Data**—Tables and charts approved by a registered professional engineer and used to design and construct a protective system.

**Trench**—An excavation made below the surface of the ground. In general, the depth is greater than the width at the bottom, but the width of a trench at the bottom is not greater than 15 feet.

## **3.0 EXCAVATION AND TRENCHING**

### **3.1 Pre-Excavation Requirements**

#### **3.1.1 Underground Installations**

Prior to opening an excavation, the estimated location of utility installations such as sewer, telephone, fuel, electric, water lines, or any underground installations that may

reasonably be expected to be encountered during the excavation work shall be determined.

Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations.

When utility companies or owners cannot respond to a request within 24 hours - excluding weekends and holidays - (or longer if required by state or local law), or if the exact location of installations cannot be established, excavation may proceed with caution, provided detection equipment or other means to locate utility installations are used.

### **3.1.2 Surface Encumbrances**

All surface encumbrances (trees, poles, boulders, etc.) that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

### **3.1.3 Training**

Employees shall not be assigned, or permitted, to design, supervise, or work in or about excavations until they have completed formal classroom training on:

- types of hazards associated with excavation operations
- safe work practices and techniques
- a review of applicable Federal, state and local regulations
- a review of this procedure.

Tailgate Safety Meetings detailing the specific hazards of the work to be performed and safety precautions and procedures specific for the job shall be conducted by the project supervisor at the beginning of each shift for each job. The meeting shall be documented on the Tailgate Safety Meeting Form.

Formal training shall be complemented with on-the-job training and instruction by management as part of standard employee supervision, and to the extent necessary to assure compliance with this procedure, and all other applicable health and safety practices.

### **3.1.4 Hazard Assessment**

During the project planning stage, an assessment of potential hazards shall be made to include:

- the presence and quantity of hazardous substances in the area of the excavation.
- toxicity and flammability of hazardous substances present, or to be introduced into, the area of the excavation.
- potential for work meeting the definition of confined space work.
- the presence of nearby above-ground or overhead utility installations.
- exposure of the general public to the excavation operations.
- potential for surface water runoff into the excavation.

At this time, the Project Notification Worksheet must be completed.

## **3.2 Excavation Work Practices**

### **3.2.1 General**

Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with 29 CFR 1926.652. The project supervisor shall ensure that the required protective system is installed and maintained per the design specifications.

No employee shall be permitted to enter the excavation unless he/she is specifically required to do so. Unauthorized persons shall not be allowed access.

### **3.2.2 Supervision**

Work in an excavation shall at all times be supervised by an EQ project supervisor. This individual will remain outside of the excavation at all times, and will be responsible for identifying any unusual developments above ground which may warn of impending earth movement.

### **3.2.3 Access and Egress**

Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design. Ramp design and construction shall comply with 29 CFR 1926.651(c).

A stairway, ladder, ramp, or other safe means of egress shall be located in trench excavations that are 4 or more feet in depth so as to require no more than 25 feet of lateral travel for employees.

### **3.2.4 Protective Systems**

Protective systems designed in accordance with 29 CFR 1926.652(b) or (c) shall be installed except when:

- the excavation is made entirely in stable rock; or
- the excavation is less than 5 feet in depth, and examination of the ground by a competent person provides no indication of a potential cave-in.

Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

### **3.2.5 Placement of Spoil**

All spoil shall be placed at least 2 feet from the edge of the excavation. It is strongly recommended that spoil be placed 4 or more feet from the excavation edge so as not to cover surface indicators of subsidence (such as fissures or cracks). No method that disturbs the soil in place (such as driving stakes) shall be used to contain the spoil material.

### **3.2.6 Exposure to Falling Loads**

No employees shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded provided the vehicles are equipped with protection as specified in 29 CFR 1926.601(b)(6).

### **3.2.7 Warning System for Mobile Equipment**

When mobile equipment is operated adjacent to an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs.

### **3.2.8 Hazardous Atmospheres**

Where an oxygen deficient (less than 20.5% O<sub>2</sub>) or hazardous atmosphere exists, or could reasonably be expected to exist, the excavation shall be tested before employees enter.

Adequate precautions shall be taken to prevent employee exposure to oxygen-deficient or hazardous atmospheres. As appropriate, ventilation and/or respiratory protective devices shall be used.

Adequate precautions, including ventilation, shall be taken to prevent employee exposure to atmospheres containing a concentration of flammable gas in excess of 10 percent of the lower explosive limit (LEL) of the gas.

Testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

### **3.2.9 Water Accumulation Hazards**

Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation.

If water is controlled or prevented from accumulating by the use of water removal equipment. The water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

If the excavation work interrupts the natural drainage of surface water (streams, run-off channels), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation.

Excavations subject to run-off from heavy rains shall be inspected by a competent person in compliance with Subsection 4.2.10 below.

### **3.2.10 Stability of Adjacent Structures**

The stability of structures adjoining the excavation shall be supported to protect employees.

Excavation below the level of the base or footing of any foundation or retaining wall that could reasonably be expected to pose a hazard to employees shall not be permitted except when:

- a support system (underpinning) is provided to ensure the safety of employees and the stability of the structure; or
- the excavation is in stable rock; or
- a registered professional engineer has determined that the structure will be unaffected by the excavation; or
- a registered professional engineer has determined that such excavation will not pose a hazard to employees.

Sidewalks, pavements, and appurtenant structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

### **3.2.11 Protection of Employees from Loose Rock or Soil**

Employees shall be protected from loose rock or soil which could fall or roll from the excavation face. Such protection could be scaled to remove loose material or barriers could be installed.

Employees shall be protected from spoil or other materials or equipment which could fall or roll into the excavation. Such materials shall be kept at least 2 feet from the excavation edge, and/or retaining devices shall be used to prevent materials or equipment from falling or rolling into excavations.

### **3.2.12 Inspections**

A competent person shall make daily inspections of excavations, the adjacent areas, and protective systems for evidence of conditions that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions.

The inspection shall be made prior to the start of work, and as needed throughout the shift. Inspections shall be made after each rainstorm or other hazard-increasing event.

Where the inspection finds evidence of any hazardous condition, exposed employees shall be removed from the hazardous area until necessary precautions have been taken.

### **3.2.13 Fall Protection**

Where employees or equipment are permitted to cross over excavations, walkways or bridges with standard guardrails shall be provided.

Adequate barrier physical protection shall be provided at all remotely located excavations. All wells, pits, shafts, etc., shall be barricaded or covered. Temporary well, pits, shafts, etc., shall be backfilled as soon as possible.

### **3.3 Requirements for Protective Systems**

#### **3.3.1 Protection for Employees in Excavations**

Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed and installed in compliance with 29 CFR 1926.652(b) or 29 CFR 1926.652(c), except when

- the excavation is made entirely in stable rock; or
- the excavation is less than 5 feet in depth and a competent person determines there is no danger of cave-in.

Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

### **4.0 EXCEPTION PROVISIONS**

No exceptions to the requirements of this policy are permitted.

### **5.0 CROSS REFERENCES**

29 CFR 1926 Subpart P - Excavations  
§ 650; Scope, application and definitions  
§ 651; General requirements  
§ 652; Requirements for protective systems  
Appendices A - F, mandatory

### **6.0 FORMS AND CHECKLISTS**

Trench/Excavation Notification Worksheet. This form is mandatory. It is to be completed by the project manager and/or design engineer. After the form is completed, a copy is submitted to the responsible health and safety professional whom will review it, and make any necessary state or local notifications.

- Attachment 1. Selection of Protective Systems for Excavations 20 Feet or Less in Depth
- Attachment 2. Sloping Options
- Attachment 3. Shoring or Shielding Options
- Attachment 4. Responsibility Matrix
- Attachment 5. 29 CFR 1926 Subpart P - Excavations

## TRENCH/EXCAVATION NOTIFICATION WORKSHEET

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

Customer's Name: \_\_\_\_\_

Specific Jobsite Location: \_\_\_\_\_

Nearest Major Cross Street: \_\_\_\_\_

City: \_\_\_\_\_ County: \_\_\_\_\_

Name and Title of Site Supervisor: \_\_\_\_\_

Starting Date: \_\_\_\_\_ Estimated Completion Date: \_\_\_\_\_

High Voltage Lines in Proximity: YES \_\_\_\_\_ NO \_\_\_\_\_ How Near \_\_\_\_\_

Depth Range (ft): \_\_\_\_\_ Width Range (ft): \_\_\_\_\_ Length (ft): \_\_\_\_\_  
min max min max

Project Description: \_\_\_\_\_

Anticipated Soil Condition: Hard Compact \_\_\_\_\_ Unstable \_\_\_\_\_ Running \_\_\_\_\_

Ground Protection Method: Shoring \_\_\_\_\_ Sloping \_\_\_\_\_

Trench Shield \_\_\_\_\_ Alternate \_\_\_\_\_

**ALL METHODS MUST MEET ACCEPTED ENGINEERED REQUIREMENTS.  
PLANS MUST BE KEPT ON-SITE.**

Describe Chemical Hazards at Site: \_\_\_\_\_

Subcontractor's Name: \_\_\_\_\_

Equipment to be Used: \_\_\_\_\_

Design Engineer: \_\_\_\_\_ Project Supervisor: \_\_\_\_\_

Phone: (       ) \_\_\_\_\_

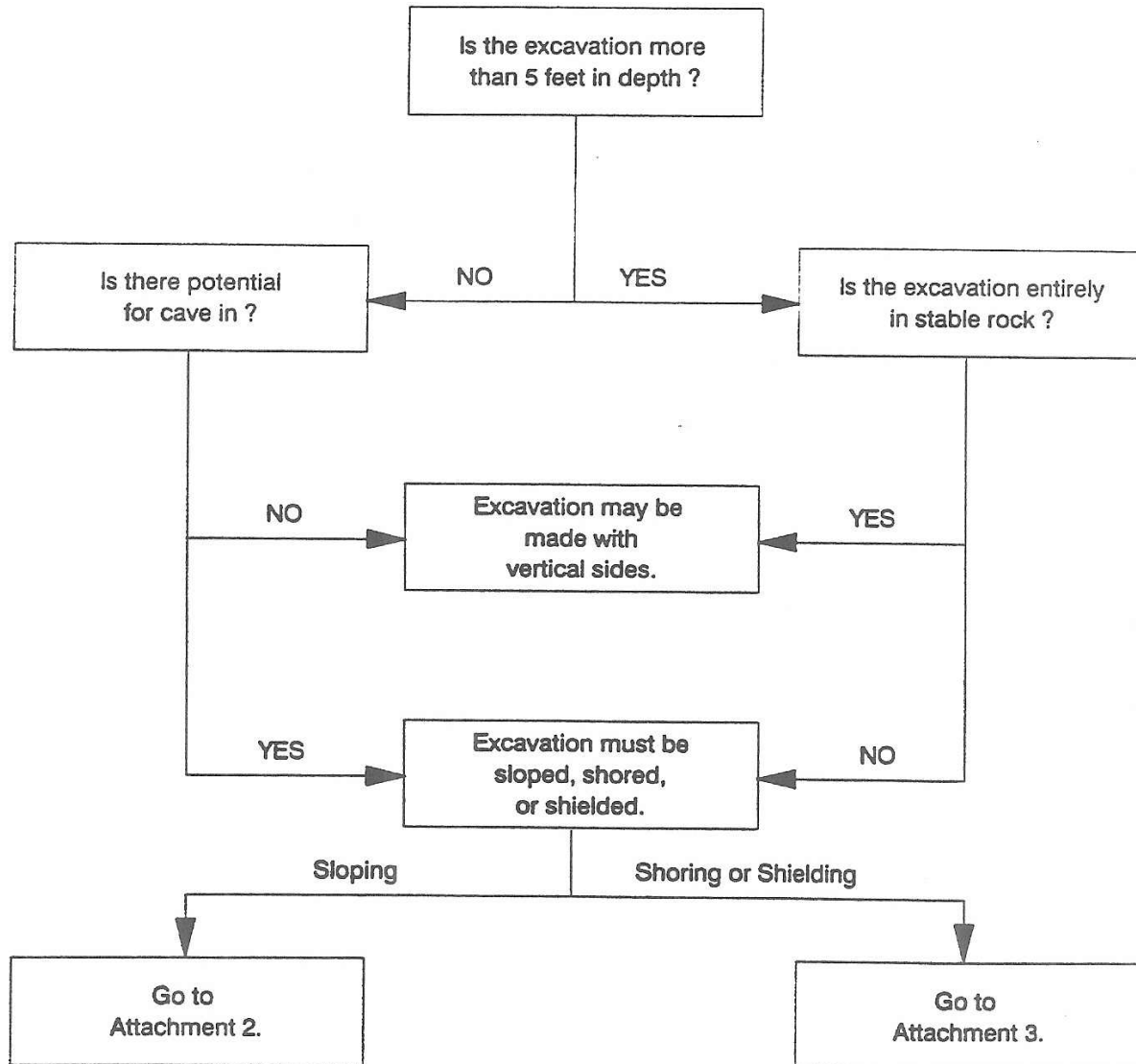
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### HEALTH AND SAFETY USE ONLY

EQ Permit Number: \_\_\_\_\_ Date Issued: \_\_\_\_\_ Expires: \_\_\_\_\_

Issued By: \_\_\_\_\_

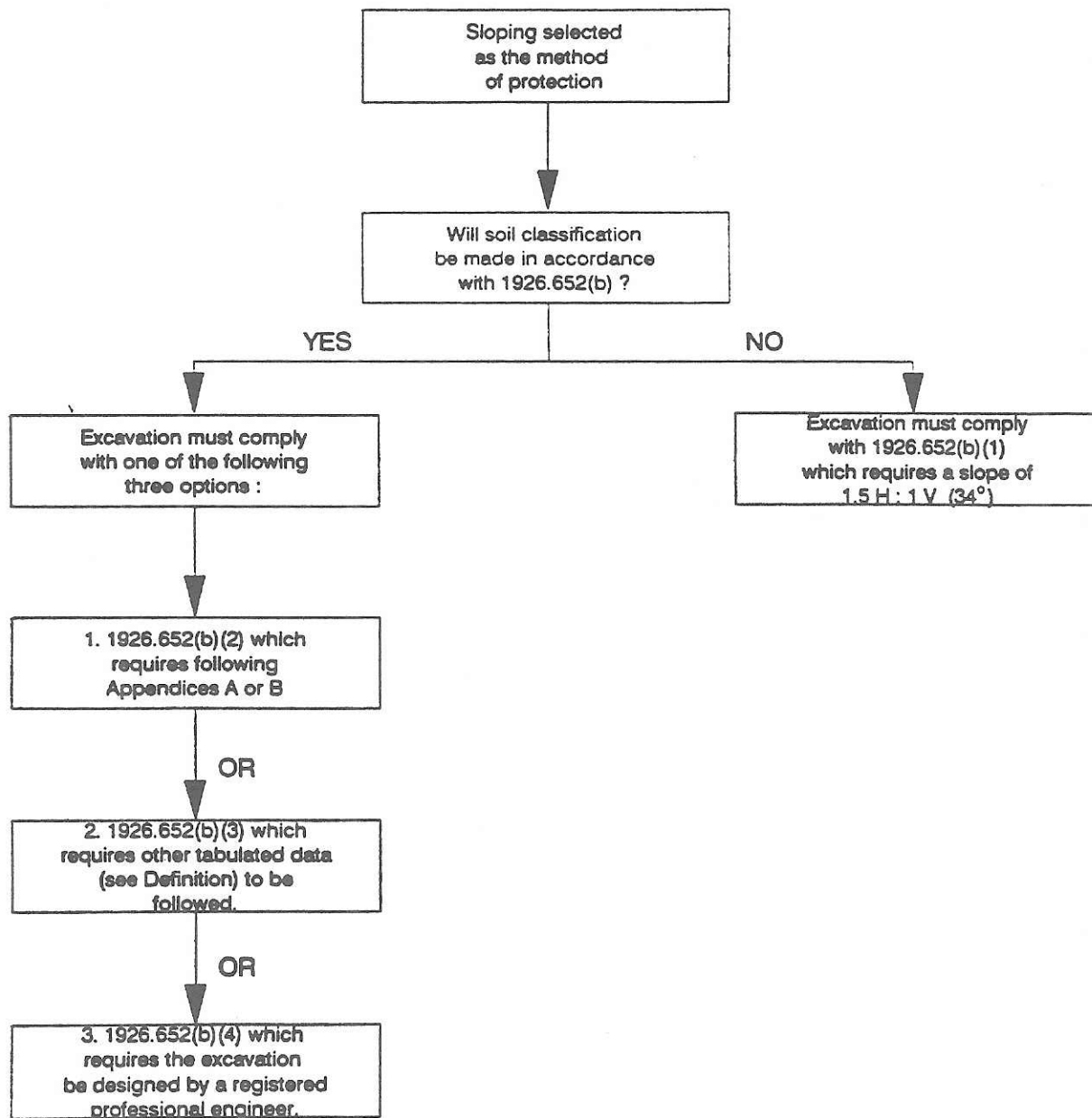
**ATTACHMENT 1.**  
**Selection of Protective Systems for Excavations**  
**20 Feet or Less in Depth**



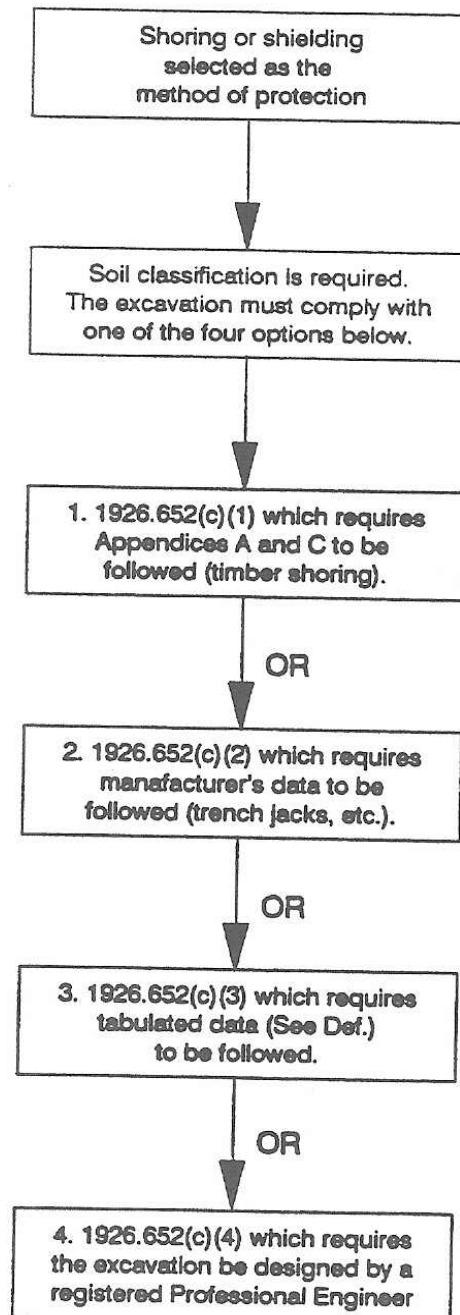
For excavations greater than 20 feet in depth,  
design by a registered professional engineer in  
compliance with 1926.652(b) and (c) is required.

## ATTACHMENT 2.

### Sloping Options



**ATTACHMENT 3.**  
**Shoring or Shielding Options**



## Subpart P--Excavations

Sec. 1926.650 Scope, application, and definitions applicable to this subpart.

Authority: Sec. 107, Contract Worker Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), or 9-83 (48 FR 35736), as applicable, and 29 CFR part 1911.

Source: 54 FR 45959, Oct. 31, 1989, unless otherwise noted.

(a) Scope and application. This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) Definitions applicable to this subpart.

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed, specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or sides means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with Sec. 1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See "Faces."

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See ``Shield."

Trench shield. See ``Shield."

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called ``sheeting."

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

## Sec. 1926.651 Specific excavation requirements.

(a) Surface encumbrances. All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) Underground installations. (1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c) Access and egress--(1) Structural ramps. (i) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

(ii) Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

(iii) Structural members used for ramps and runways shall be of uniform thickness.

(iv) Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

(v) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

(2) Means of egress from trench excavations. A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) Exposure to vehicular traffic. Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) Exposure to falling loads. No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or

unloaded when the vehicles are equipped, in accordance with Sec. 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) Warning system for mobile equipment. When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(g) Hazardous atmospheres--(1) Testing and controls. In addition to the requirements set forth in subparts D and E of this part (29 CFR 1926.50-1926.107) to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

(i) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

(ii) Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation in accordance with subparts D and E of this part respectively.

(iii) Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

(iv) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

(2) Emergency rescue equipment. (i) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

(ii) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

(h) Protection from hazards associated with water accumulation. (1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

(i) Stability of adjacent structures. (1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(ii) The excavation is in stable rock; or

(iii) A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(3) Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) Protection of employees from loose rock or soil. (1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) Inspections. (1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or

other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with Sec. 1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

[54 FR 45959, Oct. 31, 1989, as amended by 59 FR 40730, Aug. 9, 1994]

Sec. 1926.652 Requirements for protective systems.

(a) Protection of employees in excavations. (1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

- (i) Excavations are made entirely in stable rock; or
- (ii) Excavations are less than 5 feet (1.52m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) Design of sloping and benching systems. The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3), or, in the alternative, paragraph (b)(4), as follows:

(1) Option (1)--Allowable configurations and slopes. (i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(2) Option (2)--Determination of slopes and configurations using Appendices A and B. Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(3) Option (3)--Designs using other tabulated data. (i) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and shall include all of the following:

(A) Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;

(B) Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) Option (4)--Design by a registered professional engineer. (i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

- (ii) Designs shall be in written form and shall include at least the following:
  - (A) The magnitude of the slopes that were determined to be safe for the particular project;
  - (B) The configurations that were determined to be safe for the particular project; and
  - (C) The identity of the registered professional engineer approving the design.
- (iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.
- (c) Design of support systems, shield systems, and other protective systems. Designs of support systems shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(1); or, in the alternative, paragraph (c)(2); or, in the alternative, paragraph (c)(3); or, in the alternative, paragraph (c)(4) as follows:
  - (1) Option (1)--Designs using appendices A, C and D. Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.
  - (2) Option (2)--Designs Using Manufacturer's Tabulated Data. (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.
    - (ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.
    - (iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.
  - (3) Option (3)--Designs using other tabulated data. (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.
    - (ii) The tabulated data shall be in written form and include all of the following:
      - (A) Identification of the parameters that affect the selection of a protective system drawn from such data;
      - (B) Identification of the limits of use of the data;
      - (C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
    - (iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) Option (4)--Design by a registered professional engineer. (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) Materials and equipment. (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) Installation and removal of support--(1) General. (i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) Additional requirements for support systems for trench excavations. (i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) Sloping and benching systems. Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) Shield systems--(1) General. (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) Additional requirement for shield systems used in trench excavations. Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

#### Appendix A to Subpart P--Soil Classification

(a) Scope and application--(1) Scope. This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth

requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) Application. This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in Sec. 1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in Sec. 1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) Definitions. The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653-85 and D2488; The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS-121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical

sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or shear vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam.

Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

- (i) The soil is fissured; or
- (ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
- (iii) The soil has been previously disturbed; or
- (iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or
- (v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

- (i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand; or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) Requirements--(1) Classification of soil and rock deposits. Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) Basis of classification. The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) Visual and manual analyses. The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) Layered systems. In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) Reclassification. If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) Acceptable visual and manual tests.--(1) Visual tests. Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) Manual tests. Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) Plasticity. Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter.

Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) Dry strength. If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) Thumb penetration. The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488--`Standard Recommended Practice for Description of Soils (Visual--Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be

penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) Other strength tests. Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shear vane.

(v) Drying test. The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

## Appendix B to Subpart P--Sloping and Benching

(a) Scope and application. This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in Sec. 1926.652(b)(2).

(b) Definitions.

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and travelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) Requirements--(1) Soil classification. Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) Maximum allowable slope. The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(3) Actual slope. (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least  $\frac{1}{2}$  horizontal to one vertical ( $\frac{1}{2}$ H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with Sec. 1926.651(i).

(4) Configurations. Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1  
MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) <sup>[1]</sup> FOR EXCAVATIONS LESS THAN 20 FEET DEEP <sup>[3]</sup>
STABLE ROCK TYPE A <sup>[2]</sup> TYPE B TYPE C	VERTICAL (90°) 3/4 : 1 (53°) 1:1 (45°) 1½ : 1 (34°)

**NOTES:**

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

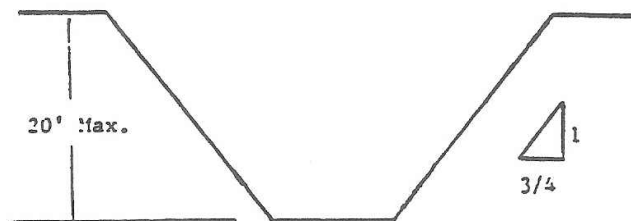
Figure B-1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

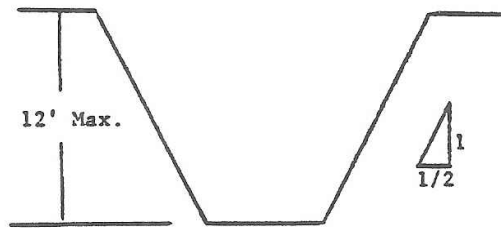
*B-1.1 Excavations made in Type A soil.*

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



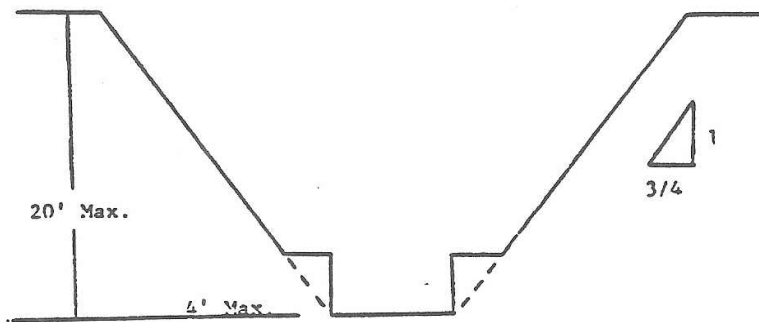
Simple Slope—General

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

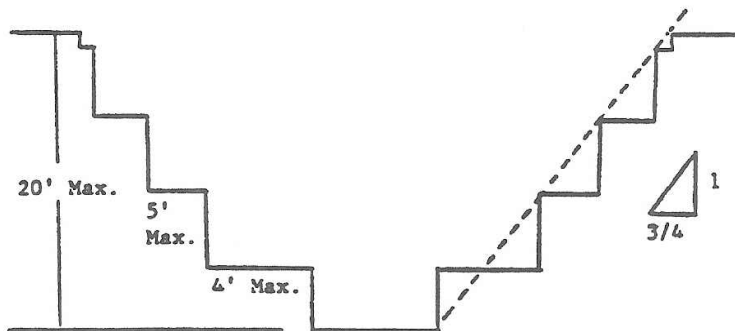


**Simple Slope—Short Term**

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of  $\frac{3}{4}$  to 1 and maximum bench dimensions as follows:

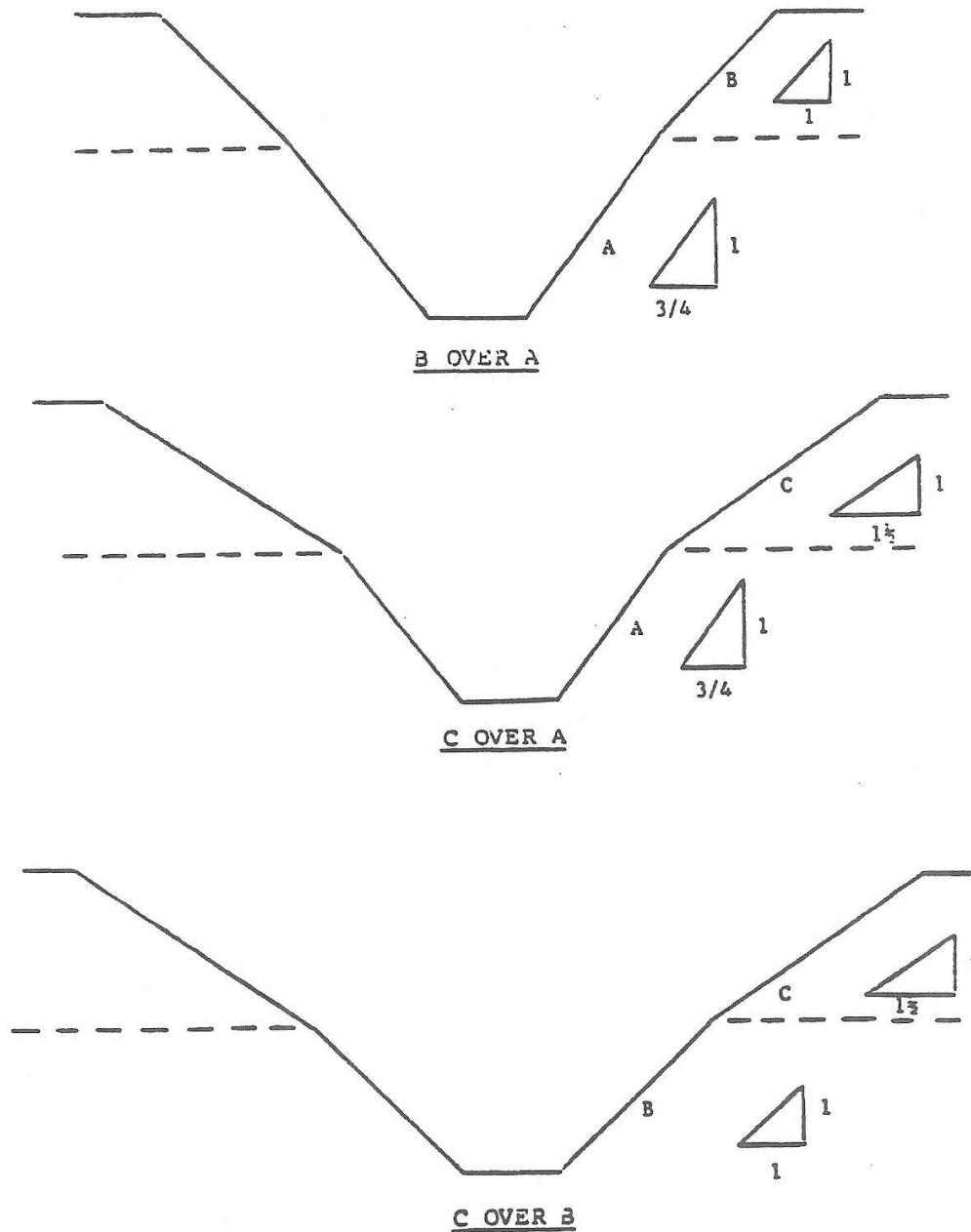


**Simple Bench**



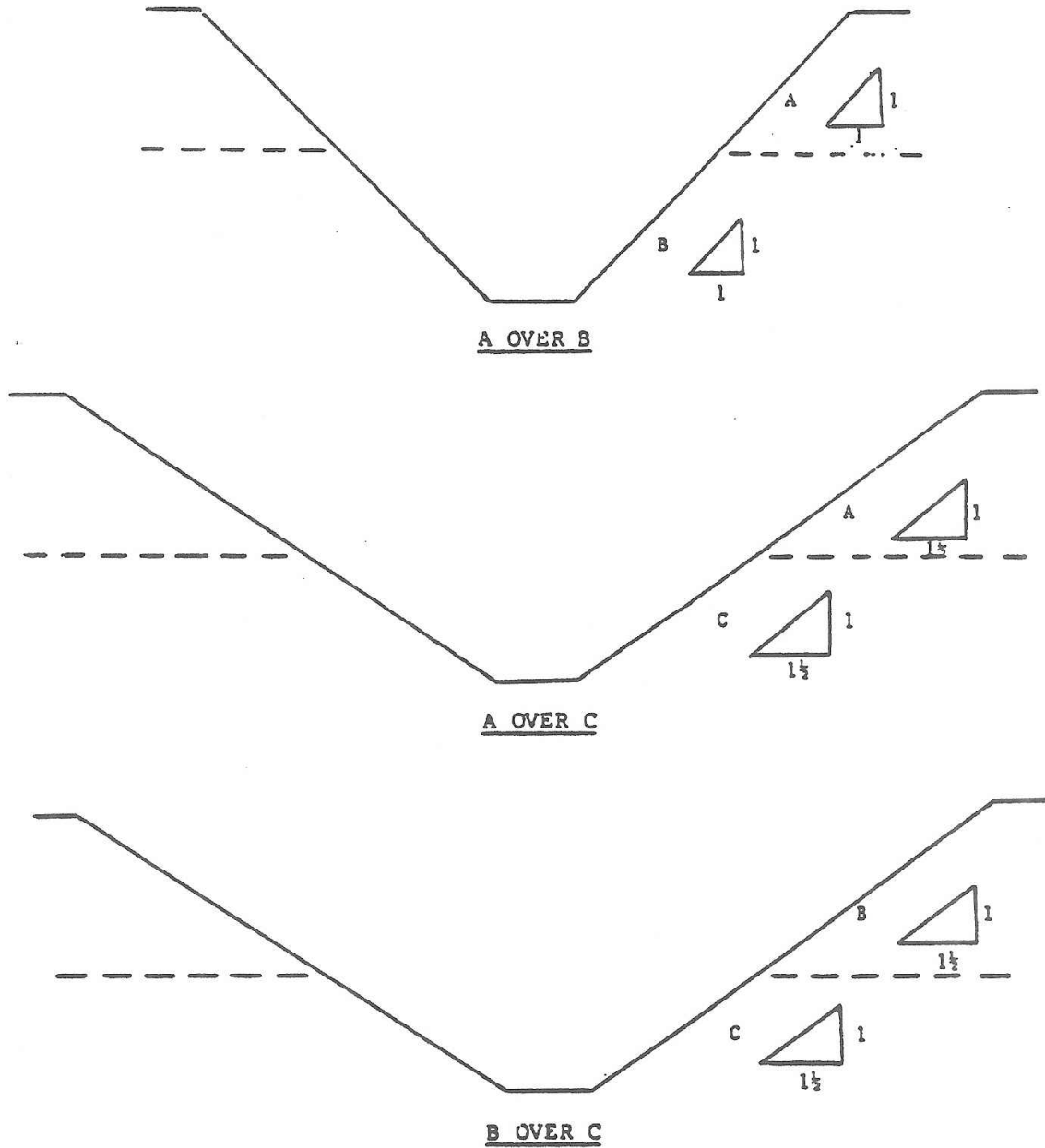
**Multiple Bench**

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.



# B-1.1 Excavations made in Type A soil.

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+

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of  $\frac{3}{4}$ :1.

#### Simple Slope--General

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of  $\frac{1}{2}$ :1.

#### Simple Slope--Short Term

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of  $\frac{3}{4}$  to 1 and maximum bench dimensions as follows:

#### Multiple Bench

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of  $3\frac{1}{2}$  feet.

#### Unsupported Vertically Sided Lower Portion--Maximum 8 Feet in Depth

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of  $3\frac{1}{2}$  feet.

#### Unsupported Vertically Sided Lower Portion--Maximum 12 Feet in Depth

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of  $\frac{3}{4}$ :1. The support or shield system must extend at least 18 inches above the top of the vertical side.

#### Supported or Shielded Vertically Sided Lower Portion

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under Sec. 1926.652(b).

#### B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

#### Simple Slope

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

#### Multiple Bench

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

#### Vertically Sided Lower Portion

4. All other sloped excavations shall be in accordance with the other options permitted in Sec. 1926.652(b).

### B-1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.

#### Simple Slope

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.

#### Vertical Sided Lower Portion

3. All other sloped excavations shall be in accordance with the other options permitted in Sec. 1926.652(b).

### B-1.4 Excavations Made in Layered Soils

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.

2. All other sloped excavations shall be in accordance with the other options permitted in Sec. 1926.652(b).

### Appendix C to Subpart P--Timber Shoring for Trenches

(a) Scope. This appendix contains information that can be used timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with Sec. 1926.652(c)(1). Other timber

shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in Sec. 1926.652(b) and Sec. 1926.652(c).

(b) Soil Classification. In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of this part.

(c) Presentation of Information. Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C-1.1, C-1.2, and C-1.3, and Tables C-2.1, C-2.2 and C-2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C-1.1 through C-1.3 and Tables C-2.1 through C-2.3 are presented in paragraph (g) of this Appendix.

(d) Basis and limitations of the data.--(1) Dimensions of timber members. (i) The sizes of the timber members listed in Tables C-1.1 through C-1.3 are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C-1.1 through C-1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C-2.1 through C-2.3, or have this choice under Sec. 1926.652(c)(3), and are referred to The Corps of Engineers, The Bureau of Reclamation or data from other acceptable sources.

(2) Limitation of application. (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in Sec. 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with Sec. 1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term "adjacent"

as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) Use of Tables. The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) Examples to Illustrate the Use of Tables C-1.1 through C-1.3.

(1) Example 1.

A trench dug in Type A soil is 13 feet deep and five feet wide.

From Table C-1.1, for acceptable arrangements of timber can be used.

#### Arrangement B1

Space 4 x 4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3 x 8 uprights at six feet horizontally. This arrangement is commonly called "skip shoring."

#### Arrangement B2

Space 4 x 6 crossbraces at eight feet horizontally and four feet vertically.

Space 8 x 8 wales at four feet vertically.

Space 2 x 6 uprights at four feet horizontally.

#### Arrangement B3

Space 6 x 6 crossbraces at 10 feet horizontally and four feet vertically.

Space 8 x 10 wales at four feet vertically.

Space 2 x 6 uprights at five feet horizontally.

#### Arrangement B4

Space 6 x 6 crossbraces at 12 feet horizontally and four feet vertically.

Space 10 x 10 wales at four feet vertically.

Spaces 3 x 8 uprights at six feet horizontally.

(2) Example 2.

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C-1.2 three acceptable arrangements of members are listed.



### Arrangement B1

Space 6 x 6 crossbraces at six feet horizontally and five feet vertically.

Space 8 x 8 wales at five feet vertically.

Space 2 x 6 uprights at two feet horizontally.

### Arrangement B2

Space 6 x 8 crossbraces at eight feet horizontally and five feet vertically.

Space 10 x 10 wales at five feet vertically.

Space 2 x 6 uprights at two feet horizontally.

### Arrangement B3

Space 8 x 8 crossbraces at 10 feet horizontally and five feet vertically.

Space 10 x 12 wales at five feet vertically.

Space 2 x 6 uprights at two feet vertically.

(3) Example 3.

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C-1.3 two acceptable arrangements of members can be used.

### Arrangement B1

Space 8 x 8 crossbraces at six feet horizontally and five feet vertically.

Space 10 x 12 wales at five feet vertically.

Position 2 x 6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

### Arrangement B2

Space 8 x 10 crossbraces at eight feet horizontally and five feet vertically.

Space 12 x 12 wales at five feet vertically.

Position 2 x 6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) Example 4.

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C-1.3. Only one arrangement of

members is provided.

Space 8 x 10 crossbraces at six feet horizontally and five feet vertically.

Space 12 x 12 wales at five feet vertically.

Use 3 x 6 tight sheeting.

Use of Tables C-2.1 through C-2.3 would follow the same procedures.

(g) Notes for all Tables.

1. Member sizes at spacings other than indicated are to be determined as specified in Sec. 1926.652(c), "Design of Protective Systems."

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

TABLE C-1.1  
 TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS \*  
 SOIL TYPE A  $P_a = 25 \times H + 72 \text{ psf}$  (2 ft Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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\* Mixed oak or equivalent with a bending strength not less than 850 psi.

\*\* Manufactured members of equivalent strength may be substituted for wood.

TABLE C-1.2

## TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS \*

SOIL TYPE B  $P_a = 45 \text{ X H} + 72 \text{ psf (2 ft. Surcharge)}$ 

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**										UPRIGHTS		
	CROSS BRACES					WALES		MAXIMUM ALLOWABLE HORIZONTAL SPACING					
	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)		VERT. SPACING (FEET)					
	HORIZ. SPACING (FEET)	UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15	UP TO 15	SIZE (IN)	5	5	CLOSE	2	3
5	UP TO 6	4X6	4X6	6X6	6X6	6X6	6X6	6X8	5	5			2X6
TO	UP TO 8	6X6	6X6	6X6	6X8	6X8	6X8	8X10	5	5			2X6
10	UP TO 10	6X6	6X6	6X6	6X8	6X8	6X8	10X10	5	5			2X6
	See Note 1												
10	UP TO 6	6X6	6X6	6X6	6X8	6X8	6X8	8X8	5	5	2X6		
TO	UP TO 8	6X8	6X8	6X8	8X8	8X8	8X8	10X10	5	5	2X6		
15	UP TO 10	8X8	8X8	8X8	8X8	8X10	8X10	10X12	5	5	2X6		
	See Note 1												
15	UP TO 6	6X8	6X8	6X8	8X8	8X8	8X8	8X10	5	5	3X6		
TO	UP TO 8	8X8	8X8	8X8	8X8	8X10	8X10	10X12	5	5	3X6		
20	UP TO 10	8X10	8X10	8X10	8X10	10X10	10X10	12X12	5	5	3X6		
	See Note 1												
OVER 20	SEE NOTE 1												

\* Mixed oak or equivalent with a bending strength not less than 850 psi.

\*\* Manufactured members of equivalent strength may be substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS \*

SOIL TYPE C P<sub>a</sub> = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**										UPRIGHTS	
	CROSS BRACES					VERT. SPACING (FEET)					MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2)	
	WIDTH OF TRENCH (FEET)					SIZE (IN)					CLOSE	
	HORIZ. SPACING (FEET)	UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15	VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)			
5	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5		2X6	
TO	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6	
10	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5		2X6	
	See Note 1											
10	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6	
TO	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5		2X6	
15	See Note 1											
	See Note 1											
15	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5		3X6	
TO	See Note 1											
20	See Note 1											
	See Note 1											
OVER 20	SEE NOTE 1											

\* Mixed Oak or equivalent with a bending strength not less than 850 psi.

\*\* Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING --- MINIMUM TIMBER REQUIREMENTS \*

SOIL TYPE B P = 45 X H + 72 psf (2 ft. Surcharge)

SIZE (S4S) AND SPACING OF MEMBERS **																
DEPTH OF TRENCH (FEET)	CROSS BRACES										WALES		UPRIGHTS			
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)						
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3	4	6		
5 TO 10	UP 6 TO	4X6	4X6	4X6	6X6	6X6	5	6X8	5				3X12 4X8		4	6
	UP 8 TO	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8				4X8	
	UP 10 TO	4X6	4X6	6X6	6X6	6X6	5	8X10	5			4X8				
	See Note 1															
10 TO 15	UP 6 TO	6X6	6X6	6X6	6X6	6X8	5	8X8	5		3X6	4X10				
	UP 8 TO	6X8	6X8	6X8	8X8	8X8	5	10X10	5		3X6	4X10				
	UP 10 TO	6X8	6X8	8X8	8X8	8X8	5	10X12	5		3X6	4X10				
	See Note 1															
15 TO 20	UP 6 TO	6X8	6X8	6X8	6X8	8X8	5	8X10	5		4X6					
	UP 8 TO	6X8	6X8	6X8	8X8	8X8	5	10X12	5		4X6					
	UP 10 TO	8X8	8X8	8X8	8X8	8X8	5	12X12	5		4X6					
	See Note 1															
OVER 20	SEE NOTE 1															

\* Douglas fir or equivalent with a bending strength not less than 1500 psi.

\*\* Manufactured members of equivalent strength may be substituted for wood.



## Appendix D to Subpart P--Aluminum Hydraulic Shoring for Trenches

(a) Scope. This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with Sec. 1926.652(c)(2).

(b) Soil Classification. In order to use data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) Presentation of Information. Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D-1.1, D-1.2, D-1.3 and E-1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D-1.1 and D-1.2 are for vertical shores in Types A and B soil. Tables D-1.3 and D-1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D-1.1 through D-1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled "Aluminum Hydraulic Shoring; Typical Installations."

(d) Basis and limitations of the data.

(1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D-1 Tables. Aluminum material is 6061-T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in Sec. 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Tables are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with Sec. 1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) Use of Tables D-1.1, D-1.2, D-1.3 and D-1.4. The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D-1.1 and D-1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D-1.3 and D-1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) Example to Illustrate the Use of the Tables:

(1) Example 1:

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D-1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The trench is 16 feet deep and 9 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote B2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically, plywood (per footnote (g)(7) to the D-1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working

space. From Table D-1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3 x 12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D-1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3 x 12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) Footnotes, and general notes, for Tables D-1.1, D-1.2, D-1.3, and D-1.4.

(1) For applications other than those listed in the tables, refer to Sec. 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to Sec. 1926.652(c)(2) and Sec. 1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch. thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

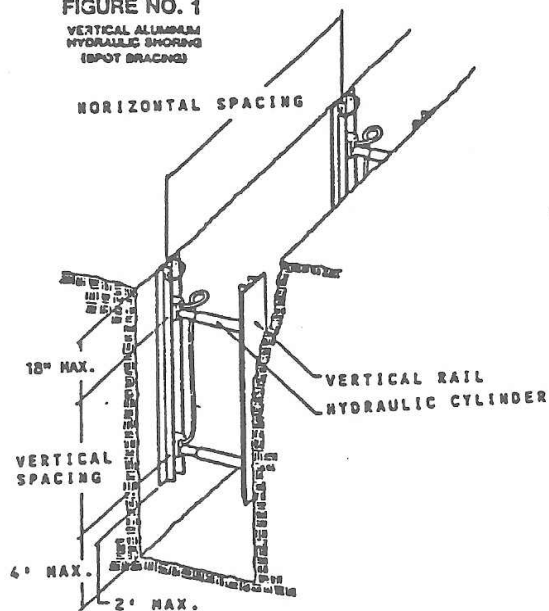
(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

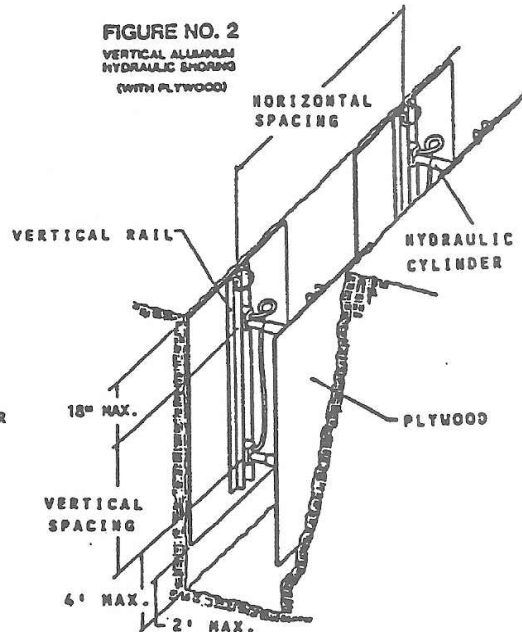
(10) See appendix D, item (d), for basis and limitations of the data.

## ALUMINUM HYDRAULIC SHORING TYPICAL INSTALLATIONS

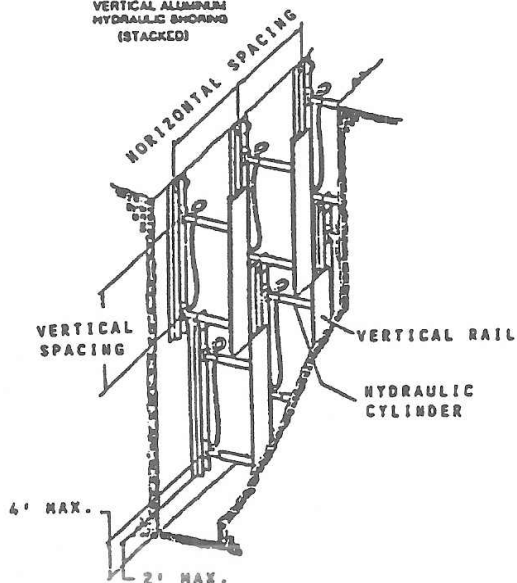
**FIGURE NO. 1**  
VERTICAL ALUMINUM  
HYDRAULIC SHORING  
(SPOT BRACING)



**FIGURE NO. 2**  
VERTICAL ALUMINUM  
HYDRAULIC SHORING  
(WITH PLYWOOD)



**FIGURE NO. 3**  
VERTICAL ALUMINUM  
HYDRAULIC SHORING  
(STACKED)



**FIGURE NO. 4**  
ALUMINUM HYDRAULIC SHORING  
WALE SYSTEM  
(TYPICAL)

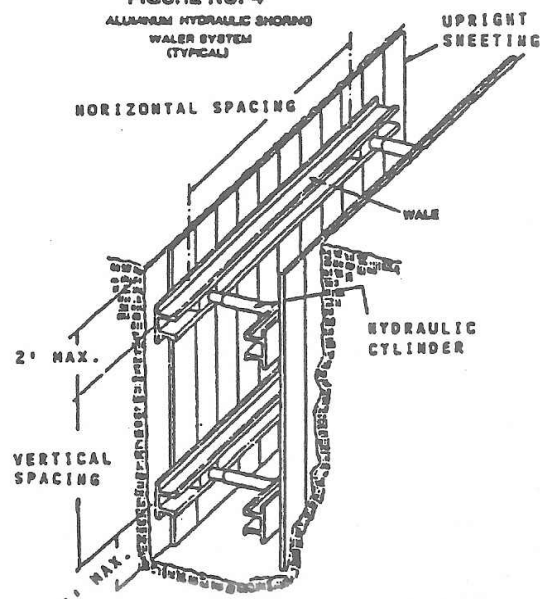


TABLE D - 1.1  
ALUMINUM HYDRAULIC SHORING  
VERTICAL SHORES  
FOR SOIL TYPE A

HYDRAULIC CYLINDERS					
DEPTH OF TRENCH (FEET)	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Note (1): See Appendix D, Item (g) (1)

Note (2): See Appendix D, Item (g) (2)

**TABLE D - 1.2  
ALUMINUM HYDRAULIC SHORING  
VERTICAL SHORES  
FOR SOIL TYPE B**

HYDRAULIC CYLINDERS					
DEPTH OF TRENCH (FEET)	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Note (1): See Appendix D, Item (g) (1)

Note (2): See Appendix D, Item (g) (2)

**TABLE D - 1.3**  
**ALUMINUM HYDRAULIC SHORING**  
**WALER SYSTEMS**  
**FOR SOIL TYPE B**

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
	VERTICAL SPACING (FEET)	SECTION MODULUS (IN <sup>3</sup> )	WIDTH OF TRENCH (FEET)						MAX. HORIZ. SPACING (ON CENTER)		
			UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE(2)	8.0	3 IN			
		7.0	9.0	2 IN	9.0	2 IN NOTE(2)	9.0	3 IN			3x12
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN		3x12	
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE(2)	5.5	3 IN	3x12		
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Notes (1): See Appendix D, item (g) (1)

Notes (2): See Appendix D, item (g) (2)

\* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

TABLE D - 1.4  
ALUMINUM HYDRAULIC SHORING  
WALER SYSTEMS  
FOR SOIL TYPE C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS							TIMBER UPRIGHTS	
	VERTICAL SPACING (FEET)	SECTION MODULUS (IN³)	WIDTH OF TRENCH (FEET)							SOLID SHEET	MAX. HORIZ SPACING (ON CENTER)
			UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15				
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	—	
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	—	
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12	—	
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Notes (1): See Appendix D, item (g) (1)

Notes (2): See Appendix D, item (g) (2)

\* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

SHILLING CODE 4510-36-C

Appendix E to Subpart P—Alternatives to Timber Shoring

Figure 1. Aluminum Hydraulic Shoring

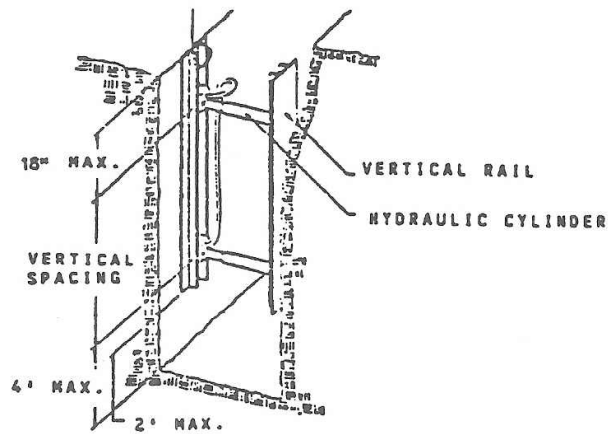
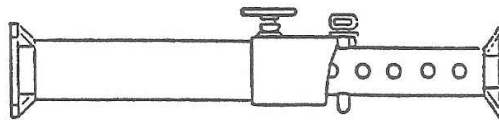
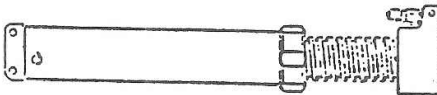


Figure 2. Pneumatic/hydraulic Shoring



BILLING CODE 4510-26-M

Figure 3. Trench Jacks (Screw Jacks)

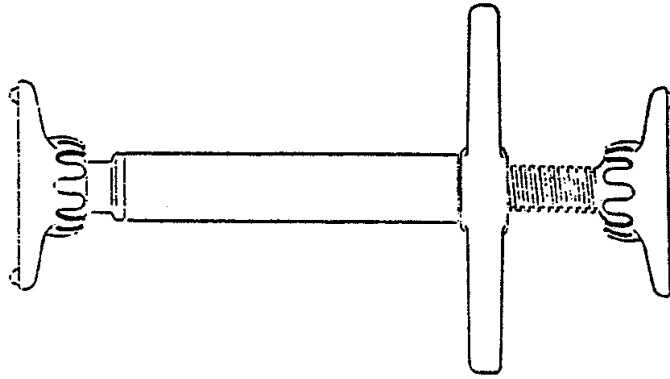
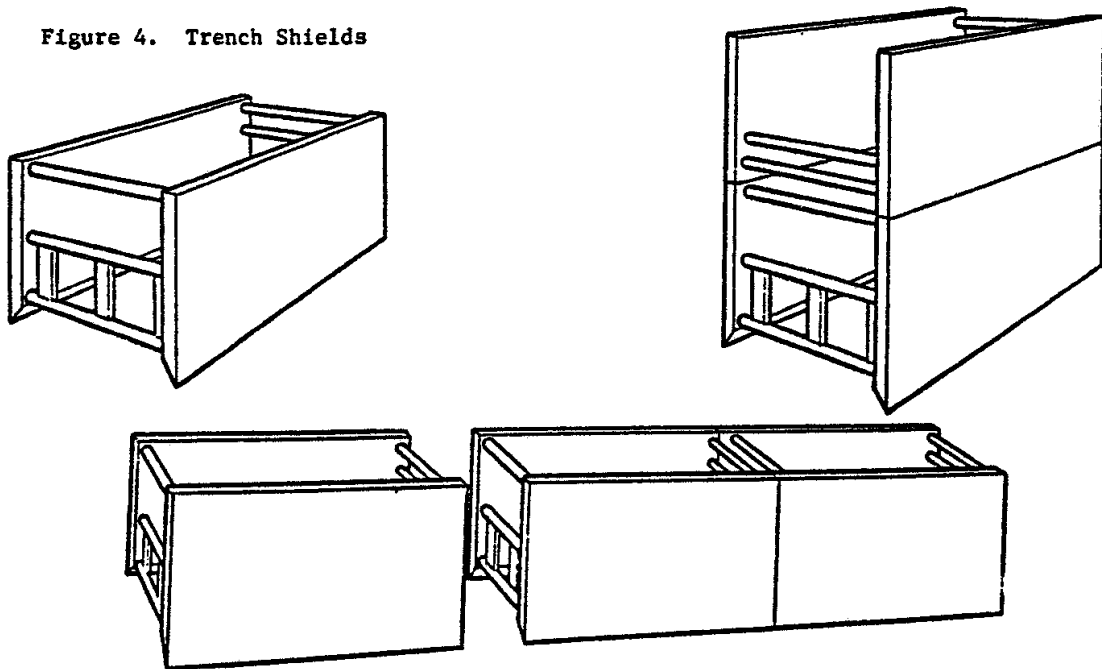


Figure 4. Trench Shields



## Appendix F to Subpart P—Selection of Protective Systems

The following figures are a graphic summary of the requirements contained in subpart P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with § 1926.652 (b) and (c).

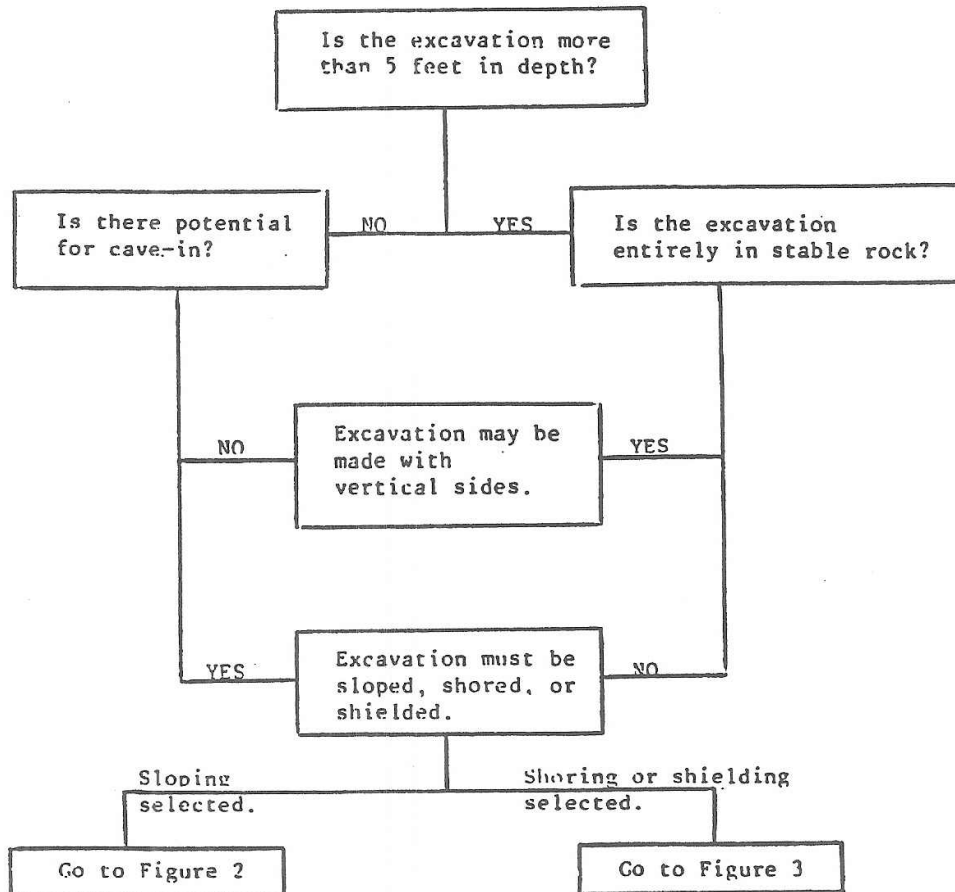
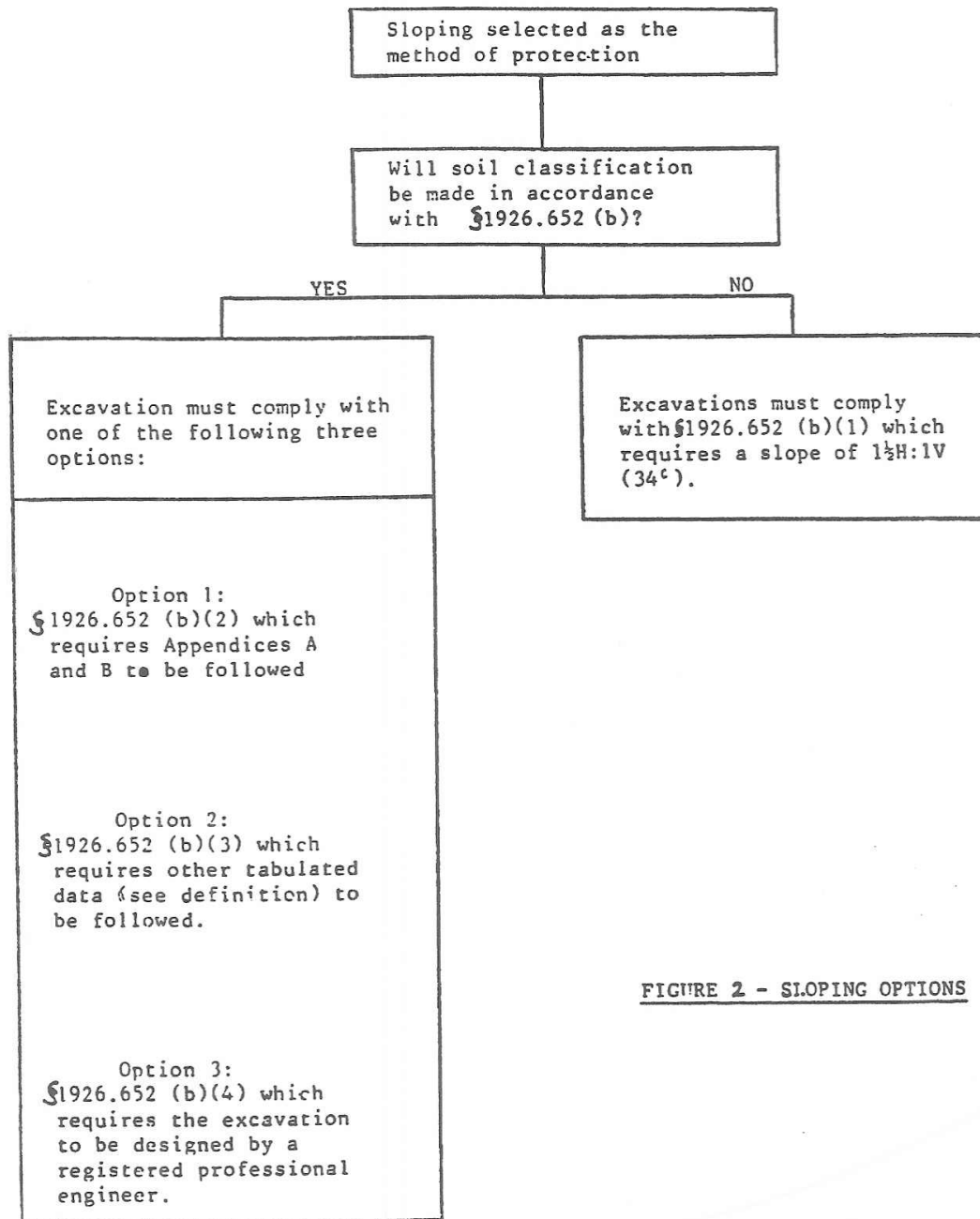


FIGURE 1 - PRELIMINARY DECISIONS

BILLING CODE 4510-25-M

FIGURE 2 - SLOPING OPTIONS

## EXCAVATION AND TRENCHING NOTIFICATION LOG

Date: Project Number:  
Customer: OSHA Permit Required: YES NO  
Customer: Project Manager:  
H&S Internal Permit Number:  
Comments:

\*\*\*\*\*

Date: Project Number:  
Customer: OSHA Permit Required: YES NO  
Customer: Project Manager:  
H&S Internal Permit Number:  
Comments:


\*\*\*\*\*

Date: Project Number:  
Customer: OSHA Permit Required: YES NO  
Customer: Project Manager:  
H&S Internal Permit Number:  
Comments:

\*\*\*\*\*

Date: Project Number:  
Customer: OSHA Permit Required: YES NO  
Customer: Project Manager:  
H&S Internal Permit Number:  
Comments:

\*\*\*\*\*

 <b>Standard Operating Procedure</b>	Procedure No.	<b>SOP 318</b>
	Issue Date:	January 2007
Title: <b>Stress, Cold/Heat</b>		
Approved by:		Revision No. 5

## **COLD STRESS**

### **1.0 OBJECTIVE**

Environmental Quality Management, Inc. (EQ) recognizes that work must be performed in various weather conditions, including cold climates. In order to minimize cold-related illnesses, site supervisors are to be aware of the symptoms of environmental conditions that lead to cold-related illnesses and the appropriate steps to take to prevent their occurrence.

### **2.0 PURPOSE**

This procedure describes the causes, symptoms, treatment, and/or prevention of cold-related illness.

### **3.0 GENERAL INFORMATION**

When the temperature of the surrounding air or water is much colder than the worker, the body's physical processes must increase to maintain thermal balance. Shivering is the body's attempt to generate increased heat.

Shivering, pain, and numbness are not trustworthy indicators of cold exposure because prolonged cold exposure numbs all body sensations. Rather, wind-chill temperature is a better means of evaluation because it takes into account the wind's ability to strip heat from the body through convection.

Protective clothing that is wet with sweat or from rain will cause heat loss through conduction.

Personnel are at an extreme cold stress hazard when performing spill clean-up in boats in cold weather situations. Falling into cold water can rob the body of dry heat very quickly.

## 4.0 COLD INJURY

**Trench Foot** occurs as a result of extended exposure of the feet to cold and moisture. Capillary walls of the feet are injured, resulting in tingling, itching, and pain. Blisters may form, followed by ulceration of the skin.

**Frost-Nip** is localized superficial freezing of extremities such as ears, nose, toes, and fingers. Initially there is a dark bluish color due to bleeding under the skin which at times can become gangrenous. Workers experiencing frost nip are susceptible to future injury and should avoid chilling.

**Frostbite** occurs when the moisture in the skin actually freezes, forming ice crystals, resulting in the damage of skin cells. The injured area becomes red, then blue/red. A burning pain is noted initially, then pain decreases and numbness sets in. The skin becomes waxy pale in appearance because of a lack of oxygen. The ears, nose, toes, and fingers are most susceptible. Damaged areas can become gangrenous resulting in the loss of tissue, finger tips, and toes.

**Hypothermia** occurs when heat production of the body is not sufficient to replace heat lost to the environment. The results are a lowering of the core body temperature, the pulse rate slows, muscular weakness occurs, mental abilities dull, and the workers become uncoordinated. Signs of hypothermia are evident at 95 degrees Fahrenheit body core temperature, and consciousness is lost between 89.6 - 86.0 degrees Fahrenheit. At lower core temperatures, cardiac arrest is possible.

Exposure to cold water decreases the body core temperature rapidly and consciousness is quickly lost. Workers on or over water should be acutely aware of the danger of immersion during cold weather.

Hypothermia results in dulling of the senses and could result in poor decision making. Workers that are exposed to extreme cold should not be given tasks that are critical to their health and safety or that of others.

## 5.0 PREVENTION

Just as with heat stress, cold stress must be controlled in order to prevent cold- related illness. The following are cold stress prevention guidelines.

**Education**—All personnel will receive training on the cause, symptoms, and (most importantly) methods of prevention of cold stress injuries.

**Clothing**—Prevention of hypothermia and other cold injuries is best accomplished by protecting workers from cold and moisture. Clothing is the most important factor in prevention of injury. Personnel working on land should layer clothing with the outer layer being wind and water resistant. The layers should be capable of being vented at

the wrist, neck, and waist to reduce wetting by perspiration. Feet should be kept dry and socks should be changed when they become wet. Gloves which protect the hands from cold but allow freedom of movement are necessary. Never allow bare skin to contact metal surfaces at sub-zero temperatures.

**Acclimatization**—A limited degree of acclimation can occur from exposure and working in cold environments. Some physiological changes do occur, but people also learn how to more effectively protect themselves from temperature extremes.

**Fluid Replacement**—Cold weather does cause significant water loss as a result of the dryness of the air. Fluid intake should be increased to prevent dehydration which directly affects blood volumes and flow to the extremities. Warm, sweet, caffeine-free, nonalcoholic drinks and soup offer the best fluid replacement and provide caloric energy.

**Work-Rest Regimes**—When temperatures are less than 20° F (actual or windchill), heated warming shelters should be made available. Workers should use these on a regular basis.

**Diet**—As with any work in extreme temperatures, personnel will be instructed to eat a well-balanced diet to replace calories burned and provide necessary vitamins and nutrients.

**Environmental Monitoring**—Regular monitoring of the environment by recording wind speed and actual thermometer readings for comparison to the windchill chart should occur at regular intervals depending on conditions.

**Prohibited Activities**—Alcohol should not be consumed because it increases blood circulation to the skin and interferes with internal thermostatic control. Alcohol also interferes with mental acuity, which can lead to risk taking. Cigarette smoking should be prohibited since the nicotine restricts the flow of blood to the extremities.

# HEAT STRESS

## 1.0 OBJECTIVE

In work situations where heat stress may be a factor, Environmental Quality Management, Inc. (EQ) will attempt to prevent heat-related illness by use of work-rest schedules, physiological monitoring, and/or personal cooling devices.

## 2.0 PURPOSE

This procedure describes the causes, symptoms, treatment, and prevention of heat-related illness.

## 3.0 GENERAL INFORMATION

Heat-related illnesses are caused by the body's inability to dissipate excessive metabolic heat while wearing PPE.

A period of adjustment or acclimatization is necessary before maximum tolerance to heat is acquired. Most workers require 7 to 10 working days of gradually increasing workload to become fully acclimatized.

## 4.0 HEAT-RELATED ILLNESSES

**Heat rash** can be caused by continuous exposure to hot and humid air and skin abrasion from sweat-soaked clothing.

Signs and Symptoms: The condition is characterized by a localized red skin rash and reduced sweating. Aside from being a nuisance, the ability to tolerate heat is reduced.

Treatment: Keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing.

**Heat cramps** are caused by profuse perspiration with inadequate fluid intake and salt replacement. This often robs the larger muscle groups (stomach and quadriceps) of blood which can make them cramp.

Signs and Symptoms: Muscle spasm and pain in the extremities and abdomen.

Treatment: Remove affected person to a cool place and give sips of clear water or an electrolytic drink (Gatorade®). The person experiencing heat cramps should lightly salt

his/her food to make up for the sodium lost when sweating. Manual pressure may also be applied to the cramped muscles.

**Heat exhaustion** is a mild form of shock caused by sustained physical activity in the heat and profuse perspiration without adequate fluid and salt replacement.

Signs and Symptoms: Weak pulse; shallow breathing; pale, cool, moist (clammy) skin; profuse sweating; dizziness; fatigue.

Treatment: Remove affected person to a cool place and remove as much clothing as possible. Give sips of water or electrolytic solution and fan the person continually to remove heat by convection. CAUTION: Do not allow the affected person to become chilled -- treat for shock if necessary.

**Heat stroke** is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death. **THIS IS A MEDICAL EMERGENCY!!**

Signs and Symptoms: Red, hot, dry skin; body temperature of 105 degrees Fahrenheit or higher; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; coma.

Treatment: Heat stroke is a true medical emergency. Transportation of the victim to a medical facility must not be delayed. Prior to transport, remove as much clothing as possible and wrap the victim in a sheet soaked with water. Fan vigorously while transporting to help reduce body temperature. Apply cold packs, if available; place under the arms, around the neck, or any other place where they can cool large surface blood vessels. If transportation to a medical facility is delayed, reduce body temperature by immersing victim in an ice/water bath (however, be careful not to over-chill the victim once body temperature is reduced below 102 degrees Fahrenheit). If this is not possible, keep victim wrapped in a sheet and continuously douse with water while fanning the victim.

## 5.0 SPECIFIC REQUIREMENTS

The environmental hazards section of site health and safety plans will address heat stress if the ambient temperature is expected to exceed 70 degrees Fahrenheit.


The site health and safety plan will discuss work-rest cycles and provisions for monitoring the level of heat stress (i.e., pulse rate). Workers are to be advised not to drink caffeinated or alcoholic beverages because they increase the rate of body water loss.

Increased dietary salt or lightly salted (0.2 percent) water is adequate to replace lost salt. Salt tablets are not to be used.

If juice or electrolyte drinks are used, they should be diluted prior to drinking.

Thirst is not an adequate indicator of body water loss. Workers are to drink at least small amounts of water on each break.

Workers are to rest when any of the symptoms described above are present. The buddy system is mandatory, as most often the potential victim will not be aware of any symptoms. Watch out for each other.

 <b>Standard Operating Procedure</b>		Procedure No.	<b>SOP 326</b>
		Issue Date:	December 2006
Title: <b>Working Around Heavy Equipment and Machinery (Excavators/Loaders)</b>			
Approved by:		Revision No.	3

## 1. PURPOSE

The hazards associated with the operation of heavy equipment are injury to personnel, equipment damage, and property damage. The potential for injury or damage to personnel and property is due to the size and power of the equipment; limited visibility of the operator/driver; the potential overhead hazards leading to electrocution, crushing, tripping, falls, cuts, or punctures; and the high noise levels created by the equipment.

## 2. GENERAL

- The work area shall be appropriately delineated to prevent non-essential personnel from wandering into the area.
- Equipment operators shall maintain eye contact with ground personnel at all times, giving ground personnel the right of way.
- Equipment operators shall maintain eye contact and/or radio contact with the operators/drivers of all other equipment working in proximity on-site.
- Vehicles/equipment paths shall be marked as feasible to prevent personnel from crossing.
- Equipment operators must stop operating while on or using a cell phone.
- Equipment shall be outfitted with the appropriate safety features, back-up alarms, rollover protection, fire extinguishers, etc.
- Loads shall be lowered and equipment de-energized and secured before any adjustments are made to load, repositioning, etc.
- Personnel shall be cognizant of excavations, material/debris piles and other equipment in the work area. These areas shall be appropriately marked or protected to prevent falls.

## 3. EXCAVATORS/LOADERS

- Only trained and qualified individuals shall operate heavy equipment/excavators.
- All heavy equipment shall be inspected before mobilization, while on site, and daily prior to use; inspections shall be documented.
- All heavy equipment shall be equipped with the appropriate safety devices [ROPS, fire extinguishers, seat belts, backup alarms, (etc.)].
- Vehicles shall maintain appropriate operating speeds and load capacities at all times.

- A spotter shall be utilized for any of the following conditions: 1) during critical lifts with cranes or derricks; 2) when overhead powerlines or overhead objects may obstruct heavy equipment operation; 3) when a driver does not have a full view of the backing path, in order to ensure safe backing of equipment; and 4) as directed by the site foreman, when feasible, to prevent injuries and to assist heavy equipment operator(s) in non-routine operations.
- The area of excavation (or other operation) shall be appropriately marked to prevent non-essential personnel from wandering into the vehicle path (safe work buffer zone).
- Ground personnel shall be given the right of way at all times. Safety vests, and/or reflective clothing shall be worn by all field personnel. Eye contact shall be maintained between operators and laborers in the vicinity.
- Radio contact shall be maintained between operators and the appropriate on-site personnel.
- At the end of the day, equipment breathing air and safety equipment shall be checked, the cab shall be cleaned, refueling will occur, brakes will be set, and a daily report shall be completed by the equipment operator.
- The area shall be visually inspected and all structural encumbrances shall be removed or protected prior to work.
- Personnel shall enter and exit vehicles using handrails and steps that are provided.
- Work area shall be kept neat and in an orderly state of housekeeping.
- All underground utilities shall be located prior to excavation; utility companies shall be contacted if necessary.
- Excavators shall be prohibited from operating on severe inclines or questionable surfaces. Excavators operating near the edge of a quarry shall be supported with a swamp pad.
- Employees shall be prohibited from standing or working in areas where they would be exposed to falling loads. Personnel shall stand away from vehicles during excavation or loading. Operators may remain within vehicle cabs during loading as outlined in 29 CFR 1926.601(b)(6) for adequate protection.
- All personnel working around the excavators shall be trained in emergency shutdown of the equipment.
- Stop logs/railroad ties shall be used to barricade a quarry rim to prevent equipment or personnel from coming too close to the edge. Barricade shall be established 5 feet from the edge of the excavation, and a warning sign shall be posted in this area to alert personnel of the dangers.
- Areas within a quarry that are directly beneath the excavation areas shall be barricaded to prevent personnel from standing below in areas with a potential hazard of falling objects/debris.
- When lowering excavator(s) from the rim into a quarry, the load weight shall be checked to ensure lifting equipment has sufficient capacity.
- Air monitoring for carbon monoxide, oxygen, etc., shall be performed by EQ within vehicle cabs throughout work operations.

- Equipment operators shall wear appropriate PPE as outlined in the SWP to protect personnel from exposure to potential chemical and radiological hazards.
- Personnel shall be prohibited from reaching into loading operations with arms or legs while in operation. Any adjustments or repairs that need to be made to equipment (or loads) shall be made with the equipment disengaged and shut down. If there is a suspended load, the load shall be lowered to the ground (or securely braced) before any adjustments are made to the equipment.

#### **4. CRANES**

- All cranes must have proof of a thorough inspection within the last year by an appropriately qualified individual. Crane personnel platform (manbasket) and rigging equipment shall be inspected daily prior to use. For personnel platform lift operation requirements, refer to OSHA 29CFR 1926.1431(b)
- Load capacities shall be must be conspicuously posted on the platform with a plate or other permanent marking equipment and observed during operations. The combined weight of the loaded personnel platform/manbasket and its rigging must not exceed 50 percent of the rated load capacity in all locations where the platform will be positioned.
- Rigging hardware (including wire rope, shackles, rings, master links, and other rigging hardware) and hooks must be capable of supporting, without failure, at least five times the maximum intended load applied or transmitted to that component. Where rotation resistant rope is used, the slings must be capable of supporting without failure at least ten times the maximum intended load.
- A pre-lift meeting must be held to review the applicable requirements of this section and the procedures that will be followed. Attended by the equipment operator, signal person (if used for the lift), employees to be hoisted, and the person responsible for the task to be performed. Held prior to the trial lift at each new work location, and must be repeated for any employees newly assigned to the operation.

A trial lift must be performed immediately prior to each shift in which personnel will be hoisted. The lift will not exceed 50 percent of the equipment's rated capacity at any time during the lift.

- Immediately after the trial lift, the competent person must conduct a visual inspection of the equipment, base support or ground, and personnel platform, to determine whether the trial lift has exposed any defect or problem or produced any adverse effect.
- The manbasket will be proof tested at 125 percent of rated capacity prior to daily use and whenever it is reattached to the hoist line. The proof test may be done concurrently with the trial lift.
- The manbasket shall be equipped with the appropriate safety features to prevent personnel from falling out (guardrails, grabrails, overhead protection if necessary, etc.). Personnel within the personnel platform will implement personal fall arrest systems (PFAS).
- The crane operator must always have full control over the movement of the personnel platform/manbasket. All vertical movement must use the power of the crane winch.

- Employees shall be prohibited from standing or working beneath crane booms.
- In the event of emergency repair work on hoisting equipment with a suspended load, the area below the load shall be barricaded and the load blocked or otherwise supported.
- Employees are prohibited from riding on loads, hooks, slings (etc.) suspended from hoisting equipment.
- All hooks, rings, pins, shackles, or other lifting attachments shall be inspected, and defective parts shall not be used. Wire ropes shall be free of kinks, sharp bends, or twists. Bridles and associated rigging for suspending the personnel platform must be used only for the platform and the necessary employees, their tools and materials necessary to do their work. The bridles and associated rigging must not have been used for any purpose other than hoisting personnel.
- When the occupied personnel platform/manbasket is in a stationary position, all brakes and locking devices on the crane must be set.
- All cranes used for personnel hoisting must have a boom angle indicator that is visible to the operator, and shall be equipped with either an anti-two-blocking device that prevents contact with the load block or a two-block damage feature that deactivates the hoisting action before damage occurs.
- No mobile crane will operate or make a heavy lift without its outriggers fully extended to assure maximum stabilization of the equipment.
- Appropriate hand signals shall be predetermined and used during crane operations. Only one individual shall issue signals to the operator unless a relay system is necessary.
- Tag lines shall be used at all times for controlling swinging loads.
- The crane operator and rigger shall confirm that the load is properly secured and balanced before it is lifted.
- Crane operations shall be stopped or restricted during bad weather or poor visibility.

## **5. MAINTENANCE AND REPAIRS**

- All equipment hazards identified shall be controlled.
- Operators shall not wear loose clothing that might get tangled in the equipment or controls.
- Appropriate machine/equipment guards shall be in place and intact at all times during operation. When guards require maintenance or replacement, equipment will be shut down and repaired, to be restarted only when guards are replaced and in good condition.
- Heavy equipment shall be demobilized to a staging area and decontaminated as necessary before performing maintenance or repairs.
- An equipment repair log shall be maintained and updated on a daily basis/whenever a repair or adjustment is made.
- Pinching and cutting hazards shall be controlled by prohibiting personnel from reaching into running equipment and by wearing the appropriate PPE. All equipment repairs shall be made while equipment is shut down.

- Appropriate PPE shall be used as outlined in the SWP to prevent contact with chemicals.

## **6. REFUELING**

- The equipment engine must be shut down before any refueling operations are conducted.
- Appropriate ABC-type fire extinguishers shall be available. No smoking within 50 ft. of refueling.
- All ignition sources shall be eliminated. No smoking.
- Fuel shall be brought to the equipment using the designated vehicle. Appropriate vehicle safety precautions shall be followed.
- Appropriate grounding/bonding shall be conducted before transferring fuel.


## **7. DECONTAMINATION AND REMOVAL**

- Appropriate PPE shall be worn as outlined in the HASP (faceshields, etc.).
- Only trained, authorized personnel shall operate high-pressure washers.
- The lance/nozzle must always be pointed at the work area, and not toward other personnel.
- The operator shall maintain good footing during cleaning.
- Non-operators shall maintain a safe distance (25 feet) from the operator during washing.
- Washer operators shall alternate to avoid fatigue. Assistants shall also be used to help move and handle the equipment.
- Washer equipment shall be cleaned/rinsed periodically to avoid build-up (around trigger, guard).
- An assistant shall monitor the pressure during operations, and shall stand near the generator in case emergency shutdown is necessary.
- All lances/nozzles shall be constructed of seamless stainless steel to avoid rusting.
- Washers shall be operated at the designated pressure. Inspections shall be made for leaks and malfunctions; damaged or faulty equipment must be repaired or taken out of service immediately.
- Personnel shall use proper lifting techniques such as keeping their back straight, lifting with legs, limiting twisting, getting help in moving bulky/heavy loads, and using mechanical equipment to move material and equipment when appropriate.
- Personnel shall work at a rational pace.
- If decontamination is performed in the presence of electrical circuits, appropriate provisions shall be made to disconnect them or protect them from contact with water.

## 8. REVISION HISTORY

The EQM Document Control Officer shall ensure this procedure is reviewed at least every three years and all revisions are tracked. If the Approver listed on the document is no longer responsible for the contents of this document, the VP of the Division will assign a new approver. The highlighted section may make more sense in the document control SOP. DCO is Jerry Day.

<b>Date</b>	<b>Purpose / Description of Revisions</b>	<b>Pages Affected</b>	<b>Authorized by</b>

 <b>Standard Operating Procedure</b>	Procedure No.	<b>SOP 328</b>
	Issue Date:	February 2013
Title: <b>Power-Operated Tools and Hand Tools</b>		
Approved by:		Revision No. 0

## 1.0 OVERVIEW

It is the policy of Environmental Quality Management, Inc. (EQ) to prevent injuries and incidents from occurring at its various job sites. The purpose of this Standard Operating Procedure (SOP) is to establish the basic safety requirements for the use of hand and power tools. Hand and power tools are commonly used at job sites every day and bring efficiency to EQ work; however, these tools can be hazardous and have the potential for causing severe injuries when improperly used or maintained.

This SOP encompasses the specific requirements for all EQ employees whose job requires the use of hand and power tools. Some EQ employees will receive specific training on the safe use of hand and power tools.

All EQ employees assigned to jobs that involve the use of hand and power tools must have the proper training prior to beginning such work at a project site. Specific requirements related to the use of these tools will be included in the Site Safety Plan.

Some EQ employees whose job assignment requires the use of such tools at a client's facility must be knowledgeable of any additional requirements prescribed regarding tool operation while performing work at client facilities.

## 2.0 RELATED DOCUMENTS

29 CFR 1910 Subpart P – Hand and Portable Powered Tools and Other Hand-held Equipment

## 3.0 RESPONSIBILITIES

### 3.1 Project Manager/Site Manager/Response Manager

The Project Manager/Response Manager/Site Manager is responsible for:

- Reviewing the scope of work to be performed by employees and assuring that adequate resources are available to manage those projects that involve the use of hand and power tools in a safe and efficient manner.
- Ensuring that all EQ employees fully understand and are trained in the use of hand and power tools at all job sites as needed.
- Enforcing all requirements contained within this SOP.

## **3.2 Corporate Health & Safety Director**

The Corporate Health & Safety Director is responsible for:

- Reviewing this SOP periodically for necessary changes and to update as needed.
- Developing, revising, and providing a training program that relates to the safe use of hand and power tools.
- Ensuring that all hand and power tools are equipped with the prescribed guarding and operational safety mechanisms as recommended by the manufacturer.

## **3.3 All Employees**

All EQ employees must meet the following minimum requirements:

- Adhere to all requirements contained in this SOP.
- Report any unsafe or hazardous conditions or acts that may cause injury to either them or any other employees.
- Receive all required training as outlined in this SOP and fulfill the needed requirements associated with the safe use of hand and power tools.
- Avoid activities that could result in injury to themselves and/or others at the job site.

Employees who do not comply with the provisions of this SOP are subject to progressive discipline as specified by EQ.

## **4.0 PROCEDURE**

### **4.1 Proper Use of Tools**

Employees who use hand and power tools are frequently exposed to the hazards of falling, flying, and abrasive objects. Exposure to harmful dusts, fumes, and mists can also be a frequent hazard when using certain tools.

Employees must be trained in the proper use of all tools and be able to recognize the hazards associated with the different types of tools and the necessary safety precautions.

Employees must focus on the following key rules regarding the use of hand and power tools:

- Keep all tools in good condition with regular maintenance.
- Use the right tool for the job.
- Examine each tool for damage before using and do not use any tool that is damaged.

- Operate all tools according to the manufacturer's instructions.
- Use the proper personal protective equipment.

## **4.2 Hand Tools**

The greatest hazards associated with hand tools result from misuse and improper maintenance.

When using saw blades, knives, or other tools with sharp edges, the force of action should be directed away from the worker and other employees who are working in close proximity.

Any tool with a wooden handle must not be splintered.

Impact tools such as drift pins, wedges, and chisels must be kept free of mushroomed heads.

Specific job assignments that occur near flammable substances require the use of spark-resistant tools to avoid the generation of an ignition source (i.e., spark).

Appropriate personal protective equipment (PPE) such as safety glasses and gloves must be worn to protect against hazards that occur while using hand tools.

Workplace floors must be kept clean and dry as possible to avoid slips, trips, and falls with or around hand tools.

## **4.3 Power Tools**

Power tools must be fitted with guards and safety switches because they are extremely hazardous when used improperly.

To prevent hazards associated with the use of power tools, workers should observe the following precautions:

- Never carry a tool by the cord or hose.
- Never pull the cord or the hose to disconnect it from the receptacle.
- Keep cords and hoses away from heat, oil and sharp edges.
- Disconnect tools when not in use, when performing servicing, cleaning them and when changing out accessories (e.g., blades).
- Keep all people not involved with the work at a safe distance from the immediate work area.
- Wear proper apparel when using power tools. Avoid loose clothing, ties, or jewelry as it can become caught in moving parts.
- Remove all damaged portable electric tools from use and tag them: "DO NOT USE."

Exposed moving parts of power tools must have safeguards. Belts, gears, shafts, drums, chains, flywheels, and other reciprocating parts of equipment must be guarded.

Machine guards must be provided in the following workplace settings:

- Point of operation
- In-running nip points
- Rotating parts
- Flying chips and/or sparks

Safety guards must never be removed when a tool is being used.

Electric tools must be equipped with a three-wire cord and ground, only be plugged into a grounded receptacle, and should not be used in wet locations unless they are approved for such service.

Cords from electric tools must not present tripping hazards.

Pneumatic tools must be checked to ensure that the components are securely fastened to the air hose. A short wire or positive locking device attaching the air hose to the tool must be used when operating a pneumatic tool.

Appropriate PPE such as safety glasses and gloves must be worn to protect against hazards that occur while using hand tools.

Workplace floors must be kept clean and dry as possible to avoid slips, trips, and falls with or around hand tools.


## **5.0 TRAINING**

All EQ employees working on projects or at job sites that involve the use of hand and power tools must be thoroughly trained in safe operations.

Some employees will be expected to complete additional training at a client's facility to become fully knowledgeable of the client's requirements for tool operation.

Refresher training is required on an annual basis or whenever an employee demonstrates a need for retraining.

All training documentation will be kept by the Corporate Safety & Health Director.

 <b>Standard Operating Procedure</b>	Procedure No.	<b>SOP 329</b>
	Issue Date:	February 2013
Title: <b>Fire Prevention and Protection</b>		
Approved by:		Revision No. 0

## 1. INTRODUCTION

This Fire Fighting Plan has been prepared in accordance with applicable federal, state, and local regulations. Specifically this procedure incorporates the requirements of 29 CFR 1910 Subpart L – Fire Protection.

## 2. FIRE EMERGENCY

Because of the possible presence of flammable materials at a project site, fire is an ever-present potential hazard. All EQ personnel are to be trained through instruction and hands-on-practice in operation of equipment that is expected to be used and in basic firefighting techniques. This training, however, should be limited to just small fires that can be handled through the use of portable fire extinguishers. If there is any doubt whether a fire can be quickly contained and extinguished, personnel are to sound the fire alarm (as available), call 911, and vacate the structure or area as soon as possible. The following procedures will be used in the event of a fire.

### 2.1 General Provisions

These procedures should be followed in the event of a fire at any project:

- Anyone who sees a fire shall sound the alarm.
- Work crews shall be comprised of pairs of workers. Workers shall leave the work site with their respective "buddies" immediately after hearing the fire alarm.
- In the event of a small fire that the worker extinguishes, the on-scene safety official is to be summoned and is to be notified. All fires must be reported to the Site Safety Officer (SSO).
- On hearing the general alarm, the workers are to disconnect any electrical equipment in use (if possible), turn off combustion engines, and proceed to the nearest fire exit egress point.
- Before workers begin operations in an area and on a daily basis, the SSO will give instructions on egress procedures and assembly points.

### Emergency Contacts

Ambulance	911
Police	911
Fire	911
Hospital	Site Specific
National Response Center (Spills)	800-424-8802 or 202-267-2675
Poison Control Center	800-222-1222

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## **2.2 Small Fires**

A small fire is defined as a fire that can be extinguished with a 20-pound ABC-type fire extinguisher. These minimum procedures should be followed for small fires:

- Evacuate all necessary personnel to an upwind location if possible.
- Attempt to extinguish the fire with a fire extinguisher or by smothering.
- The SSO should request emergency assistance as needed (ambulance, fire department, poison control center, etc.) for injury or exposure.
- Notify SSO of incident.

## **2.3 Large Fires**

A large fire is one that cannot be extinguished by means outlined in Section 2.2. The same minimum action should be taken as in the event of a small fire; however, contact, interaction, and cooperation with outside agencies (fire department) are crucial.

## **2.4 Employee Roles**

Site Manager:

- If rescue is necessary, designate individuals to don proper personal protective equipment (PPE) and assist or relieve individual(s) who discovered the fire.
- Clear the area.
- Notify SSO.

Site Safety Officer:

- Notify safety representative that there has been a fire.
- Call for emergency help.
- Instruct workers on egress areas and assembly points.

Individual who discovers fire:

- Sound fire alarm (as available) and/or call 911.
- Attempt to extinguish fire until relieved by individuals in Level B PPE.
- Do not attempt to put out a fire that is too large. In this case, immediately notify the SSO to summon emergency help.
- Receive firefighting training annually.

### **3. EQUIPMENT**

All EQ vehicles are equipped with fire extinguishers designed to handle small fires. Additional portable fire extinguishers are also available at project sites in accordance with the Site Safety Plan.


All fire extinguishers are subject to routine monthly visual inspections to ensure they are in good condition and exhibit proper pressure readings. All fire extinguishers must receive full maintenance checks annually where each unit receives a detailed functionality test. Documentation of these inspections is kept by the Health and Safety (H&S) Director.

Any fire extinguisher that has been used in any fashion or found to be low in pressure must be taken out of service and replaced.

In many cases, project sites will have centralized firefighting programs with dedicated water and foam systems. All EQ employees must be familiarized with the site's emergency response protocol and be knowledgeable to summon for help during a fire.

### **4. TRAINING**

All EQ employees are required to receive basic firefighting skills training through instruction and hands-on practice in the use of portable fire extinguishers (Class A, B, & C). This training must be received as part of the initial employee H&S training and then repeated annually. All training documentation is kept on file with the H&S Director.

 <b>Standard Operating Procedure</b>		Procedure No.	<b>SOP 332</b>
		Issue Date:	June 2016
Title: <b>Respiratory Program</b>			
Approved by:		Revision No.	1

#### Appendix A: Forms

- Fit Test Record Form
- Inspection checklist

## 1. PURPOSE

The respiratory program is in place to prevent exposure of our personnel to hazardous materials.

## 2. SCOPE

This program applies to all EQM personnel and contractors.

## 3. REFERENCE(S)

29 CFR 1910.134

## 4. DEFINITIONS

**Air-purifying respirator** means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

**Assigned protection factor (APF)** means the workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program as specified by this section.

**Atmosphere-supplying respirator** means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

**Canister or cartridge** means a container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

**Demand respirator** means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

**Emergency situation** means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

**Employee exposure** means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

**End-of-service-life indicator (ESLI)** means a system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

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**Escape-only respirator** means a respirator intended to be used only for emergency exit.

**Filter or air purifying element** means a component used in respirators to remove solid or liquid aerosols from the inspired air.

**Filtering facepiece (dust mask)** means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

**Fit factor** means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

**Fit test** means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

**Helmet** means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

**High efficiency particulate air (HEPA) filter** means a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

**Hood** means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

**Immediately dangerous to life or health (IDLH)** means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

**Interior structural firefighting** means the physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage. (See 29 CFR 1910.155)

**Loose-fitting facepiece** means a respiratory inlet covering that is designed to form a partial seal with the face.

**Maximum use concentration (MUC)** means the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of the hazardous substance. The MUC can be determined mathematically by multiplying the assigned protection factor specified for a respirator by the required OSHA permissible exposure limit, short-term exposure limit, or ceiling limit. When no OSHA exposure limit is available for a hazardous substance, an employer must determine an MUC on the basis of relevant available information and informed professional judgment.

**Negative pressure respirator (tight fitting)** means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

**Oxygen deficient atmosphere** means an atmosphere with an oxygen content below 19.5% by volume.

**Physician or other licensed health care professional (PLHCP)** means an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by paragraph (e) of this section.

**Positive pressure respirator** means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

**Powered air-purifying respirator (PAPR)** means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

**Pressure demand respirator** means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

**Qualitative fit test (QLFT)** means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

**Quantitative fit test (QNFT)** means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

**Respiratory inlet covering** means that portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

**Self-contained breathing apparatus (SCBA)** means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

**Service life** means the period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

**Supplied-air respirator (SAR) or airline respirator** means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

**This section** means this respiratory protection standard.

**Tight-fitting facepiece** means a respiratory inlet covering that forms a complete seal with the face.

**User seal check** means an action conducted by the respirator user to determine if the respirator is properly seated to the face.

## **5. RESPONSIBILITIES**

### **5.1 Human Resource Director**

- Coordinate with third party medical surveillance vendor to ensure personnel receive appropriate fit testing during annual physical.
- Communicate to managers any limitations an employee has regarding use of respirators.

### **5.2 Quality Assurance Director**

- Ensure Fit Test records are stored on CyberTrain.
- Ensure CyberTrain notifies manager and employee of fit test renewal date.
- Ensure respirator training records are located within CyberTrain.
  - Respirator training is part of the 40 Hr HAZWOPER and associated annual refresher and may not be listed as a separate topic.

### **5.3 Corporate Health and Safety Director**

- Review program for effectiveness.
- Ensure personnel receive training prior to use.
- Review HASPs for appropriate respiratory protection.

## 5.4 Managers

- Ensure personnel have appropriate training, fit testing and respirator for the hazards before entry an area where a respirator is required.
- Audit personnel to ensure respirators are stored and cleaned properly.
- Remove personnel from areas if which they are not utilizing respiratory protection properly or using the appropriate respirator and retrain.

## 5.5 Employees

- Follow all procedures.
- Clean and store respirators appropriately after each use.
- Do not use respirators without property training and fit testing.
- Inspect respirators before use.
- Do not use faulty or defective respiratory equipment.
- Change cartridges as appropriate
- Utilize proper cartridges for chemical hazard.
- Stop work if there are any concerns or do not enter until concerns are addressed.

## 6. PROCEDURE

Prior to respirator use, EQM employees involved in hazardous waste operations or other activities requiring the use of respiratory protection shall have medical respirator clearance certification by a qualified physician, respirator training, and respirator fit-testing in accordance with OSHA Respiratory Protection Standard, 29 CFR 1910.134. EQM will make respiratory protection equipment available to all employees performing work at job sites that are subject to this personal protective equipment (PPE) requirement. Respiratory equipment and other PPE will be provided at no cost to employees. EQM subcontractors are responsible for obtaining and producing documentation of the aforementioned required certification prior to using respiratory protection at EQM project sites. The Corporate Health & Safety Director is designated as the Respiratory Protection Program Administrator.

Prior to entry into designated work areas requiring the use of self-contained breathing apparatus (SCBA), supplied air respirators (SAR), or air-purifying respirators (APRs), the following criteria must be met:

- Medical certification to wear a respirator must be documented.
- Instruction and training in the proper use of respirators must be documented
- Proper fit-testing must be documented with the particular type of respirator to be used (make, model, and size).
- Employees must receive a site-specific safety briefing that includes the possible type(s) of hazards anticipated in the work area and the possible consequences of failing to maintain the proper respiratory protection.
- Respirator must be checked for worn, broken, or malfunctioning parts.
- For air-purifying respirators, proper cartridges for the anticipated exposure must be attached to the respirator base.

- Respirator seal integrity must be checked by using a positive- and negative-pressure test each time the respirator is donned.
- Neither facial hair nor eyeglass temple bars may interfere with the face-to-respirator seal. Beards are prohibited when either half-facepiece or full-facepiece respirators are worn.

Failure to meet any one of these requirements shall be considered a failure to meet all of the listed requirements and prohibits the individual from working at the EQM project site. In addition, all employees must follow manufacturer's procedures for inspecting, donning, cleaning, and storing respirators.

## **6.1 Medical Clearance Certification**

Employees performing activities at sites requiring respirator use must have current medical clearance to wear the appropriate respirator. Clearance is achieved by enrolling the employee in the EQM Health Monitoring Program prior to assignment on site. Medical evaluation is then required annually for HAZWOPER personnel and periodically based on other job positions. Medical evaluations are provided to all EQM employees at a convenient time and are scheduled during normal working hours. Results of respiratory evaluations and all other medical surveillance information is maintained in personal confidential records. All employees are given the opportunity to discuss the medical evaluation results with the physician who administers this program.

Testing will be subject to the occupational health physician based on the employee's answers to the medical questionnaire provided by the third party occupational health vendor.

### **6.1.1 Health Monitoring**

EQM uses a Health Monitoring Program designed to determine each employee's health status and fitness (including the ability to wear respiratory protection).

Project Managers are required to notify EQM's Corporate Health & Safety Director prior to hazardous investigative activities. The Corporate Health & Safety Director or designee will then consult with EQM's Occupational Health Physician if any special health monitoring procedures are necessary.

### **6.1.2 Enrollment in Health Monitoring Program**

According to company policy, the following EQM employees are required to be enrolled in the Health Monitoring Program:

1. All field personnel including but not limited to the following job categories: engineers, technicians, geologists, tank testers, drillers, equipment operators, and laborers.
2. EQM service groups involved in field work.
3. Site Safety Officers.
4. Any employee who may wear a respirator for any part of 30 days or more during a year, as per OSHA 29 CFR 1910.134.

5. Any other employee who may be at risk of exposure to chemical substances above an OSHA Permissible Exposure Limit for any part of 30 days or more during a year.

### **6.1.3 Levels of Clearance**

A physician may designate the following four levels of respirator clearance:

- Level I Full respirator use including air-purifying negative-pressure half or full facepiece, powered air purifying respirator (PAPR) with full facepiece or hood assembly, and/or SCBA or SAR in any work situation.
- Level II Limited respirator use on a temporary basis (restrictions to be specified).
- Level III Limited respirator use, air-purifying negative-pressure half or full facepiece respirators - no SCBA, no heavy lifting (over 35 lbs.), modified work/rest schedule.
- Level IV No respirator use; other work restrictions may be specified.

Employees may only perform work on sites where their level of medical certification and the level of protection are consistent.

## **6.2 Special Restrictions**

### **6.2.1 Facial Hair**

Facial hair such as stubble, moustaches, sideburns, beards, low hairlines, and bangs that pass between the face and sealing surface of the respirator will produce a break in the face-to-respirator seal and allow the introduction of contaminants into the breathing zone. Therefore, persons with these hair conditions shall not be permitted to wear respirators until the hair is removed. At the time of fit-testing, the Corporate Health & Safety Director or designee will determine if other types of protection are feasible. If this is not possible, the employee shall not be assigned to sites requiring respiratory protection.

### **6.2.2 Corrective Lenses**

When wearing respirators, employees who normally wear corrective lenses are required to wear special corrective spectacles or goggles that do not interfere with the respirator seal. The wearer is responsible for obtaining his/her own prescription and for notifying the Corporate Health & Safety Director, who will obtain special corrective lenses that fit into the respirator face mask. Information regarding suppliers may be obtained from the Corporate Health & Safety Director.

### **6.2.3 Contact Lenses**

OSHA 29 CFR 910.134(e)(5)(ii) prohibits the wearing of contact lenses in contaminated atmospheres. Beyond this regulation, EQM does not permit contact lens use when a respirator is worn.

This restriction has been mandated for the following reasons. First, work in a contaminated environment precludes the ability to adjust a contact lens without inadvertently inhaling the

contaminant and/or transferring the contaminant on the gloves to the eyes. Second, the dehumidified and pressurized air used in SCBAs and SARs may dry or irritate the eyes, thereby making a contact lens more likely to dislodge. Lastly, loss of a lens could lead to confusion and decrease visual acuity in a potentially dangerous environment.

For field personnel, respirator training does not end with this general course. Prior to entering a new site, the Project Manager or his/her designee will brief each employee on the potential hazards of the site, the level of protection required, and any special situations to be considered.

## **6.4 Respirator Usage**

Respirators, like any other equipment, are considered company property and will be treated with the same level of respect and care afforded all equipment. Respirators will be used only for the job activities and areas specified in the site safety and health plan. Each job activity will be unique and will require different levels of respiratory protection and which will mandate specific types of NIOSH-approved respirators. All impacted employees will refer to the site safety and health plan for specific details of hazards at the job site. Employees will adhere to the required level of protection associated with the hazards at the job location. The various hazards will require specific cartridge types and the corresponding levels of protection.

### **6.4.1 Air-Purifying Respirators**

The type of respirator and cartridge will be specified in the site safety and health plan. Wearers must check the match between the site safety and health plan's description of the type of cartridge to be used and the information printed on the cartridge. The new cartridge should be checked to ensure its quality. Do not use cartridges that rattle, have a peculiar odor, or are damp.

End of Service Life indicator (ESLI) shall be used for gases and vapors. The ESLI must be certified by NIOSH for the contaminant of concern. If there is not an ESLI, a change schedule shall be determined. Cartridges will be replaced at least daily. If more frequent replacement is indicated, direction will be given by the Corporate Health & Safety Director or Site Safety Officer.

Particulate HEPA will be used for particulate APRs.

Cartridges must be replaced when resistance builds and causes breathing to become somewhat labored or when breakthrough occurs. Breakthrough may take the form of odors; tastes; burning sensations in the eyes, nose, throat, or skin; irritation; headache; confusion; or drowsiness. Breakthrough is accelerated by breathing very humid or misty air. This may require the changing of cartridges several times a day.

Employees must leave the respiratory protection required area immediately if breakthrough occurs or to change cartridges. Employees must wash/decontaminate prior to changing cartridges. Report any signs of breakthrough immediately to the Site Safety Officer for respiratory protection re-evaluation and/or cartridge replacement.

Used cartridges are considered hazardous waste if exposed to substances deemed "hazardous waste" by the U.S. Environmental Protection Agency (EPA), and must be disposed of properly. Cartridges must never be left on a stored respirator.

#### **6.4.2 Use of SCBA or SAR**

SCBA or SAR will only be used in those areas and for those job functions specified in the Site Safety Plans. Examples of a job function requiring SCBA or SAR would be work in those areas that are classified as IDLH or where the air concentration of a contaminant is unknown and could increase unexpectedly. If SARs are used, an in-line escape bottle (5-minute) must be attached. Prior to using the SCBA or SAR, the employee will be briefed by the Site Safety Officer regarding its use, the potential hazards present in the work area, and the consequences of failing to maintain proper respiratory protection.

The "Buddy System" will be in effect whenever SCBA or SAR is utilized. Workers will perform their jobs in pairs and will maintain a line of sight or radio contact with the decontamination area at all times. One or more individuals with an SCBA ready to don will stand by in the decontamination area to assist in the event of an emergency.

Employees will monitor each other for indications of exposure, injury, or illness. If a change in status occurs or when a warning alarm sounds (indicating that low levels of breathing air remain in the tank), both workers will stop working and proceed with caution to the decontamination area for assistance.

#### **6.4.3 Procedures to Ensure Adequate Air Quality, Quantity, and Flow of Breathing Air**

All air cylinders will be filled with Grade D breathing air. Before cylinders are used, written certification will be obtained from the vendor stating that the air in the cylinders is Grade D breathing air.

- Safety Data Sheets (SDS) will be obtained from the supplier and made readily available to employees at the project site.

The air quantity in each tank will be monitored and a low-air-level alarm set to ensure an adequate supply for withdrawal from the work zone and/or to switch to a reserve supply cylinder. Tanks are pre-manifolded to the supply line.

Regulators are used to ensure proper flow and are certified by the manufacturer prior to use. Periodic flow verification tests are performed.

- No worker may be more than 300 feet from the supply system; i.e., the maximum hose length is 300 feet.

### **6.5 Respirator Selection**

During the Respiratory Protection Training Program, the wearer will be allowed to select the most comfortable air-purifying respirator from an array of sizes and materials, after instructions have been given regarding the types and uses of air-purifying, SCBA, and airline respirators. Wearers

will be shown how to don a respirator, how it should be positioned on the face, how to set strap tension, and how to assess a "comfortable respirator." Only NIOSH-certified respirators are approved for use.

The SCBA or SAR is to be used when the very highest level of respiratory protection is necessary, such as when the contamination levels are at the Immediately Dangerous to Life and Health (IDLH) level.

SAR or airlines must include an in-line escape cylinder of at least 5 minutes. Airlines may not be longer than 300 feet, and may not be used when the line is likely to be severed or entangled.

Respiratory hazards shall be identified as completely as possible in order to determine the best respiratory protections without adding undue stress to the employees. When the identity or reasonable estimate of employee exposure cannot be determined the atmosphere will be assumed to be IDLH.

IDLH respiratory protection shall be Full face pressure demand SCBA for a minimum of 30 minutes or a combination full face pressure demand supplied air respirator with auxillary self-contained air supply.

### 6.5.1 Assigned Protection Factors

The following assigned protection factors will be used to select a respirator that exceeds the required level of employee protection. When a combination respirator is used, the assigned protection factor must be consistent with the mode of operation in which the respirator is being used.

Table 1. Assigned Protection Factors<sup>5</sup>

Type of respirator <sup>1, 2</sup>	Quarter mask	Half mask	Full facepiece	Helmet/ hood	Loose-fitting facepiece
1. Air-Purifying Respirator	5	<sup>3</sup> 10	50	.....	.....
2. Powered Air-Purifying Respirator (PAPR)	.....	50	1,000	<sup>4</sup> 25/1,000	25
3. Supplied-Air Respirator (SAR) or Airline Respirator					
• Demand mode	.....	10	50	.....	.....
• Continuous flow mode	.....	50	1,000	<sup>4</sup> 25/1,000	25
• Pressure-demand or other positive-pressure mode	.....	50	1,000	.....	.....
4. Self-Contained Breathing Apparatus (SCBA)					
• Demand mode	.....	10	50	50	.....
• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)	.....	.....	10,000	10,000	.....

**Notes:**

<sup>1</sup>Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.

<sup>2</sup>The assigned protection factors in Table 1 are only effective when the employer implements a continuing, effective respirator program as required by this section (29 CFR 1910.134), including training, fit testing, maintenance, and use requirements.

<sup>3</sup>This APF category includes filtering facepieces, and half masks with elastomeric facepieces.

<sup>4</sup>The employer must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. This level of performance can best be demonstrated by performing a WPF or SWPF study or equivalent testing. Absent such testing, all other PAPRs and SARs with helmets/hoods are to be treated as loose-fitting facepiece respirators, and receive an APF of 25.

<sup>5</sup>These APFs do not apply to respirators used solely for escape. For escape respirators used in association with specific substances covered by 29 CFR 1910 subpart Z, employers must refer to the appropriate substance-specific standards in that subpart. Escape respirators for other IDLH atmospheres are specified by 29 CFR 1910.134 (d)(2)(ii).

## **6.5.2 Maximum Use Concentration**

Respiratory must be selected that maintains the employee's exposure to the hazardous substance, when measure outside the respirator, at or below the MUC

## **6.6 Respirator Inspection**

The wearer must inspect respirators for completeness prior to each use. All inspections will be recorded on the Respirator Inspection Log.

For air-purifying respirators, inspect the unit to be used for completeness (harness, inhalation valves, exhalation valve, exhalation valve cover, lens, lens cover, spectacles [when required], and appropriate cartridges and/or filters).

Also check the tightness of the connections. Inspect the respirator for wear such as cracks, breaks, excessive dirt, warping, frayed harness, and lens cover abrasion.

For SCBAs, inspect the breathing tube and the check valve. Stretch the breathing tube and inspect it for deterioration, discoloration, pinholes, cuts, or other signs of wear. Also inspect the connector at the end of the breathing tube. The threads should be in good condition, and the "O-ring or rubber gasket should be intact, pliable, and clean.

Check the neck of the air cylinder for the hydrostatic test date. Composite bottles (aluminum wrapped in fiberglass) must be tested every 3 years and steel bottles every 5 years. After placing the bottle in the backpack, check the stability of the cylinder and integrity of the straps.

For SARs, inspect the breathing tube as was done for SCBAs. Airlines should be inspected for deterioration, discoloration, swelling, holes, or cuts. If a Cascade System is used, the compressed gas cylinders must be inspected as was done for SCBAs. Cylinder caps should be screwed down completely when the cylinders are not in use.

Any deficiencies must be reported to the Project Manager/Site Safety Officer and corrected prior to use. Any respirator that does not pass the inspection is unacceptable for use. It must be clearly marked "Out of Service - Do Not Use" and sent for repair.

## **6.7 Donning the Respirator**

### **2.7.1 Procedure**

- Inspect the respirator.
- Loosen all harness strap adjustments.  
NOTE: If a hood is worn, wearing it under the straps will protect scalp hair from pulling, but be sure the edges of the hood do not break the face-to-respirator seal.
- Place chin in chin cup and draw evenly back on strap adjustments. (Bottom two straps first, then two top straps, and finally center top strap.)
- Check that the respirator is centered evenly on the face and that the straps are not uncomfortably tight.

### **6.7.2 Negative- and Positive-Pressure Testing**

- Check for leaks and/or proper facial seal.
  - a. **Negative-Pressure Test:** Cover cartridge air ports with the palms of both hands and attempt to pull air into the mask (breathe in) through inhalation ports. For SCBA or SAR, cover the hole at the end of the breathing tube. The mask should collapse slightly while breath is held for about 10 seconds.
  - b. **Positive-Pressure Test:** Cover the exhalation valve with the palm of your hand and attempt to exhale (do not forcefully blow). The mask should bulge slightly with the positive pressure created inside. Maintain this pressure for about 10 seconds while monitoring for air intake around the face-to-respirator seal.
  - c. If pressure is not maintained, check and/or readjust the faceplate and straps. Make sure your palms are covering all of the cartridge air ports and/or breathing tube hole. Repeat Steps a and b.
- Persistent leaks or improper face seals must be reported to the Project Manager/Site Safety Officer for correction prior to respirator use.

## **6.8 Respirator Maintenance**

Respirators must be cleaned after each use by using the manufacturer's cleaner/sanitizer or by hand washing with a mild disinfectant solution followed by a thorough rinse and air drying. The wearer shall be responsible for thoroughly cleaning and disinfecting the respirator after each day of use to ensure that proper respiratory protection is maintained. If respirators are not used over an extended period, they shall be cleaned and inspected monthly.

Respirator inspection to verify operating condition and maintenance is an integral part of the Respiratory Protection Program. Properly trained personnel will replace or repair respiratory

protective equipment using parts designed for that specific respirator. EQM employees shall not make adjustments, repairs, or replacement of components beyond the manufacturer's recommendation or the employee's level of qualification. The Site Safety Officer or designee must do a weekly pressure check and must inspect all SCBAs on a monthly basis using the manufacturer's recommended procedures. **THIS IS IN ADDITION TO THE INSPECTIONS DONE BEFORE EACH USE.** SCBA ducting, admission valves, or regulators will be repaired only by persons qualified to do so. Records of inspection of SCBA units will be maintained in accordance with 29 CFR 1910.134.

Designated personnel at each storage location will be required to maintain monthly respirator/SCBA inspections.

### **6.8.1 Air-Purifying Respirator/Cleaning and Disinfection**

Respirators that are routinely used will be cleaned and disinfected after each use. In the absence of the manufacturer's recommendations, the following procedures will be used:

1. Remove all cartridges (canisters) and filters plus gaskets and seals not permanently affixed to their seats.
2. Loosen harness adjustment straps.
3. Remove exhalation valve cover.
4. Remove inhalation and exhalation valves.
5. Remove protective faceshield cover.
6. Wash facepiece either in a cleaner/sanitizer powder mixed with warm water or a mild soap/disinfectant solution, preferably in a water temperature of about 120°F. Wash components separately from facepiece. Heavy soil may be removed from the facepiece surface using a medium-soft handbrush. Do not use isopropyl alcohol or any disinfectant containing isopropyl alcohol. It will break down the rubber parts on the respirators.
7. Remove all parts from the wash solution and rinse twice in clean, warm water.
8. Air dry all parts in a designated clean area.
9. Gently pat dry facepieces, valves, and seats to remove any remaining soap residue, water, or other foreign material with a clean, damp, lint-free cloth.
10. Inspect all respirator parts, and replace as needed.
11. Reassemble respirator.

### **6.8.2 Air-Purifying Respirator/Storage**

Respirators will be stored in plastic bags in a designated location that offers protection from dust, sunlight, extreme cold, heat, damaging chemicals, and excessive moisture. **NEVER STORE RESPIRATORS WITH ADJUSTMENT STRAPS OVER THE FRONT OF THE FACEPIECE.**

### **6.8.3 SCBA and SAR/Cleaning and Disinfection**

SCBA units must be cleaned after each day of use. Decontaminate by sponging off the tank, back-pack harness, and regulator. Never allow cleaning solution to enter the regulator. (Do not dunk, soak, or hose off.) Only those specifically trained to disassemble the regulator may do so.

Airlines also require cleaning once they are removed to the decontamination area. This is important not only for prevention of cross-contamination, but to avoid premature wearing of the lines due to chemical action. Brightly colored sleeves are available for airlines to protect them from excessive contamination, wear, and to identify personnel.

### **6.8.4 Procedure for Storing SCBAs**

1. Refill, clean, and inspect the cylinder.
2. Check to ensure the cylinder valve is closed.
3. Connect high-pressure hose tightly to the cylinder.
4. Release any pressure remaining in the high-pressure hose or regulator.
5. Check to ensure the bypass valve is closed.
6. Check to ensure the mainline valve is closed.
7. Place the cylinder in the backpack assembly.
8. Place assembled cylinder and harness in proper container.
9. Loosen straps and lay them flat.
10. Check clean facepiece and place in plastic bag with straps collapsed at the back of the respirator. NEVER STORE FACEPIECE WITH THE STRAPS FORWARD OVER THE LENS.
11. Place facepiece in container with cylinder/backpack assembly and close container.
12. Store unit in a designated area protected from dust, sunlight, extreme heat or cold, excessive moisture, or damaging chemicals.

### **6.8.5 Storage of SAR Systems**

Once dry, airlines must be carefully coiled and stored in a designated area protected from dust, sunlight, extreme heat or cold, excessive moisture, or damaging chemicals. Compressed gas cylinders must be stored upright and securely chained with the caps in place.

## **6.9 Fit-Testing**

The third party occupational evaluation center will conduct quantitative fit testing. In some cases testing maybe conducted onsite by the Site Safety Officer. Qualitative fit testing will be conducted by trained personnel for half face APRs. Quantitative fit testing will be conducted by trained personnel for full face APRs and tight fitting Powered APRs. Fit-testing will be completed annually to establish and document proper respirator fit. Qualitative respirator fit-testing using

established protocols is conducted annually, generally at the training program, or more frequently if conditions arise that affect the face-to-respirator seal. Changes in an employee's facial features (weight loss or gain), illnesses relative to potential respiratory exposures, and employee complaints involving respirator usage will be the criteria used to establish the need for additional respirator fit-testing.

## **6.10 Fit-Testing Protocols**

Qualitative fit-testing may be accomplished by using isoamyl acetate (banana oil) or stannic oxychloride (irritant smoke). Protocols must be followed closely to ensure proper protection when employees are exposed to chemicals in the field. Testing must be documented.

NOTE: If banana oil is used, perform "odor threshold screening" before respirator selection.

### **6.10.1 Respirator Selection Prior to Testing**

1. The wearer shall be allowed to select the most comfortable respirator from an array of sizes and materials.
2. The wearer shall be shown how to don a respirator, how it should be positioned on the face, how to set strap tension, and how to assess a "comfortable respirator." (This does not constitute formal training on respirator use - review only.)
3. The wearer should be instructed that he/she is being asked to select the respirator that provides the most comfortable fit. Each respirator represents a different size and shape and, if fit properly, will provide adequate protection.
4. The wearer shall hold each facepiece to his/her face and eliminate those that are clearly not giving a comfortable fit.
5. The most comfortable facepiece is donned by the employee and worn approximately 5 minutes to assess comfort. If the wearer is not familiar with respirator usage, he/she shall be instructed how to don the respirator, to adjust straps, and to remove the respirator several times. Assessment of comfort shall be based on the following points:
  - a. Proper chin placement
  - b. Strap tension
  - c. Adequate time for assessment.
6. The wearer shall be instructed to properly "seat" his/her respirator by rapidly moving his/her head (side to side, and up and down) and taking a few deep breaths.
7. The wearer shall conduct both positive- and negative-pressure fit checks in accordance with ANSI Z-88.2-1980.
8. The wearer is now ready for respirator fit-testing.
9. After testing, if there is any question relative to respirator fit or comfort, respirator selection and fit-testing shall be repeated.

### **6.10.2 Odor Threshold Screening (for Banana Oil)**

1. When testing with isoamyl acetate (also called isopentyl acetate or banana oil), the ability to smell the substance must be determined prior to the actual fit-test.
2. In a well-ventilated area away from the test room, the subjects will be asked to close their eyes. The ampule of banana oil will then be broken and allowed to vaporize for 1 minute.
3. The ampule will be held within 2 inches of the wearer's face and moved from one side to the other.
4. The wearer will then be asked to identify the odor.
5. If the wear is unable to correctly identify the banana oil odor, the irritant smoke test must be used.
6. If the wearer correctly identifies the banana oil odor, he may proceed to respirator selection and fit-testing.

### **6.10.3 Fit-Test Using Isoamyl Acetate (Banana Oil)**

1. The fit-test chamber shall be substantially similar to a clear 55-gallon drum liner suspended inverted over a 2-foot-diameter frame so that the top of the chamber is about 6 inches above the wearer's head. A small hook shall be attached to the inside top center of the chamber.
2. Each respirator used for the fitting and fit-testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.
3. After selecting, donning, and properly adjusting a respirator himself/herself, the wearer shall wear it to the fit-testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, by an exhaust fan or lab hood, to prevent general room contamination.
4. A copy of the following test exercises shall be taped to the inside of the test chamber.

#### **Test Exercises**

- a. Normal breathing.
  - b. Deep breathing. Be certain breaths are deep and regular.
  - c. Turning head from side to side. Be certain movement is complete. Alert the wearer not to bump the respirator on the shoulders. Have the wearer inhale when his/her head is at either side.
  - d. Nodding head up and down. Be certain motions are complete and made about every second. Alert the wearer not to bump the respirator on the chest. Have the wearer inhale when his/her head is in the fully up position.
  - e. Talking. Talk aloud and slowly for several minutes. Reading will result in a wide range of facial movements, and thus be useful to satisfy this requirement.
5. Each wearer shall wear his/her respirator for at least 10 minutes before starting the fit-test.
  6. Upon entering the test chamber, the wearer shall be given a 5- by 6-inch piece of paper towel or other porous absorbent single-ply material, folded in half and wetted with three-quarters

of 1 cc of pure isoamyl acetate (IAA). The wearer shall hang the wet towel on the hook at the top of the chamber.

7. Allow 2 minutes for the IAA test concentration to be reached before starting the fit- test exercises. This would be an appropriate time to talk with the wearer; to explain the fit-test, the importance of his/her cooperation, and the purpose for the head exercises; or to demonstrate some of the exercises.
8. Each exercise described in No. 4 above shall be performed for at least 1 minute.
9. If at any time during the test the wearer detects the banana-like odor of IAA, he/she shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.
10. Upon returning to the selection room, the wearer shall remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, etc. The process continues until a respirator that fits well has been found. Should the subject fail the odor sensitivity test, the subject shall wait about 5 minutes before retesting. Odor sensitivity usually returns by this time.
11. Wearers will be fitted with a full-face and/or half-mask respirator at the discretion of the Health & Safety Coordinator. When a respirator is found that passes the test, its efficiency shall be demonstrated for the subject by having him break the face seal and take a breath before exiting the chamber.
12. When the wearer leaves the chamber, he/she shall remove the saturated towel and return it to the test conductor. To keep the area from becoming contaminated, the used towels shall be kept in a self-sealing bag to prevent significant IAA concentration build-up in the test chamber from subsequent tests.
13. Persons who have successfully passed this fit-test may be assigned the use of the tested respirator in atmospheres with up to 10 times the PEL. In other words, this IAA protocol may be used to assign a protection factor no higher than 10.

NOTE: Ampules of isoamyl acetate (banana oil) may also be used instead of the towel wetted with IAA. The procedure is the same except the tester must hold or suspend the broken ampule within the chamber.

#### **6.10.4 Respirator Fit-Testing (Irritant Smoke)**

NOTE: This procedure will only be performed by the Health & Safety Manager or his/her designee.

1. The fit test chamber shall be a 55-gallon drum liner suspended in such a manner to allow the wearer's head and shoulders to be covered by the liner.
2. The respirator to be used shall be equipped with NIOSH-approved cartridges for particulate contamination.
3. The testing procedure shall be explained to the wearer and will include how the test is performed, possible reactions to irritant smoke, and action to be taken in the event of respirator leakage.

4. The wearer shall properly don the respirator and perform both the positive- and negative-pressure respirator fit checks.
5. Break both ends of the ventilation smoke tube containing stannic oxychloride. Attach a short piece of polyethylene tubing to one end of the tube and the pressure bulb to the other.
6. Place the wearer in the previously mentioned test chamber and explain that he/she should remove the test chamber immediately if he/she has any difficulty breathing or feels that contaminants are entering the mask at any point during the testing procedure.
7. The respirator fit-testing with irritant smoke shall proceed as follows:

#### Test Exercises

- a. Direct 6 to 10 puffs of irritant smoke toward the wearer and around the respirator seal at a distance of 1 inch, instructing the wearer to breathe normally. Note the number of squeezes and any reaction.
  - b. Direct 6 to 10 puffs of irritant smoke toward the wearer and around the respirator seal at a distance of 1 inch, instructing the subject to perform head nodding motions while taking even, deep breaths. Note the number of squeezes and results.
  - c. Direct 6 to 10 puffs of irritant smoke toward the wearer at a 1-inch distance and around the respirator seal of the mask, instructing the wearer to move his/her head forward and backward and from side to side while breathing normally. (Caution the subject not to touch canisters to the chest or shoulders as this may break the face-to-respirator seal.) Note the number of squeezes and results.
  - d. Direct 6 to 10 puffs of irritant smoke toward the wearer and around the respirator seal at a distance of 1 inch, instructing the wearer to perform a head nodding motion while counting backwards from 100. Note the number of squeezes and results.
8. Note the total number of squeezes applied, whether or not a seal was obtained, the type of cartridge used, and the type and size of respirator used.
  9. If, during the testing process, irritant smoke produces an involuntary reaction (cough) on the part of the wearer, the test shall be voided, the respirator shall be rejected, and another respirator shall be selected to repeat the testing process.
  10. Tests 1 through 4 of this protocol shall be performed in an area with ventilation adequate to prevent general contamination of the test area by the testing agent. At the completion of the test, the subject will be instructed to briefly crack the mask seal to be sure he/she can smell the irritant smoke.
  11. Respirators successfully tested by the protocol may be used in contaminated atmospheres up to 10 times the PEL. In other words, this protocol may be used to assign protection factors not exceeding 10.

### 6.11 Work Area Surveillance

Many variables may affect the need for respiratory protection. Upgrading of respiratory protection will be based on appropriate surveillance of the work area conditions and the degree of employee exposure or stress. Air monitoring will be conducted at all hazardous waste investigation/cleanup sites. The nature and frequency of the monitoring will depend on the

activity being performed and the known or suspected hazards present. Each Site Safety Plan will include a specific air monitoring protocol.

The Health & Safety Coordinator will be responsible for monitoring the frequency of surveillance, the results of surveillance, and the level of protection needed. The Project Manager/Site Safety Officer will be responsible for enforcing the use of respiratory protection, personal protective equipment, and air monitoring protocols as written in the Site Safety Plan.

## **6.12 Program Effectiveness**

The Project Manager or designee will frequently evaluate respirator practices to determine whether respirators are being used properly. Periodic consultation with wearers will be conducted to evaluate the following: level of discomfort, resistance to breathing, interference with vision, communication and job function, fatigue, and confidence in the respirator's effectiveness.

To maintain the program's effectiveness, the Corporate Health & Safety Director will annually review information gathered during such evaluations along with measurements of hazard levels in the work area and the medical surveillance of users. The Corporate Health & Safety Director will make all major policy decisions regarding the Respiratory Protection Program.

## **7. RECORDS**

In addition to the Respiratory Protection Program Plan and operating procedures, the following documentation will be maintained:

- Medical Clearance Certification for Respirator Usage (each employee)
- Respiratory Protection Training (each employee)
- Respirator Fit-Testing (each employee)
- Respirator Equipment Inspections and Maintenance Actions
- Program Effectiveness Inspections and Evaluations

## **8. TRAINING**

Initial respirator training is the responsibility of the Corporate Health & Safety Director. This training will be conducted during the 40-hour initial training program for field personnel. As required for non-hazardous waste site personnel, respiratory training will be provided as a separate module. Additional respirator training will be provided during the annual refresher course.

Training will include:

- Proper use and limitation of respirators
- Reasons for respirator use
- Selection of respirators and cartridges
- Inspection of respirators
- Donning the respirator
- Use in emergency situations

- Maintenance and storage
- Fit-testing (includes handling of various respirators and a long period of wear in normal air)
- Health monitoring
- Special situations - Confined space, heat, cold, lighting, etc.

Retraining will be conducted when inadequacies in employee's knowledge or use are identified

## 9. REVISION HISTORY

The EQM Directory, Health and Safety, or designee is responsible for reviewing this procedure and initiating revisions when necessary. This procedure shall be reviewed at least every 3 years and the HSO must approve any revisions.

<b>Date</b>	<b>Purpose / Description of Revisions</b>	<b>Pages Affected</b>	<b>Authorized by</b>

## **RESPIRATORY EQUIPMENT INSPECTION CHECKLIST**

### **Disposable Respirators -- Check for:**

- ☐ holes in filter (obtain new respirator)
- ☐ deterioration or loss of elasticity in straps (obtain new respirator)
- ☐ deterioration of metal nose clip (obtain new respirator)

### **Air-Purifying Respirators (half mask, full face piece, hood or helmet)**

#### **Rubber Face Piece -- Check for:**

- ☐ Excessive dirt (clean all dirt from face piece)
- ☐ Cracks, tears, or holes (obtain new respirator)
- ☐ Full face respirators cracked, scratched, or loose fitting lenses (obtain new respirator)

#### **Head Straps -- Check for:**

- ☐ Breaks or tears (replace head straps)
- ☐ Loss of elasticity (replace head straps)
- ☐ Broken or malfunctioning buckles (obtain new straps & buckles or respirator)

#### **Inhalation Valve and Exhalation Valve -- Check for:**

- ☐ Detergent residue, dust particles, or dirt on valve or valve seat (clean with water or a weak solution of Clorox and water -- one cup of bleach per gallon of water).
- ☐ Cracks, tears, or lack of flexibility in the valve material (obtain new valve)
- ☐ Cracks and flexibility of valve seats (obtain new respirator)

#### **Filter Element -- Check for:**

- ☐ Proper filter for the hazard
- ☐ Worn threads; both in filter and face piece (replace filter or face, as applicable)
- ☐ Cracks or dents in filter housing A (replace filter)
- ☐ Cartridge gaskets in place (if applicable)

### **Atmosphere Supplying Respirators**

#### **Self Contained Breathing Apparatus (SCBA)**

- ☐ Consult manufacturer's literature

<b>EQM Standard Operating Procedure</b>		Procedure No.	<b>SOP 344</b>
		Issue Date:	August 2016
<b>Title: Use of a Live Line Telescoping Tool</b>			
Approved by:	J. Kominsky, CIH, CSP, CHMM, ROH Director Health and Safety	Revision No.	0

## 1. PURPOSE

To establish safety guidelines for the use of “hot sticks.” Hot sticks is a commonly used synonym for insulating rods and foam-filled tubes made from fiberglass-reinforced plastic (FRP) that are intended of use in live line tools that meet the specification in ASTM Standard F711-02 (2013). Figure 1 shows an example of a telescoping hot stick with a tip lock feature. This SOP **ONLY** addresses the use of hot sticks utilizing an “S” hook for propping up live service lines to allow for work or travel underneath the energized line. Only licensed electricians will connect or disconnect live lines utilizing a hot stick. The goal is to educate employees to properly use, handle, and store the hot sticks in order to prevent injury to personnel and damage to equipment and property.



**Figure 1. Telescoping FRP Hot Stick.**

## 2. SCOPE

The requirements set forth in this standard operating procedure apply to EQM employees and subcontractors involved in the use of hot sticks during work activities at all EQM offices and temporary work sites.

## 3. REFERENCE(S)

29 CFR 1910.269 (j)  
ASTM F711-02(2013)

## 4. DEFINITIONS

### Hot Stick

- A fiberglass-reinforced plastic (FRP) rod and tube used in live line tools or energized electrical lines.
- Hot sticks have a certification printed on them that shows the rating and testing performed by the manufacturer in accordance with 29 CFR 1910.269 (j)(2).

**Personal Protective Equipment (PPE)**—PPE will include the prescribed equipment for each specific work site in addition to the prescribed 30-kV Class 3 electrical gloves.

## **5. RESPONSIBILITIES**

### **5.1 Corporate Health and Safety Staff**

Corporate health and safety staff are responsible for contacting state OSHA agencies to obtain copies of state-specific equipment regulations, training, and licensing requirements. Safety and health staff will coordinate training for hot stick use and ensure that appropriate training certificates are placed in the corporate training files. Safety and health staff will assist site supervisors in enforcing safe work practices and training requirements for hot stick operation.

### **5.2 Site Supervisors**

Site supervisors are responsible for verifying that personnel operating hot sticks have the required training and experience to perform their assigned work tasks. This may be done by reviewing training certificates and licenses and/or observing hands-on exercises with the equipment. Site supervisors will inspect equipment operations for unsafe work practices and immediately correct unsafe situations. Inspections will be documented in writing at least monthly as well as before each use of the equipment.

Site supervisors are responsible for establishing a routine maintenance schedule for each piece of equipment and ensuring that maintenance is completed on time. Site Supervisors will also arrange for required repairs and major servicing and verify that such repairs and service have been properly completed before the equipment is returned to work operations. In addition, Site Supervisors are responsible for ensuring the proper PPE is available and used.

### **5.3 Personnel Utilizing Hot Sticks**

Personnel are prohibited from using hot sticks without authorization from the Site Supervisor. Personnel will demonstrate adequate training and experience with the equipment to the Site Supervisor before receiving authorization to begin work.

Personnel using hot sticks will perform an inspection prior to and immediately following their use. This inspection must include verifying the safe operating condition prescribed in 29 CFR 1910.269 (j) (2) and will be documented on the equipment inspection checklist:

- Check for visible damage and wipe clean with the appropriate silicone wipe specifically manufactured for cleaning and maintaining the proper condition of hot sticks.
- Damaged or defective equipment must be immediately tagged out-of-service until such problems are corrected and verified by the Site Supervisor.
- If the Site Supervisor also determines the damage will render the hot stick “out of service,” he/she will immediately dispose of the hot stick and replace it.

## 5.4 All Employees

EQM employees are responsible for complying with this procedure and with Federal, State, and Local regulations governing the use and safety of the equipment. Employees are prohibited from horseplay with or around the equipment or in any other area within the project limits and from using such equipment without authorization from the Site Supervisor or Project Manager.

## 6. OPERATING

### 6.1 Minimum Safety Requirements

#### 6.1.1 Fire Extinguishers (ABC)

Fire extinguishers will be present within 20 feet of the generator if a gas-powered generator is being used as a power source.

#### 6.1.2 Personal Protective Equipment (PPE)

The following personal protective equipment (at a minimum) shall be used at all EQM work sites:

- Hard hat
- Safety glasses with attached side shields
- Safety toe boots
- Class 2 DOT reflective safety vest.

Additional PPE required when utilizing hot sticks:

- 30-kV Class 3 electrical gloves.

### 6.2 Materials

The hot stick shall be used only for its intended purpose as outlined in this SOP and within the limits of its design and capabilities.

### 6.3 Authorized Personnel

Only trained personnel shall be permitted to use hot sticks. Training shall include instruction in operation under normal conditions. Hot sticks can be used on energized electrical lines for many purposes. EQM and its employees are **ONLY** authorized to use hot sticks to temporarily prop up or raise low or sagging electrical lines to allow for safe travel or work under the lines. EQM personnel will **NEVER** use hot sticks to disconnect or sever energized lines or move downed lines that are still energized.

### 6.4 Operational Safety

When utilizing hot sticks, it is imperative to wear the proper PPE and use only the designated gloves (30-kV or higher Class 2 electrical gloves).

## 6.5 Procedures

The following procedures pertain to the proper use of hot sticks:

- Perform a pre-use visual inspection. Ensure that the hot stick is clean and free of moisture or condensation. Wipe down the hot stick with the specified silicone wipe.
- Ensure that the proper safety equipment (PPE) is in use. Begin by extending the hot stick until the “S” hook engages the line that is to be raised. Once the line has been engaged, continue to extend the telescoping hot stick until the desired height is achieved to allow for safe travel or work under that line. **DO NOT** extend the line to the extent that there is undue stress on the line or any of its connection points to any structure. This could result in a line breaking and causing an unsafe condition that could result in injury/death to personnel and damage to equipment and property.
- Place the bottom of the hot stick on the ground or into a base constructed for the hot stick so that there is enough tension from the line to hold the hot stick in place without causing undue stress on the line.
- Using safety cones, construction fence, or caution tape, cordon off the area around the Hot Stick to ensure that it is not disturbed by equipment or personnel. For lines and equipment energized at 50 kV or less, the distance is 3.05 meters (10 feet). For lines and equipment energized at more than 50 kilovolts, the distance is 3.05 meters (10 feet) plus 0.10 meter (4 inches) for every 10 kV over 50 kV.
- Periodically check the hot stick to ensure it is still in place and that it has not been disturbed by wind, personnel, or equipment. If it has been disturbed, clear the area underneath the line and reposition the hot stick.
- At the end of the shift, remove the hot stick, perform an inspection, wipe it down with a silicone wipe, and store it properly in its case. **DO NOT** leave the hot stick in place and unattended during non-work hours.

## 6.6 Cleaning Tips

**WARNING!!!** Some detergents/cleaning agents may be harmful to the hot stick, causing it to become unsafe for use.

**CAUTION** – Never Use:

- Bleach, chlorine, or other corrosive chemicals
- Liquids containing solvents (i.e., paint thinner, gasoline, or oils)
- Tri-sodium phosphate products
- Ammonia products
- Acid-based products.

If the hot stick requires cleaning beyond the capability of the silicone wipe to remove dirt, dust, etc., the only acceptable cleaning agent is a mild detergent and water. An acceptable mild detergent is Dawn Dishwashing detergent and water used in conjunction with a soft cotton cloth.

Abrasive cloths and other materials will harm the outer coating of the hot stick and are not to be used to clean the hot stick.

## **6.7 Repairs and Servicing**

Because the cost to repair and have the hot stick tested and certified by an outside facility is prohibitive, any damage that places the hot stick out of service will require it to be replaced. The damaged hot stick should be dismantled and disposed of to ensure it is not used again or mistakenly placed back into service.


## **7. TRAINING**

All training will be performed by qualified personnel and documented.

## **8. REVISION HISTORY**

The EQM Director, Health and Safety, or designee is responsible for reviewing this procedure and initiating revisions when necessary. This procedure shall be reviewed at least every 3 years and the HSO must approve any revision.

<b>Date</b>	<b>Purpose/Description of Revisions</b>	<b>Pages Affected</b>	<b>Authorized by</b>

 <b>Standard Operating Procedure</b>		Procedure No.	<b>SOP 347</b>
		Issue Date:	09/14/2017
Title: <b>Manual Lifting</b>			
Approved by:	David Arthur	Revision No.	0

## 1. PURPOSE

To prevent back and other strain injuries by using correct procedures for lifting and moving heavy objects and loads, as described in this Standard Operating Procedure (SOP).

## 2. SCOPE

This document applies to all EQM personnel and subcontractors at all work locations.

## 3. REFERENCES

- OSHA's Ergonomic E-Tool  
(<https://www.osha.gov/SLTC/etools/electricalcontractors/materials/heavy.html>)
- *OSHA Technical Manual*, Section VII: Chapter 1, Back Disorders and Injuries

## 4. DEFINITIONS

**Heavy Object** – Any object weighing more than 40 pounds.

**Manual Lifting** – Any transporting or supporting of a load (including the lifting, putting down, pushing, pulling, carrying, or moving thereof) by hand or by bodily force.

## 5. RESPONSIBILITIES

### 5.1 Project Management (includes Site Manager, Project Manager, Response Manager, and Site Safety Officer)

The Project Manager and/or Site Safety Officer are responsible for:

- Ensuring personnel do not lift heavy objects alone, or lift objects improperly.
- Providing training to employees covering lifting techniques and how to avoid back injuries through proper body positioning.
- Assessing the risks of non-routine tasks.

## 5.2 Corporate Health and Safety Director (HSO)

The Corporate Health and Safety Director is responsible for:

- Disseminating ergonomic information as it becomes available.
- Establishing general lift training for new employees.
- Assisting (when requested) in coordinating responses to all inquiries by employees regarding lifting devices and/or manual lifting techniques.

## 5.3 All Employees

All employees will follow these minimum requirements:

- Adhere to all client and EQM ergonomic requirements while at EQM work sites.
- Utilize any EQM provided lifting devices when lifting objects greater than 40 pounds, and follow proper lifting techniques for manual lifting.
- Notify immediate supervisor of defective lifting devices, or if they suffer/suspect an injury.
- Participate in training.
- Refuse to lift heavy objects without assistance, or using a lifting device until receiving appropriate lift training.

Employees who do not comply with the provisions of this program will be held accountable in accordance with EQM's policy of progressive discipline.

## 6. PROCEDURE

### 6.1 Specific Lifting Technique

By following the proper lifting technique, individuals will protect their back while being able to lift objects less than 40 pounds. Proper lifting technique will also inform them when it's time to get assistance. The general rules for minimizing injuries from manual lifting are:

- If an object is too awkward or heavy to lift, **GET HELP**. Always use two or more persons when necessary.
- Analyze if manual lifting is even necessary, and utilize equipment to move heavy objects if practical.
- If there's no other way to move a heavy object other than manual lifting:
  - Plan the lift.
  - Lift close to your body and with minimal torso twisting.
  - Ensure a firm grip on the object.
  - Place feet shoulder width apart.
  - Bend at the knees.
  - Keep a straight back.
  - Tighten the stomach muscles.

- Lift gradually by straightening the legs.
- Bend at knees to lower an object.

Weight is not the only factor in protecting workers from back injuries during lifting. Other considerations include how frequent the task will be performed, how far of a reach is needed to grasp the object, and how high the object must be lifted. Additional factors to be considered include footing and the twist angle the worker must use to pick up and set down the object.

The National Institute for Safety and Health (NIOSH) has issued a smart-phone app for calculating a safe lift. Supervisors are advised to use it before assigning work that would require heavy lifting.

It is essential to follow the procedures noted above, as back injuries can be permanent and very painful.

## **6.2 Non-Routine Tasks**

Employees may be required to perform non-routine tasks that may result in encountering heavy objects or heavy lifting situations. Prior to starting work on such tasks, the Response or Project Manager (or their designee) will alert workers about the hazardous situation they may encounter.

This information will include, at a minimum:

- Specific lifting techniques for the specific object(s).
- Methods for preventing or eliminating stress on the worker's body.
- Use of the buddy system where required.
- Emergency procedures in the event of an injury.

## **6.3 Multi-Employer Sites**

If employees of another employer could encounter heavy objects on site, the Project Manager (or designee) will:

- Provide the other on-site employer(s) with access to any weight analysis for heavy objects (by type when more than one) that the other employer(s)' employee(s) may encounter while working.
- Inform the other employer(s) about precautionary measures that need to be taken to protect employees during normal operating conditions and in emergencies.
- Inform the other employer(s) of any devices used to assist in lifting heavy objects.

## **6.4 Recordkeeping**

The Corporate Health and Safety Manager will maintain records pertaining to back and spine injuries, along with the ergonomic training to avoid them, at the corporate level; the Site Safety Officer will maintain these records on temporary work sites.

## **7. RECORDS**

The following records will be kept:

- Training records regarding lifting techniques.
- Incident and near-miss reports.

## **8. TRAINING**

### **8.1 Initial Training**

Prior to starting work, all EQM employees will receive initial training on this SOP and on proper lifting techniques as part of the new hire orientation. If lifting devices are available on site, workers must be trained on how to use them properly.

EQM employees are encouraged to identify any topics where they believe additional training or remedial training is needed in addition to the prescribed levels.

### **8.2 Site-Specific Training**

Site-specific training will take place prior to the start of field work. With the aid of Safety Data Sheets (SDSs), the Project Manager (or designee) will be responsible for training all employees regarding site-specific objects and lifting hazards. Individual or small-group training will be conducted during normal working hours. The length of training will vary depending on the hazards present. Site-specific training will be conducted to educate employees on anticipated hazards, and conservative protective measures will be implemented to protect workers from harm.

### **8.3 Periodic Training**

If new objects or new hazards are introduced, each employee in the affected work area will be given information and training on new requirements. Retraining will not be necessary as long as individuals are using proper lifting techniques and training has already been conducted.

### **8.4 Training Content**

Employees who work with, or will be potentially exposed to, hazardous chemicals will receive information and training on the following:

- Overview of the ergonomics relating to lifting.
- How to calculate a proper lift.
- Location and availability of lifting devices.
- Physical and health effects of an improper lift.
- Methods and techniques to lift properly.

- Methods of preventing or eliminating manual lifting through use of engineering controls and work practices.
- Emergency procedures to follow if you are injured.

The information and training may be designed to cover specific lifting situations. All training will be documented in the EQM training management system. Trade secret information is not associated with manual lifting.

## 9. REVISION HISTORY

The EQM Health and Safety Director (or designee) is responsible for reviewing this procedure and initiating revisions when necessary. This procedure shall be reviewed at least every 3 years and the HSO must approve any revision.

<b>Date</b>	<b>Purpose / Description of Revision</b>	<b>Page(s) Affected</b>	<b>Authorized by</b>

## **APPENDIX C**

### **ACTIVITY HAZARD ANALYSES**

## ACTIVITY HAZARD ANALYSIS

**JOB TASK:** Air Monitoring

**PERSONAL PROTECTIVE EQUIPMENT:** Level D

HAZARD	CONTROL MEASURES
Chemical Exposure –	Conduct air monitoring in accordance with monitoring requirements specified in 29 CFR 1910.120. Wear proper PPE at all times.
Slip/Trip/Fall – Debris, wet surfaces, spoilage, excavation	Use buddy system. Maintain awareness of surroundings.
Heat/Cold Stress – Weather conditions, physical activity, and wet clothing	Take breaks in climate-controlled areas, use buddy system, maintain dry clothing inventory, monitor weather forecasts and dress appropriately, provide sufficient drinking water, ensure RMHO monitoring of workers.

<b>JOB TASK:</b>	Clearing Vegetation with Heavy Equipment	<b>RISK ASSESSMENT CODE (RAC):</b>																																						
<b>RECOMMENDED PROTECTIVE CLOTHING AND EQUIPMENT</b>		<table border="1"> <tr> <td colspan="2" rowspan="2"> E = Extremely High Risk  H = High Risk  M = Moderate Risk  L = Low Risk </td> <th colspan="5">Probability</th> </tr> <tr> <th>Frequent</th> <th>Likely</th> <th>Occasional</th> <th>Seldom</th> <th>Unlikely</th> </tr> <tr> <td rowspan="4">Severity</td> <td>Catastrophic</td> <td>E</td> <td>E</td> <td>H</td> <td>H</td> <td>M</td> </tr> <tr> <td>Critical</td> <td>E</td> <td>H</td> <td>H</td> <td>M</td> <td>L</td> </tr> <tr> <td>Marginal</td> <td>H</td> <td>M</td> <td>M</td> <td>L</td> <td>L</td> </tr> <tr> <td>Negligible</td> <td>M</td> <td>L</td> <td>L</td> <td>L</td> <td>L</td> </tr> </table>		E = Extremely High Risk H = High Risk M = Moderate Risk L = Low Risk		Probability					Frequent	Likely	Occasional	Seldom	Unlikely	Severity	Catastrophic	E	E	H	H	M	Critical	E	H	H	M	L	Marginal	H	M	M	L	L	Negligible	M	L	L	L	L
E = Extremely High Risk H = High Risk M = Moderate Risk L = Low Risk		Probability																																						
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	Marginal	H	M	M	L	L																																		
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HAZARDS	CONTROLS (NOT ACTIONS) TO ELIMINATE OR MINIMIZE HAZARDS	RISK
Contact with poison ivy / dermatitis	<ul style="list-style-type: none"> <li>Wear PPE to avoid skin contact with contaminated soil, waste, plants, or other skin irritants</li> <li>Identify and review poisonous plants with workers</li> <li>Identify workers who are known to contract poison ivy</li> <li>Wear PPE and tape joints to keep poison ivy irritants and plant matter away from skin</li> </ul>	
Handling heavy objects / injuries resulting from manual lifting of pumps, piping, or hoses	<ul style="list-style-type: none"> <li>Observe proper lifting techniques (i.e., back straight, bend at knees, load close to body, lift smoothly, and do not twist)</li> <li>Obey sensible lifting limits (50 lb. Maximum per person manual lifting)</li> <li>Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads</li> <li>Avoid carrying heavy objects above shoulder level</li> <li>Avoid manual lifting/carrying tasks</li> <li>Split heavy loads into smaller loads whenever possible</li> <li>Make sure the path of travel is clear prior to the lift</li> </ul>	
Falling objects	<ul style="list-style-type: none"> <li>Staging areas will be kept in an orderly manner</li> <li>Housekeeping will be a constant priority</li> <li>All materials stored in tiers shall be stacked, racked, blocked, or in some means secured to prevent sliding, falling or collapsing</li> <li>Cylindrical materials such as piping shall be blocked or bound to contain spreading or rolling</li> <li>Spotter to be used when unloading any materials</li> </ul>	
Eye injury	<ul style="list-style-type: none"> <li>Wear ANSI compliant safety glasses at all times</li> </ul>	
Head injury	<ul style="list-style-type: none"> <li>ANSI-compliant hard hats will be worn at all times, in the manner they are designed (brim forward, no modifications, no ball caps, etc.)</li> </ul>	
Foot injury	<ul style="list-style-type: none"> <li>Workers will wear safety-toed leather boots at all times</li> </ul>	
Hand injury	<ul style="list-style-type: none"> <li>Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects</li> <li>Avoid razor knives. Use hooked cutters or shears whenever possible</li> <li>Cut away from the body</li> <li>Maintain all hand and power tools in a safe condition</li> <li>Leather gloves shall be worn when handling sharp, rough, or slippery surfaces</li> </ul>	
Heat stress/high ambient temperature	<ul style="list-style-type: none"> <li>Workers will be trained in the recognition of heat stress and appropriate actions to take</li> <li>Workers are encouraged to increase fluid intake while working</li> <li>Workers should minimize or avoid alcohol intake the night before working in heat stress situations</li> <li>Workers will increase the frequency and duration of rest breaks while working in heat stress situations</li> <li>Workers will watch each other for signs and symptoms of heat exhaustion and fatigue</li> </ul>	
Cold Stress/low ambient	<ul style="list-style-type: none"> <li>Workers will be trained in the recognition of cold stress and appropriate actions</li> </ul>	

HAZARDS	CONTROLS (NOT ACTIONS) TO ELIMINATE OR MINIMIZE HAZARDS	RISK
temperature	<ul style="list-style-type: none"> <li>to take</li> <li>Workers will watch others for signs and symptoms of cold stress (shivering, numbness, sluggishness)</li> <li>Provide dry, warm break area. Take breaks in heated shelters</li> <li>Drink warm liquids to reduce the susceptibility to cold stress</li> <li>Remove outer layer of clothing and loosen other layers to promote evaporation of perspiration upon entering shelter</li> </ul>	
Accidents due to poor lighting	<ul style="list-style-type: none"> <li>Work at site is only expected to take place during daylight hours</li> <li>Proper lighting must be in place when working inside or after daylight hours</li> </ul>	
Pinch points	<ul style="list-style-type: none"> <li>Review equipment adjustment procedures, identify pinch points</li> <li>Isolate/block pinch points to limit motion when inserting pins, fasteners, closing tackles</li> <li>Wear leather gloves</li> </ul>	
High noise levels / hearing damage	<ul style="list-style-type: none"> <li>Workers will wear hearing protection whenever voices must be raised above normal conversational speech or when noise levels exceed 85 decibels due to a loud noise source; such as working around heavy equipment</li> <li>Hearing protection will be worn by equipment operators when working in open cab equipment, or when doors/windows are open</li> </ul>	
Injury due to inclement weather	<ul style="list-style-type: none"> <li>Outdoor work will cease during extreme weather conditions, such as electrical storms, high wind rain, and extreme temperatures</li> <li>Shut all equipment down when lightening is visible and wait for "all-clear" from the PM/SSO</li> <li>Supervisors will monitor local forecasts for warnings about specific weather hazards</li> <li>Workers will take cover indoors or in vehicle</li> <li>Workers will comply with all evacuation orders regarding rough weather directives</li> </ul>	
Overexertion	<ul style="list-style-type: none"> <li>Use the right tool for the task at hand</li> <li>Avoid actions/activities that produce overexertion</li> </ul>	
Slips, trips, falls	<ul style="list-style-type: none"> <li>Clear walkways work areas of equipment, tools, vegetation clutter, debris, and congestion to the greatest extent possible</li> <li>Exit equipment slowly and maintain three point contact</li> <li>Mark, identify, or barricade other obstructions</li> <li>Wear hard hat, safety glasses, leather gloves, and steel toe work boots</li> <li>Personnel will be briefed on the hazards of wet, muddy soil hazards and traversing uneven grades</li> <li>Walk or climb only on equipment and/or surfaces that are designed for personnel access</li> <li>Be aware of potential for poor footing while working on un-compacted backfill materials</li> </ul>	
Electrical shock	<ul style="list-style-type: none"> <li>De-energize or shut off utility lines at their source before work begins</li> <li>Use double insulated or properly grounded electric power-operated tools</li> <li>Provide an equipment-grounding conductor program or employ ground-fault circuit interrupters</li> <li>Use qualified electricians to hook up / disconnect electrical circuits</li> <li>Inspect all extension cords daily for structural integrity, ground continuity, and damaged insulation</li> <li>Cover or elevate electric wire or flexible cord passing through work areas to protect from damage</li> <li>Keep all plugs and receptacles out of water</li> <li>Use approved water-proof, weather-proof type if exposure to moisture is likely</li> <li>Inspect all electrical power circuits prior to commencing work</li> <li>Lockout / Tag out device</li> </ul>	
Injuries due to contact with	<ul style="list-style-type: none"> <li>Wear reflective warning vests when exposed to vehicular traffic</li> </ul>	

HAZARDS	CONTROLS (NOT ACTIONS) TO ELIMINATE OR MINIMIZE HAZARDS	RISK
equipment / struck by or against heavy equipment / injuries from being "caught" on equipment	<ul style="list-style-type: none"> <li>Isolate equipment swing areas</li> <li>Make eye contact with operators before approaching equipment</li> <li>Understand and review hand signals</li> <li>Follow hand signals of ground workers for equipment manipulation when placing/loading equipment into bucket</li> <li>Step away from equipment when buck adjustments are made</li> <li>Wear warning vests, hard hat, safety glasses, and steel toe work boots</li> <li>Workers on the ground will maintain visual contact with the equipment operator when heavy equipment is used</li> <li>Workers on the ground will not enter an equipment swing radius</li> <li>Equipment requiring an operator will not be permitted to run unattended</li> <li>All heavy equipment will be equipped with a functional backup alarm</li> <li>Workers will avoid wearing loose-fitting clothing</li> <li>Workers will keep your hands away from moving parts</li> </ul>	
Ladders	<ul style="list-style-type: none"> <li>Inspect ladders before use for mud buildup on treads</li> <li>Clean mud from boots before climbing on ladders</li> <li>Follow the three point of contact rule</li> </ul>	
Pinch points	<ul style="list-style-type: none"> <li>Review equipment adjustment procedures, identify pinch points</li> <li>Isolate/block pinch points to limit motion when inserting pins, fasteners, closing tackles</li> <li>Wear leather gloves</li> </ul>	
Injuries and accidents due to equipment failures	<ul style="list-style-type: none"> <li>Equipment will be checked for proper operation prior to starting work each shift, includes visual inspections, checking all fluid levels and hydraulic systems. Operators will fill out daily equipment checklist</li> </ul>	
Injuries and damage due to fire	<ul style="list-style-type: none"> <li>Prohibit smoking in work areas. Smoking will be allowed in designated areas only</li> <li>Prohibit storage and transfer of flammable liquids in plastic containers. Flammable liquids will be kept in approved, closed containers. Store flammable liquids in well ventilated areas</li> <li>The site will be kept clean and free of combustible debris such as paper</li> <li>Hot work safety procedures will be followed when welding or performing other activities requiring an open flame</li> <li>Flammable and combustible materials from kept separate from ignition sources</li> <li>Eliminate sources of ignition from the work area</li> <li>Provide ABC (or equivalent) fire extinguishers for all flammable storage areas, powered cutting equipment re-fueling areas, fuel powered generators / compressors</li> <li>Enforce use of approved flammable liquid safety cans</li> <li>Store combustible materials away from flammables</li> <li>Allow machines to cool off before refueling</li> </ul>	
Insect stings/snake bites	<ul style="list-style-type: none"> <li>Avoid hand mowing/clearing in dense brush areas, suspected areas of stinging insects</li> <li>Use insect repellant, wear PPE to protect against sting/bite injuries</li> <li>Emphasize the buddy system where such injury potential exists</li> <li>Avoid insect nests areas, likely habitats of snakes outside work areas</li> <li>Review injury potential and types of snakes with workers</li> </ul>	
Walking on machine tracks	<ul style="list-style-type: none"> <li>Avoid sudden awkward motions (pulling/jerking fuel hoses)</li> <li>Observe track surfaces when walking, move cautiously on uneven, slippery surfaces</li> <li>Avoid walking on machine tracks whenever possible; clean tracks for safe walking/working surfaces</li> </ul>	
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
•	•	•
<b>SITE-SPECIFIC HAZARD INFORMATION</b>		

HAZARDS		CONTROLS (NOT ACTIONS) TO ELIMINATE OR MINIMIZE HAZARDS		RISK
Date:		Job Name:		
Prepared by:			Reviewed by:	
Add'l PPE/Eq:				
HAZARDS		CONTROLS TO ELIMINATE OR MINIMIZE HAZARDS		RISK
		•		
		•		
		•		
		•		
		Updated Risk Assessment Code:		<input type="text"/>
<b>COMMENT(S):</b>				

## ACTIVITY HAZARD ANALYSIS

**JOB TASK:** Confined Space Entry

**PERSONAL PROTECTIVE EQUIPMENT:** Level C

HAZARD	CONTROL MEASURES
Toxic, oxygen deficient Atmosphere – CSE Entry	Utilize CSE permit and proper air monitoring equipment and techniques. Take multiple readings at 3’ intervals until reaching the bottom of the space before entry. Identify any substances within the space prior to entry.
Slip/Trip/Fall – CSE entry, wet surfaces, protruding objects/piping	Use fall protection and retrieval device, CSE permit use buddy system, flag, mark or remove hazards, practice good housekeeping.
Chemical Exposure – Contaminated surfaces/atmosphere	Ensure use of proper PPE and Respiratory protection. Perform continuous air monitoring with periodic (every 15 min) recording of the readings.
Physical Hazards - Entrapment or Engulfment	Ensure that the shape of the area being entered is adequate for personal mobility without the possibility of entrapment. Also ensure that the area is free from the possibility materials may fall upon or engulf an entrant.
Biological Hazards – Human blood and or body fluids from injuries	Ensure first aid equipment and trained personnel are serviceable and available. Reinforce bloodborne pathogen training and ensure biological response kit is available
Energized Utilities/stored energy – piping, hydraulics, steam, electrical connections and gravity fed materials or liquids	Review CSE Permit. Identify and release all stored energy, utilize lockout tag-out protocols. Utilize double blank/blind or misalignment techniques.
Heat/Cold Stress – PPE and Hot water pressure washing performed in interior spaces that are heated / or spaces that are not heated under winter conditions	Take breaks in climate-controlled areas, use buddy system, provide sufficient drinking water, maintain dry clothing inventory, monitor weather forecasts and dress appropriately, ensure RM/SHSO monitoring of workers.

ACTIVITY HAZARD ANALYSIS	
JOB TASK: Excavation/Backfilling/Restoration	
PERSONAL PROTECTIVE EQUIPMENT: Level D	
HAZARD	CONTROL MEASURES
Collision/Crush/Trauma – Struck by heavy equipment	Make and maintain eye contact with operator, do not pass under overhead loads, keep unnecessary personnel away, use backup alarms on equipment, use a spotter as necessary, delineate work area with physical barrier.
Crush/Trauma/Engulfment by Soil – Excavation, spoilage	If necessary, slope or shore excavation IAW 29 CFR 1926 Subpart P, buddy system.
Slip/Trip/Fall – Debris, uneven and/or wet surfaces, open excavation	Use caution, use buddy system, clear path of travel, practice good housekeeping, and keep unnecessary personnel away from excavation, barricade excavation.
Heat/Cold Stress – Weather, physical exertion, wet clothing	Take sufficient breaks in climate controlled areas, use buddy system, provide sufficient drinking water, maintain a change of dry clothing, ensure RMHO monitoring of workers.
Exposure to Electrical/Gas/Water/ Steam/Sewer Lines – Utility lines	Shut off or cap outside of building before demolition. Notify proper utility company
Biological Hazards – Ticks, Vermin, Wildlife	Implement hazard recognition training, use buddy system, use caution, and avoid vermin and areas where they may exist.

## ACTIVITY HAZARD ANALYSIS

**JOB TASK:** Site Mobilization, Setup, and Demobilization: The assigned work crew will mobilize at EQM's field office.

**PERSONAL PROTECTIVE EQUIPMENT:** Level D

HAZARD	CONTROL MEASURES
Muscle Strain – Lifting heavy equipment and bending	Utilize proper lifting techniques. Use mechanical devices for handling materials greater than 60 pounds when possible. Utilize buddy system.
Slip/Trip/Fall – Debris and wet surfaces	Use caution, use buddy system, flag or mark hazards, practice good housekeeping.
Chemical Exposure – Contaminated soils	Limit setup operations to only "clean" areas. Perform air monitoring to ensure proper PPE is used ( <i>may upgrade to Level C</i> ).
Biological Hazards – Snakes, ticks, vermin, etc.	Implement hazard recognition training, use buddy system, use caution, and avoid vermin and areas where they may exist.
Electrocution – Energized utilities	Use qualified electrician during site setup, properly grounded hand tools, and use Ground Fault Circuit Interrupter (GFCI) on electrical lines which are not a part of permanent wiring.
Heat/Cold Stress – Weather conditions, physical activity, and wet clothing	Take breaks in climate-controlled areas, use buddy system, provide sufficient drinking water, maintain dry clothing inventory, monitor weather forecasts and dress appropriately, ensure RM/SHSO monitoring of workers.

## **APPENDIX D**

### **EQM SPECIFIC HAZARD INFORMATION**



# CAMEO *Chemicals*



## Substances In This Report

1. LEAD
2. ARSENIC

## Contents

This report contains:

- Reaction hazard predictions associated with mixing these substances.
- Detailed information from the datasheet for each substance.

## Chemical Reactivity

### Substances In The Mix

1. LEAD
2. ARSENIC



### Hazard Predictions

ARSENIC *mixed with*  
LEAD

- No known hazardous reaction

**Chemical Datasheet****LEAD****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
7439-92-1	none	data unavailable	none

**NFPA 704**

data unavailable

**NIOSH Pocket Guide**

Lead

**International Chem Safety Card**

LEAD

**General Description**

PHYSICAL DESCRIPTION: Soft silver-bluish white to gray metal. (NTP, 1992)

**Hazards****Reactivity Alerts**

none

**Air & Water Reactions**

Insoluble in water.

**Fire Hazard**

Flash point data for this compound are not available, however, it is probably non-combustible. (NTP, 1992)

**Health Hazard**

Exposure Routes: inhalation, ingestion, skin and/or eye contact

Symptoms: Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension

Target Organs: Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue (NIOSH, 2016)

**Reactivity Profile**

In the presence of carbon, the combination of chlorine trifluoride with aluminum, copper, lead, magnesium, silver, tin, or zinc results in a violent reaction [Mellor 2, Supp. 1: 1956]. A solution of sodium azide in copper pipe with lead joints formed copper and lead azide, both are detonating compounds [Klotz 1973]. Sodium acetylide becomes pyrophoric when mixed with metals like lead. Mixtures of trioxane with 60% hydrogen

peroxide in contact with metallic lead when heated detonated. Lead containing rubber ignited in a nitric acid atmosphere. Lead is incompatible with strong oxidants such as: ammonium nitrate, chlorine trifluoride, hydrogen peroxide, etc.

**Belongs to the Following Reactive Group(s)**

- Metals, Less Reactive

**Potentially Incompatible Absorbents**

No information available.

Response Recommendations
--------------------------

**Isolation and Evacuation**

No information available.

**Firefighting**

Fires involving this material can be controlled with a dry chemical, carbon dioxide, foam, or Halon extinguisher. (NTP, 1992)

**Non-Fire Response**

STORAGE PRECAUTIONS: You should store this chemical under refrigerated temperatures, and keep it away from oxidizing materials. (NTP, 1992)

**Protective Clothing**

Skin: Wear appropriate personal protective clothing to prevent skin contact.

Eyes: Wear appropriate eye protection to prevent eye contact.

Wash skin: The worker should wash daily at the end of each work shift.

Remove: Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premise. (NIOSH, 2016)

**DuPont Tychem® Suit Fabrics**

No information available.

**First Aid**

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated

clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

**INHALATION:** IMMEDIATELY leave the contaminated area; take deep breaths of fresh air.

IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

**INGESTION:** Some heavy metals are VERY TOXIC POISONS, especially if their salts are very soluble in water (e.g., lead, chromium, mercury, bismuth, osmium, and arsenic). IMMEDIATELY call a hospital or poison control center and locate activated charcoal, egg whites, or milk in case the medical advisor recommends administering one of them. Also locate Ipecac syrup or a glass of salt water in case the medical advisor recommends inducing vomiting. Usually, this is NOT RECOMMENDED outside of a physician's care. If advice from a physician is not readily available and the victim is conscious and not convulsing, give the victim a glass of activated charcoal slurry in water or, if this is not available, a glass of milk, or beaten egg whites and IMMEDIATELY transport victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, assure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital.

**OTHER:** Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

Physical Properties
---------------------

**Chemical Formula:** Pb

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

**Melting Point:** 621.5 ° F (NTP, 1992)

**Vapor Pressure:** 1.77 mm Hg (NTP, 1992)

Vapor Density (Relative to Air): data unavailable

**Specific Gravity:** 11.3437 at 61 ° F (NTP, 1992)

**Boiling Point:** 3164 ° F at 760 mm Hg (NTP, 1992)

**Molecular Weight:** 207.19 (NTP, 1992)

**Water Solubility:** Insoluble (NTP, 1992)

Ionization Potential: data unavailable

**IDLH:** 100 mg/m<sup>3</sup> (as Pb) (NIOSH, 2016)

**AEGLs (Acute Exposure Guideline Levels)**

No AEGL information available.

**ERPGs (Emergency Response Planning Guidelines)**

No ERPG information available.

**PACs (Protective Action Criteria)**

Chemical	PAC-1	PAC-2	PAC-3
Lead (7439-92-1)	0.15 mg/m3	120 mg/m3	700 mg/m3

(DOE, 2016)

Regulatory Information
------------------------

**EPA Consolidated List of Lists**

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112 (r) RMP TQ
Lead	7439-92-1			10 pounds	313		
Lead Compounds	N420			&	313		

& indicates that no RQ is assigned to this generic or broad class, although the class is a CERCLA hazardous substance. See 50 Federal Register 13456 (April 4, 1985).

(EPA List of Lists, 2015)

**DHS Chemical Facility Anti-Terrorism Standards (CFATS)**

No regulatory information available.

**Chemical Datasheet****ARSENIC****Chemical Identifiers**

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
7440-38-2	1558	Poison	ARX

**NFPA 704**

data unavailable

**NIOSH Pocket Guide**

Arsenic (inorganic compounds, as As)

**International Chem Safety Card**

ARSENIC

**General Description**

A grayish metallic solid that turns black upon exposure to air. Insoluble in water. Toxic by ingestion.

**Hazards****Reactivity Alerts**

none

**Air & Water Reactions**

Turns black on exposure to air. Insoluble in water.

**Fire Hazard**

Special Hazards of Combustion Products: Contain highly toxic arsenic trioxide and other forms of arsenic. Arsenic gas, the most dangerous form of arsenic, is produced upon contact with an acid or acid fumes.

Behavior in Fire: Burns to produce dense white fumes of highly toxic arsenic trioxide. (USCG, 1999)

**Health Hazard**

Poisonous by inhalation of dust or by ingestion. Regardless of exposure route, symptoms in most cases are characteristic of severe gastritis or gastroenteritis. All chemical forms of arsenic eventually produce similar toxic effects. Symptoms may be delayed. (USCG, 1999)

**Reactivity Profile**

ARSENIC reacts incandescently with bromine trifluoride, even at 10°C [Mellor 2:113 1946-47]. Causes bromoazide to explode upon contact. Ignites if ground up together with solid potassium permanganate [Mellor 12:322 1946-47]. Is oxidized by sodium peroxide with incandescence [Mellor 2:490-93 1946-47]. A combination of finely divided arsenic with finely divided bromates (also chlorates and iodates) of barium, calcium, magnesium, potassium, sodium, or zinc can explode by heat, percussion, and friction [Mellor 2:310

1946-47]. Bromine pentafluoride reacts readily in the cold with arsenic. Ignition usually occurs. Reacts vigorously with fluorine at ordinary temperatures [Mellor 9:34 1946-47].

### **Belongs to the Following Reactive Group(s)**

- Metals, Less Reactive

### **Potentially Incompatible Absorbents**

No information available.

Response Recommendations
--------------------------

### **Isolation and Evacuation**

Excerpt from ERG Guide 152 [Substances - Toxic (Combustible)]:

As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

SPILL: Increase, in the downwind direction, as necessary, the isolation distance shown above.

FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2016)

### **Firefighting**

Excerpt from ERG Guide 152 [Substances - Toxic (Combustible)]:

SMALL FIRE: Dry chemical, CO2 or water spray.

LARGE FIRE: Water spray, fog or regular foam. Move containers from fire area if you can do it without risk. Dike fire-control water for later disposal; do not scatter the material. Use water spray or fog; do not use straight streams.

FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2016)

### **Non-Fire Response**

Excerpt from ERG Guide 152 [Substances - Toxic (Combustible)]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Cover with plastic sheet to prevent spreading. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. DO NOT GET WATER INSIDE CONTAINERS. (ERG, 2016)

### **Protective Clothing**

**Skin:** Wear appropriate personal protective clothing to prevent skin contact.

**Eyes:** Wear appropriate eye protection to prevent eye contact.

**Wash skin:** The worker should immediately wash the skin when it becomes contaminated. The worker should wash daily at the end of each work shift.

**Remove:** Work clothing that becomes wet or significantly contaminated should be removed and replaced.

**Change:** Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premise.

**Provide:** Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection. Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2016)

### **DuPont Tychem® Suit Fabrics**

No information available.

### **First Aid**

**Eye:** If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

**Skin:** If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.

**Breathing:** If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

**Swallow:** If this chemical has been swallowed, get medical attention immediately. (NIOSH, 2016)

<b>Physical Properties</b>
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### **Chemical Formula:** As

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

**Melting Point:** 1135 ° F (Sublimes) (NIOSH, 2016)

**Vapor Pressure:** 0 mm Hg (approx) (NIOSH, 2016)

Vapor Density (Relative to Air): data unavailable

**Specific Gravity:** 5.727 at 77 ° F (USCG, 1999)

**Boiling Point:** 1135 ° F at 760 mm Hg (sublimes) (USCG, 1999)

**Molecular Weight:** 74.9216 (USCG, 1999)

**Water Solubility:** Insoluble (NIOSH, 2016)

Ionization Potential: data unavailable

**IDLH:** 5 mg/m3 for Arsenic (inorganic compounds, as As); A potential occupational carcinogen. (NIOSH, 2016)

#### AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

#### ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

#### PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Arsenic (7440-38-2)	1.5 mg/m3	17 mg/m3	100 mg/m3

(DOE, 2016)

Regulatory Information
------------------------

#### EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112 (r) RMP TQ
Arsenic	7440-38-2			1 pound	313		
Arsenic Compounds	N020			&	313		

& indicates that no RQ is assigned to this generic or broad class, although the class is a CERCLA hazardous substance. See 50 Federal Register 13456 (April 4, 1985).

(EPA List of Lists, 2015)

#### DHS Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

## **APPENDIX E**

### **SPECIFIC CHEMICAL HAZARD INFORMATION (SDS)**



**MATHESON**

ask. . .The Gas Professionals™

## Safety Data Sheet

**Material Name:** Hydrogen Sulfide, Hydrosulfuric Acid

**SDS ID:** 00244247

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### Section 1 - PRODUCT AND COMPANY IDENTIFICATION

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**Material Name**

Hydrogen Sulfide, Hydrosulfuric Acid

**Synonyms**

Hydrogen sulfide (H<sub>2</sub>S); Dihydrogen monosulfide; Dihydrogen sulfide; Sulfur dihydride; Sulfureted hydrogen; Sulfur hydride; Sewer gas

**Product Use**

Industrial and Specialty Gas Applications.

**Restrictions on Use**

None known.

**Details of the supplier of the safety data sheet**

MATHESON TRI-GAS, INC.

150 Allen Road, Suite 302

Basking Ridge, NJ 07920

General Information: 1-800-416-2505

Emergency #: 1-800-424-9300 (CHEMTREC)

Outside the US: 703-527-3887 (Call collect)

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### Section 2 - HAZARDS IDENTIFICATION

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**Classification in accordance with paragraph (d) of 29 CFR 1910.1200.**

Flammable Gases - Category 1

Gases Under Pressure - Liquefied gas

Acute Toxicity - Inhalation - Dust/Mist - Category 2

Acute Toxicity - Inhalation - Vapor - Category 1

Serious Eye Damage/Eye Irritation - Category 2A

Specific target organ toxicity - Single exposure - Category 1

Specific target organ toxicity - Repeated exposure - Category 1

Hazardous to the Aquatic Environment - Acute - Category 1

Hazardous to the Aquatic Environment - Chronic - Category 1

**GHS Label Elements**

**Symbol(s)**





## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid****SDS ID: 00244247****Signal Word**

Danger

**Hazard Statement(s)**

Extremely flammable gas.

Contains gas under pressure; may explode if heated.

Fatal if inhaled.

Causes serious eye irritation.

Causes damage to organs. ( Cardiovascular system, central nervous system, respiratory system )

Cardiovascular system, central nervous system, respiratory system

Causes damage to organs through prolonged or repeated exposure. ( nervous system, respiratory system )

nervous system, respiratory system

Very toxic to aquatic life with long lasting effects.

**Precautionary Statement(s)****Prevention**

Keep away from heat, sparks, open flame, and hot surfaces - No smoking.

Do not breathe gas.

Use only outdoors or in a well-ventilated area.

Wear respiratory protection.

Do not eat, drink or smoke when using this product.

Wear eye/face protection.

Wash thoroughly after handling.

Avoid release to the environment.

**Response**

Leaking gas fire: Do not extinguish, unless leak can be stopped safely.

Eliminate all ignition sources if safe to do so.

IF exposed.

Call a POISON CENTER or doctor/physician.

IF INHALED.

Remove person to fresh air and keep comfortable for breathing.

Immediately call a POISON CENTER or doctor/physician.

Specific treatment is urgent, see first aid section of Safety Data Sheet.

IF IN EYES.

Rinse cautiously with water for several minutes.

Remove contact lenses, if present and easy to do.

Continue rinsing.

If eye irritation persists.

Get medical advice/attention.

Collect spillage.

**Storage**

Store in a well-ventilated place.

Keep container tightly closed.



## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid****SDS ID: 00244247**

Protect from sunlight.

Store locked up.

**Disposal**

Dispose in accordance with all applicable regulations.

**Statement of Unknown Toxicity**

100% of the mixture consists of ingredient(s) of unknown acute toxicity.

**Other Hazards**

May cause frostbite upon sudden release of liquefied gas.

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### Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

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CAS	Component Name	Percent
7783-06-4	Hydrogen sulfide	100

The chemical identity and/or percentage of composition is being withheld as a trade secret.

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### Section 4 - FIRST AID MEASURES

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**Inhalation**

Do not attempt rescue in confined spaces without adequate protective gear and proper training. If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

**Skin**

If frostbite or freezing occur, immediately flush with plenty of lukewarm water (105-115 F; 41-46 C). DO NOT USE HOT WATER. If warm water is not available, gently wrap affected parts in blankets. Get immediate medical attention.

**Eyes**

Flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Then get immediate medical attention.

**Ingestion**

If swallowed, get medical attention.

**Most Important Symptoms/Effects****Acute**

frostbite, mild skin irritation, eye irritation, cardiovascular system damage, central nervous system damage, respiratory system damage



**MATHESON**

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## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid**

**SDS ID: 00244247**

**Delayed**

nervous system damage, respiratory system damage

**Note to Physicians**

For inhalation, consider oxygen.

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### Section 5 - FIRE FIGHTING MEASURES

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**Extinguishing Media**

**Suitable Extinguishing Media**

regular dry chemical, carbon dioxide, water spray, foam, Let burn unless leak can be stopped immediately. Large fires: Use water spray, fog or regular foam.

**Unsuitable Extinguishing Media**

None known.

**Special Hazards Arising from the Chemical**

Extremely flammable. Containers may rupture or explode if exposed to heat. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

**Hazardous Combustion Products**

oxides of sulfur

**Fire Fighting Measures**

Move container from fire area if it can be done without risk. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. Cool containers with water spray until well after the fire is out. Do not direct water at source of leak or safety devices; icing may occur. Keep unnecessary people away, isolate hazard area and deny entry. For tank, rail car or tank truck, evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Stop flow of gas.

**Special Protective Equipment and Precautions for Firefighters**

Wear full protective fire fighting gear including self contained breathing apparatus (SCBA) for protection against possible exposure.

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### Section 6 - ACCIDENTAL RELEASE MEASURES

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**Personal Precautions, Protective Equipment and Emergency Procedures**

Wear personal protective clothing and equipment, see Section 8.

**Methods and Materials for Containment and Cleaning Up**



## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid****SDS ID: 00244247**

Keep unnecessary people away, isolate hazard area and deny entry. Do not touch or walk through spilled material. Eliminate all ignition sources if safe to do so. Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. All equipment used when handling the product must be grounded. Use only non-sparking tools. Stop leak if possible without personal risk. Use water spray to reduce vapors or divert vapor cloud drift. If possible, turn leaking containers so that gas escapes rather than liquid. Ventilate closed spaces before entering. Isolate area until gas has dispersed. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

**Environmental Precautions**

Avoid release to the environment. Collect spillage.

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### Section 7 - HANDLING AND STORAGE

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**Precautions for Safe Handling**

Keep away from heat, sparks, open flame, and hot surfaces - No smoking. Do not breathe gas. Use only outdoors or in a well-ventilated area. Wear respiratory protection. Do not eat, drink or smoke when using this product. Wear eye/face protection. Wash hands thoroughly after handling. Avoid release to the environment.

**Conditions for Safe Storage, Including any Incompatibilities**

Store in a well-ventilated place.

Keep container tightly closed.

Protect from sunlight.

Store locked up.

Store and handle in accordance with all current regulations and standards. Store in a tightly closed container. Compressed gases can present significant safety hazards. Store in a cool, dry place. Store in a well-ventilated area. Protect from physical damage. Avoid heat, flames, sparks and other sources of ignition. Cylinders should be stored upright (with valve protection cap in place). Avoid direct sunlight. Keep locked up. Store cylinders away from heavily trafficked areas and emergency exits. For additional and specific safe practices consult the following Compressed Gas Association (CGA) publications: P-1 "Safe Handling of Compressed Gases in Cylinders", AV-1 "Safe Handling and Storage of Compressed Gases", and "Compressed Gas Handbook". Grounding and bonding required. Use non-sparking tools and equipment. Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. Notify State Emergency Response Commission for storage or use at amounts greater than or equal to the TPQ (U.S. EPA SARA Section 302). SARA Section 303 requires facilities storing a material with a TPQ to participate in local emergency response planning (U.S. EPA 40 CFR 355.30). See original container for storage recommendations. Keep separated from incompatible substances.

**Incompatible Materials**

combustible materials, metals, oxidizing materials, halogens, metal oxides, metal salts, bases

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## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid****SDS ID: 00244247**

### Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

#### Component Exposure Limits

Hydrogen sulfide	7783-06-4
ACGIH:	1 ppm TWA
	5 ppm STEL
NIOSH:	10 ppm Ceiling 10 min; 15 mg/m <sup>3</sup> Ceiling 10 min
	100 ppm IDLH
Europe:	5 ppm TWA; 7 mg/m <sup>3</sup> TWA
	10 ppm STEL; 14 mg/m <sup>3</sup> STEL
OSHA (US):	20 ppm Ceiling
Mexico:	10 ppm TWA LMPE-PPT; 14 mg/m <sup>3</sup> TWA LMPE-PPT
	15 ppm STEL [LMPE-CT]; 21 mg/m <sup>3</sup> STEL [LMPE-CT]

#### EU - Occupational Exposure (98/24/EC) - Binding Biological Limit Values and Health Surveillance Measures

There are no biological limit values for any of this product's components.

#### ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI)

There are no biological limit values for any of this product's components.

#### Engineering Controls

Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust or process enclosure ventilation system. All energized electrical equipment must be designed in accordance with the electrical classification of the area (e.g., Class I, Division I). Ensure compliance with applicable exposure limits.

#### Individual Protection Measures, such as Personal Protective Equipment

##### Eye/face protection

Wear splash resistant safety goggles with a faceshield. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

##### Skin Protection

For the gas: Wear appropriate chemical resistant clothing. For the liquid: Wear appropriate protective, cold insulating clothing.

##### Respiratory Protection

The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA. 100 ppm. Any powered, air-purifying respirator with cartridge(s) providing protection against this substance. Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or



## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid****SDS ID: 00244247**

back-mounted canister providing protection against the compound of concern. Any supplied-air respirator. Any self-contained breathing apparatus with a full facepiece. Emergency or planned entry into unknown concentrations or IDLH conditions -. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode. Escape -. Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted canister providing protection against the compound of concern. Any appropriate escape-type, self-contained breathing apparatus.

**Glove Recommendations**

For the gas: Wear appropriate chemical resistant gloves. For the liquid: Wear insulated gloves.

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### Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

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<b>Appearance</b>	colorless gas	<b>Physical State</b>	liquid
<b>Odor</b>	rotten eggs,paralyzes sense of smell above 100ppm	<b>Color</b>	colorless
<b>Odor Threshold</b>	0.14 ppm (Recognition Arsine)	<b>pH</b>	4.1 at 0.1 N (Aqueous solution)
<b>Melting Point</b>	-85.6 °C (-122 °F)	<b>Boiling Point</b>	-60.2 °C (-76 °F)
<b>Freezing point</b>	Not available	<b>Evaporation Rate</b>	Not available
<b>Boiling Point Range</b>	Not available	<b>Flammability (solid, gas)</b>	Flammable gas
<b>Autoignition</b>	260 °C (500 °F)	<b>Flash Point</b>	(Flammable gas)
<b>Lower Explosive Limit</b>	4.0 to 4.3 % (by volume)	<b>Decomposition</b>	Not available
<b>Upper Explosive Limit</b>	44 to 46 % (by volume)	<b>Vapor Pressure</b>	18100 hPa at 20 °C
<b>Vapor Density (air=1)</b>	1.19	<b>Specific Gravity (water=1)</b>	Not available
<b>Water Solubility</b>	4 g/L (@ 20 °C)	<b>Partition coefficient: n-octanol/water</b>	Not available
<b>Viscosity</b>	0.0128 cp	<b>Solubility (Other)</b>	Not available



## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid****SDS ID: 00244247**

<b>Density</b>	1.5355 g/L at 0 °C	<b>Log KOW</b>	0.45 at 25 °C
<b>Physical Form</b>	compressed, liquefied gas	<b>Molecular Formula</b>	H <sub>2</sub> -S
<b>Molecular Weight</b>	34.08		

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### Section 10 - STABILITY AND REACTIVITY

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**Reactivity**

No reactivity hazard is expected.

**Chemical Stability**

Stable at normal temperatures and pressure.

**Possibility of Hazardous Reactions**

Will not polymerize.

**Conditions to Avoid**

Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Avoid inhalation of material or combustion by-products.

**Incompatible Materials**

combustible materials, metals, oxidizing materials, halogens, metal oxides, metal salts, bases

**Hazardous decomposition products**

oxides of sulfur

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### Section 11 - TOXICOLOGICAL INFORMATION

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**Information on Likely Routes of Exposure****Inhalation**

irritation, cough, lack of sense of smell, sensitivity to light, changes in blood pressure, nausea, vomiting, difficulty breathing, headache, drowsiness, dizziness, Disorientation, hallucinations, pain in extremities, tremors, visual disturbances, suffocation, lung congestion, internal bleeding, heart disorders, nerve damage, brain damage, convulsions, coma, death

**Skin Contact**

irritation, skin disorders

**Eye Contact**

irritation, sensitivity to light, tearing, visual disturbances, eye damage



## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid****SDS ID: 00244247****Ingestion**

ingestion of a gas is unlikely

**Acute and Chronic Toxicity****Component Analysis - LD50/LC50**

The components of this material have been reviewed in various sources and the following selected endpoints are published:

Hydrogen sulfide (7783-06-4)

Inhalation LC50 Rat 0.99 mg/L 1 h

**Immediate Effects**

frostbite, mild skin irritation, eye irritation, cardiovascular system damage, central nervous system damage, respiratory system damage

**Delayed Effects**

nervous system damage, respiratory system damage

**Irritation/Corrosivity Data**

mild skin irritation, eye irritation

**Respiratory Sensitization**

No information available for the product.

**Dermal Sensitization**

No information available for the product.

**Component Carcinogenicity**

None of this product's components are listed by ACGIH, IARC, NTP, DFG or OSHA

**Germ Cell Mutagenicity**

No data available.

**Tumorigenic Data**

No data available

**Reproductive Toxicity**

No data available.

**Specific Target Organ Toxicity - Single Exposure**

Cardiovascular system, central nervous system, Respiratory system

**Specific Target Organ Toxicity - Repeated Exposure**

nervous system, Respiratory system

**Aspiration hazard**

No data available.

**Medical Conditions Aggravated by Exposure**

eye disorders, respiratory disorders, nervous system disorders



## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid****SDS ID: 00244247**

### Section 12 - ECOLOGICAL INFORMATION

**Ecotoxicity**

Very toxic to aquatic life with long lasting effects.

**Component Analysis - Aquatic Toxicity**

Hydrogen sulfide	7783-06-4
Fish:	LC50 96 h <i>Lepomis macrochirus</i> 0.0448 mg/L [flow-through]; LC50 96 h <i>Pimephales promelas</i> 0.016 mg/L [flow-through]

**Persistence and Degradability**

No information available for the product.

**Bioaccumulative Potential**

This material is believed not to bioaccumulate.

**Mobility**

No information available for the product.

### Section 13 - DISPOSAL CONSIDERATIONS

**Disposal Methods**

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001.

**Component Waste Numbers**

Hydrogen sulfide	7783-06-4
RCRA:	waste number U135

### Section 14 - TRANSPORT INFORMATION

**US DOT Information:**

**Shipping Name:**Hydrogen sulfide

**Hazard Class:** 2.3

**UN/NA #:** UN1053

**Required Label(s):** 2.3 2.1

**IMDG Information:**

**Shipping Name:**Hydrogen sulphide



## Safety Data Sheet

**Material Name:** Hydrogen Sulfide, Hydrosulfuric Acid**SDS ID:** 00244247**Hazard Class:** 2.3**UN#:** UN1053**Required Label(s):** 2.3 2.1

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### Section 15 - REGULATORY INFORMATION

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**U.S. Federal Regulations**

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), and/or require an OSHA process safety plan.

Hydrogen sulfide	7783-06-4
SARA 302:	500 lb TPQ
SARA 313:	1 % de minimis concentration
CERCLA:	100 lb final RQ; 45.4 kg final RQ
OSHA (safety):	1500 lb TQ
SARA 304:	100 lb EPCRA RQ

**SARA Section 311/312 (40 CFR 370 Subparts B and C)****Acute Health:** Yes **Chronic Health:** Yes **Fire:** Yes **Pressure:** Yes **Reactivity:** No**U.S. State Regulations**

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA
Hydrogen sulfide	7783-06-4	Yes	Yes	Yes	Yes	Yes

**Not listed under California Proposition 65****Canadian WHMIS Ingredient Disclosure List (IDL)**

Components of this material have been checked against the Canadian WHMIS Ingredients Disclosure List. The List is composed of chemicals which must be identified on MSDSs if they are included in products which meet WHMIS criteria specified in the Controlled Products Regulations and are present above the threshold limits listed on the IDL

Hydrogen sulfide	7783-06-4
	1 %

**Component Analysis - Inventory**

Hydrogen sulfide (7783-06-4)



## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid****SDS ID: 00244247**

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR - KECI/KECL	KR - TCCA	CN	NZ	MX	TW
Yes	DSL	EIN	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes

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### Section 16 - OTHER INFORMATION

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#### NFPA Ratings

Health: 4 Fire: 4 Reactivity: 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

#### Summary of Changes

Updated: 05/01/2015

#### Key / Legend

ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CAS - Chemical Abstracts Service; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CLP - Classification, Labelling, and Packaging; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSD - Dangerous Substance Directive; DSL - Domestic Substances List; EEC - European Economic Community; EINECS - European Inventory of Existing Commercial Chemical Substances; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL - Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime Dangerous Goods; JP - Japan; Kow - Octanol/water partition coefficient; KR - Korea; LEL - Lower Explosive Limit; LLV - Level Limit Value; LOLI - List Of Lists™ - ChemADVISOR's Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL - Maximum Exposure Limits; NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PH - Philippines; RCRA - Resource Conservation and Recovery Act; REACH- Registration, Evaluation, Authorisation, and restriction of Chemicals; RID - European Rail Transport; SARA - Superfund Amendments and Reauthorization Act; STEL - Short-term Exposure Limit; TDG - Transportation of Dangerous Goods; TSCA - Toxic Substances Control Act; TWA - Time Weighted Average; UEL - Upper Explosive Limit; US - United States.

#### Other Information

##### Disclaimer:

Matheson Tri-Gas, Inc. makes no express or implied warranties, guarantees or representations regarding the product or the information herein, including but not limited to any implied warranty or merchantability or fitness for use. Matheson Tri-Gas, Inc. shall not be liable for any personal injury,



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## Safety Data Sheet

**Material Name: Hydrogen Sulfide, Hydrosulfuric Acid**

**SDS ID: 00244247**

property or other damages of any nature, whether compensatory, consequential, exemplary, or otherwise, resulting from any publication, use or reliance upon the information herein.

# SAFETY DATA SHEET

**Airgas**

Methane

## Section 1. Identification

<b>GHS product identifier</b>	: Methane
<b>Chemical name</b>	: methane
<b>Other means of identification</b>	: Methane or natural gas; Marsh gas; Methyl hydride; CH <sub>4</sub> ; Fire Damp;
<b>Product use</b>	: Synthetic/Analytical chemistry.
<b>Synonym</b>	: Methane or natural gas; Marsh gas; Methyl hydride; CH <sub>4</sub> ; Fire Damp;
<b>SDS #</b>	: 001033
<b>Supplier's details</b>	: Airgas USA, LLC and its affiliates 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
<b>24-hour telephone</b>	: 1-866-734-3438

## Section 2. Hazards identification

<b>OSHA/HCS status</b>	: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
<b>Classification of the substance or mixture</b>	: FLAMMABLE GASES - Category 1 GASES UNDER PRESSURE - Compressed gas

### GHS label elements

#### **Hazard pictograms**



#### **Signal word**

: Danger

#### **Hazard statements**

: Extremely flammable gas.  
May form explosive mixtures with air.  
Contains gas under pressure; may explode if heated.  
May displace oxygen and cause rapid suffocation.

### Precautionary statements

#### **General**

: Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Approach suspected leak area with caution.

#### **Prevention**

: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

#### **Response**

: Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

#### **Storage**

: Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.

#### **Disposal**

: Not applicable.

#### **Hazards not otherwise classified**

: In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

## Section 3. Composition/information on ingredients

**Substance/mixture** : Substance  
**Chemical name** : methane  
**Other means of identification** : Methane or natural gas; Marsh gas; Methyl hydride; CH<sub>4</sub>; Fire Damp;

### CAS number/other identifiers

**CAS number** : 74-82-8  
**Product code** : 001033

Ingredient name	%	CAS number
methane	100	74-82-8

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

**There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.**

Occupational exposure limits, if available, are listed in Section 8.

## Section 4. First aid measures

### Description of necessary first aid measures

**Eye contact** : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

**Inhalation** : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

**Skin contact** : Wash contaminated skin with soap and water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

**Ingestion** : As this product is a gas, refer to the inhalation section.

### Most important symptoms/effects, acute and delayed

#### Potential acute health effects

**Eye contact** : Contact with rapidly expanding gas may cause burns or frostbite.  
**Inhalation** : No known significant effects or critical hazards.  
**Skin contact** : Contact with rapidly expanding gas may cause burns or frostbite.  
**Frostbite** : Try to warm up the frozen tissues and seek medical attention.  
**Ingestion** : As this product is a gas, refer to the inhalation section.

#### Over-exposure signs/symptoms

**Eye contact** : No specific data.  
**Inhalation** : No specific data.  
**Skin contact** : No specific data.  
**Ingestion** : No specific data.

### Indication of immediate medical attention and special treatment needed, if necessary

**Notes to physician** : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.  
**Specific treatments** : No specific treatment.

## Section 4. First aid measures

- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

## Section 5. Fire-fighting measures

### Extinguishing media

- Suitable extinguishing media** : Use an extinguishing agent suitable for the surrounding fire.
- Unsuitable extinguishing media** : None known.

- Specific hazards arising from the chemical** : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

- Hazardous thermal decomposition products** : Decomposition products may include the following materials:  
carbon dioxide  
carbon monoxide

- Special protective actions for fire-fighters** : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

## Section 6. Accidental release measures

### Personal precautions, protective equipment and emergency procedures

- For non-emergency personnel** : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
- For emergency responders** : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

- Environmental precautions** : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

### Methods and materials for containment and cleaning up

- Small spill** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.
- Large spill** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

## Section 7. Handling and storage

### Precautions for safe handling

- Protective measures** : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
- Advice on general occupational hygiene** : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.
- Conditions for safe storage, including any incompatibilities** : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

## Section 8. Exposure controls/personal protection

### Control parameters

#### Occupational exposure limits

Ingredient name	Exposure limits
methane	Oxygen Depletion [Asphyxiant]

- Appropriate engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
- Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

### Individual protection measures

- Hygiene measures** : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
- Eye/face protection** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

#### Skin protection

## Section 8. Exposure controls/personal protection

- Hand protection** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
- Body protection** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.
- Other skin protection** : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory protection** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

## Section 9. Physical and chemical properties

### Appearance

- Physical state** : Gas. [Compressed gas.]
- Color** : Colorless.
- Molecular weight** : 16.05 g/mole
- Molecular formula** : C-H<sub>4</sub>
- Boiling/condensation point** : -161.48°C (-258.7°F)
- Melting/freezing point** : -187.6°C (-305.7°F)
- Critical temperature** : -82.45°C (-116.4°F)
- Odor** : Odorless.
- Odor threshold** : Not available.
- pH** : Not available.
- Flash point** : Closed cup: -188.15°C (-306.7°F)
- Burning time** : Not applicable.
- Burning rate** : Not applicable.
- Evaporation rate** : Not available.
- Flammability (solid, gas)** : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.
- Lower and upper explosive (flammable) limits** : Lower: 5%  
Upper: 15%
- Vapor pressure** : Not available.
- Vapor density** : 0.55 (Air = 1)      Liquid Density@BP: 26.5 lb/ft<sup>3</sup> (424.5 kg/m<sup>3</sup>)
- Specific Volume (ft<sup>3</sup>/lb)** : 24.3956
- Gas Density (lb/ft<sup>3</sup>)** : 0.040991 (25°C / 77 to °F)
- Relative density** : Not applicable.
- Solubility** : Not available.
- Solubility in water** : 0.0244 g/l
- Partition coefficient: n-octanol/water** : 1.09
- Auto-ignition temperature** : 287°C (548.6°F)
- Decomposition temperature** : Not available.
- SADT** : Not available.

## Section 9. Physical and chemical properties

**Viscosity** : Not applicable.

## Section 10. Stability and reactivity

**Reactivity** : No specific test data related to reactivity available for this product or its ingredients.

**Chemical stability** : The product is stable.

**Possibility of hazardous reactions** : Under normal conditions of storage and use, hazardous reactions will not occur.

**Conditions to avoid** : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

**Incompatible materials** : Oxidizers

**Hazardous decomposition products** : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

**Hazardous polymerization** : Under normal conditions of storage and use, hazardous polymerization will not occur.

## Section 11. Toxicological information

### Information on toxicological effects

#### Acute toxicity

Not available.

#### Irritation/Corrosion

Not available.

#### Sensitization

Not available.

#### Mutagenicity

Not available.

#### Carcinogenicity

Not available.

#### Reproductive toxicity

Not available.

#### Teratogenicity

Not available.

#### Specific target organ toxicity (single exposure)

Not available.

#### Specific target organ toxicity (repeated exposure)

Not available.

#### Aspiration hazard

Not available.

**Information on the likely routes of exposure** : Not available.

### Potential acute health effects

## Section 11. Toxicological information

<b>Eye contact</b>	: Contact with rapidly expanding gas may cause burns or frostbite.
<b>Inhalation</b>	: No known significant effects or critical hazards.
<b>Skin contact</b>	: Contact with rapidly expanding gas may cause burns or frostbite.
<b>Ingestion</b>	: As this product is a gas, refer to the inhalation section.

### Symptoms related to the physical, chemical and toxicological characteristics

<b>Eye contact</b>	: No specific data.
<b>Inhalation</b>	: No specific data.
<b>Skin contact</b>	: No specific data.
<b>Ingestion</b>	: No specific data.

### Delayed and immediate effects and also chronic effects from short and long term exposure

#### Short term exposure

<b>Potential immediate effects</b>	: Not available.
<b>Potential delayed effects</b>	: Not available.

#### Long term exposure

<b>Potential immediate effects</b>	: Not available.
<b>Potential delayed effects</b>	: Not available.

#### Potential chronic health effects

Not available.

<b>General</b>	: No known significant effects or critical hazards.
<b>Carcinogenicity</b>	: No known significant effects or critical hazards.
<b>Mutagenicity</b>	: No known significant effects or critical hazards.
<b>Teratogenicity</b>	: No known significant effects or critical hazards.
<b>Developmental effects</b>	: No known significant effects or critical hazards.
<b>Fertility effects</b>	: No known significant effects or critical hazards.

### Numerical measures of toxicity

#### Acute toxicity estimates

Not available.

## Section 12. Ecological information

### Toxicity

Not available.

### Persistence and degradability

Not available.

### Bioaccumulative potential

Product/ingredient name	LogP <sub>ow</sub>	BCF	Potential
methane	1.09	-	low

### Mobility in soil

## Section 12. Ecological information






**Soil/water partition coefficient (K<sub>oc</sub>)** : Not available.

**Other adverse effects** : No known significant effects or critical hazards.

## Section 13. Disposal considerations

**Disposal methods** : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

## Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
<b>UN number</b>	UN1971	UN1971	UN1971	UN1971	UN1971
<b>UN proper shipping name</b>	Methane, compressed	Methane, compressed or Methane or Natural gas, compressed (with high methane content)	Methane, compressed	Methane, compressed	Methane, compressed
<b>Transport hazard class(es)</b>	2.1 	2.1 	2.1 	2.1 	2.1 
<b>Packing group</b>	-	-	-	-	-
<b>Environment</b>	No.	No.	No.	No.	No.
<b>Additional information</b>	-	Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).  <u><b>Explosive Limit and Limited Quantity Index</b></u> 0.125  <u><b>ERAP Index</b></u> 3000  <u><b>Passenger Carrying Ship Index</b></u> Forbidden  <u><b>Passenger Carrying Road or Rail Index</b></u> Forbidden	-	-	<u><b>Passenger and Cargo Aircraft</b></u> Quantity limitation: 0 Forbidden <u><b>Cargo Aircraft Only</b></u> Quantity limitation: 150 kg

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

**Special precautions for user** : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

## Section 14. Transport information

Transport in bulk according : Not available.  
to Annex II of MARPOL  
73/78 and the IBC Code

## Section 15. Regulatory information

**U.S. Federal regulations** : TSCA 8(a) CDR Exempt/Partial exemption: Not determined  
United States inventory (TSCA 8b): This material is listed or exempted.  
Clean Air Act (CAA) 112 regulated flammable substances: methane

Clean Air Act Section 112 : Not listed  
(b) Hazardous Air  
Pollutants (HAPs)

Clean Air Act Section 602 : Not listed  
Class I Substances

Clean Air Act Section 602 : Not listed  
Class II Substances

DEA List I Chemicals : Not listed  
(Precursor Chemicals)

DEA List II Chemicals : Not listed  
(Essential Chemicals)

### SARA 302/304

#### Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

### SARA 311/312

Classification : Fire hazard  
Sudden release of pressure

#### Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
methane	100	Yes.	Yes.	No.	No.	No.

### State regulations

Massachusetts : This material is listed.  
New York : This material is not listed.  
New Jersey : This material is listed.  
Pennsylvania : This material is listed.

### International regulations

#### International lists

#### National inventory

Australia : This material is listed or exempted.  
Canada : This material is listed or exempted.  
China : This material is listed or exempted.  
Europe : This material is listed or exempted.  
Japan : This material is listed or exempted.  
Malaysia : This material is listed or exempted.  
New Zealand : This material is listed or exempted.  
Philippines : This material is listed or exempted.  
Republic of Korea : This material is listed or exempted.

## Section 15. Regulatory information

**Taiwan** : This material is listed or exempted.

### Canada

**WHMIS (Canada)** : Class A: Compressed gas.  
Class B-1: Flammable gas.  
**CEPA Toxic substances**: This material is listed.  
**Canadian ARET**: This material is not listed.  
**Canadian NPRI**: This material is listed.  
**Alberta Designated Substances**: This material is not listed.  
**Ontario Designated Substances**: This material is not listed.  
**Quebec Designated Substances**: This material is not listed.

## Section 16. Other information

**Canada Label requirements** : Class A: Compressed gas.  
Class B-1: Flammable gas.

### Hazardous Material Information System (U.S.A.)

Health	0
Flammability	4
Physical hazards	3

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

### National Fire Protection Association (U.S.A.)



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

### Procedure used to derive the classification

Classification	Justification
Flam. Gas 1, H220 Press. Gas Comp. Gas, H280	Expert judgment According to package

### History

**Date of printing** : 5/9/2016  
**Date of issue/Date of revision** : 5/9/2016  
**Date of previous issue** : No previous validation  
**Version** : 0.01

## Section 16. Other information

### Key to abbreviations

: ATE = Acute Toxicity Estimate  
BCF = Bioconcentration Factor  
GHS = Globally Harmonized System of Classification and Labelling of Chemicals  
IATA = International Air Transport Association  
IBC = Intermediate Bulk Container  
IMDG = International Maritime Dangerous Goods  
LogPow = logarithm of the octanol/water partition coefficient  
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)  
UN = United Nations

### References

: Not available.

Indicates information that has changed from previously issued version.

### Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

## **APPENDIX F**

### **MAPS**



## Injury Treatment Contact Information & Protocols

### Injury Management Protocol:

- ☐ **Diagnose & Treat** (Injury)

### Billing Information

1 Source OHS  
Accounts Payable  
7501 West 15<sup>th</sup> Ave.  
Gary, IN 46406  
Phone #: (855) 517-6872

### Send All Reports To:

[compliance@1sourceohs.com](mailto:compliance@1sourceohs.com)

or

Fax #: (219) 228-8852

Contact these individuals if you have any questions in regards to medical treatment. 1 Source is available 24 / 7 / 365.

### Injury Triage Contact Lines

**Primary: (866) 622-7348**

**Secondary: (855) 517-6872**

**Tertiary: (815) 370-2940**

### Treatment Locations – Indianapolis, IN

#### Primary Clinic:

**MedCheck Speedway  
Occupational Health**  
1011 N. Main St.  
Speedway, IN 46224

Phone #: (317) 957-9000

#### Clinic Hours:

Mon – Sun: 9:00 am – 9:00 pm

#### After-Hours Emergency Care:

**IU Health Methodist Hospital  
Emergency Room**  
1701 Senate Blvd.  
Indianapolis, IN 46206

Phone #: (317) 962-2000

#### Clinic Hours: 24/7/365

Use During Primary Clinic's Off-Hours

## Site Map



Note: The area outlined in pink involves the crawl space methane abatement. The area outlined in black is where excavation is necessary.

## **APPENDIX G**

### **HEALTH AND SAFETY PLAN ACKNOWLEDGMENT FORM**



HEALTH AND SAFETY PLAN ACKNOWLEDGMENT FORM

I have been informed and understand and will abide by the procedures set forth in the Site Health and Safety Plan and respective Amendments, if any, for the <<Project>>.

Name	Company	Signature	Date



**APPENDIX H**

**START-SPECIFIC INFORMATION**

	<p style="text-align: center;"><b>TETRA TECH, INC.</b>  <b>GENERAL SAFE WORK PRACTICES</b>  <b>for</b>  <b>HAZARDOUS WASTE SITE ACTIVITIES</b></p>	Revision Date: 10/1/2008
		Document Control Number:
		<b>SWP 5-2</b>
		Page 1 of 3

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.

**Disclaimer:** This safe work practice (SWP) is the property of Tetra Tech, Inc. (Tetra Tech). Any reuse of the SWP without Tetra Tech’s permission is at the sole risk of the user. The user will hold harmless Tetra Tech for any damages that result from unauthorized reuse of this SWP. Authorized users are responsible for obtaining proper training and qualification from their employer before performing operations described in this SWP.

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Revision Date	Document Authorizer		Revision Details
	Name	Approval Date	
10/1/2008	Chris McClain		Update from 1998 format
	Rick Lemmon		

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## 1.0 PURPOSE

The purpose of this procedure is to identify minimum requirements, and to provide guidance to Tetra Tech Inc. (Tetra Tech) project personnel concerning the management of construction tools and equipment on construction projects.

## 2.0 SCOPE

This procedure applies to all Tetra Tech projects that include a construction, O&M, and/or UXO component, including remediation construction.

## 3.0 MINIMUM REQUIREMENTS

### 3.1 Definitions

#### 3.1.1 Construction Equipment

For the purposes of this procedure, construction equipment shall mean heavy equipment, such as excavators, scrapers, off-road trucks, dozers, road graders, compactors, dredges, and cranes; light equipment, such as skid-steers, forklifts, generators, and light plants; and operating systems such as screens, crushers, conveyors, pugmills, mobile treatment plants, and pumps. Any discussion of construction equipment shall be understood not to include cars, pickup trucks, flatbed trucks, etc. registered for use on public roadways, which shall be called vehicles hereinafter. Also for the purposes of this procedure, construction equipment shall be synonymous with Contractor's Equipment, a term also commonly used in the construction industry to designate the types of equipment described above.

#### 3.1.2 Terms

The terms "should, may, and might" as used in statements in this procedure are intended to denote a discretionary consideration; the terms "shall & must" are intended to impose a mandatory requirement. The terms "is, are, & will" as used in statements in this procedure are intended to denote discretionary or mandatory requirements that are addressed in other department/disciplines' procedures. However, nothing contained herein should be interpreted as to prohibit development and approval of project-specific procedures or plans that take exception to mandatory direction presented in this procedure provided that the appropriate level of approval, (Executive Vice President of Construction, Business Line Executive Vice President, or the Vice President ESQ Services as appropriate) is obtained for deviations from such requirements.

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### **3.1.3 Tools of the Trade**

Specific hand tools and or equipment (e.g., manlifts, trucks, trenchers, and pumps) normally provided by or to workers for the performance of their particular work activity.

## **3.2 Roles & Responsibilities**

### **3.2.1 Equipment Supervisor**

Depending on the project's equipment needs, an individual may be designated as the Equipment Supervisor. Responsibilities of the Equipment Supervisor include:

- Determination of the equipment needs for the project;
- Providing input to the Work Plan concerning equipment;
- Identification of Contract and legal/regulatory requirements for mobilization of equipment on client facilities;
- Submit required certifications, inspection reports, and test reports for equipment;
- Arranging for the mobilization/demobilization of equipment in support of the project's schedule, providing required notices, such as mobilization details and dates, and obtaining Contractual or legally required approvals for mobilization;
- Receipt inspection of equipment arriving at the site, including coordination of any client or third party inspection;
- Coordination with equipment yard personnel or vendors regarding equipment maintenance;
- Ensuring implementation of safe work practices for equipment utilization; and
- Assuring that the return of demobilized equipment is performed in accordance with the terms of the rental/lease/PO agreement and documented correctly, or, for Tetra Tech owned equipment, that the equipment transfer form is completed and coordinated with the Equipment Manager; and
- All other responsibilities as assigned by the Project Manager or Site Supervisor

## **3.3 Safe Operation Requirements for Tools**

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### **3.3.1 Manual T-Post Drivers**

There shall be no use of manual fence post drivers, such as those typically used to drive T-posts, without prior approval from the Site Safety Coordinator or the Vice President of Construction. Any approval of the use of such a tool shall require the implementation of an Activity Hazard Analysis (AHA) to identify and control the hazards presented by the tool. The AHA shall address appropriate PPE and position for the task in order to avoid injury to the worker.

### **3.3.2 Tools**

The Site Supervisor shall determine the nature and quantity of tools required for the construction effort and shall ensure that adequate tools are provided in support of the schedule.

Tools may be assigned to workers or crews for the duration of their activities and shall be stored in gang boxes or other secured storage areas when not in use.

The Site Supervisor may designate certain tools to be issued from a tool control area on a daily basis. These tools should be signed out at the beginning of the work, returned to the tool control area at the end of the work, and signed back in.

### **3.3.3 Worker Provided Personal Tools**

Workers may be required to provide personal tools of the trade for their particular work. Master mechanics, for example, may be required to provide tools required for repairs and maintenance of construction equipment and vehicles. Requirements for workers to provide their own tools shall be established based on the project requirements and shall be discussed at the Pre-Job Conference to be held in accordance with the requirements of the Labor Relations Guidelines LR-8, Pre-Job Conferences.

Any worker required or offering to provide personal tools shall be required to present a list of personal tools being provided upon reporting to the project site. The Site Supervisor shall inventory the tools against this list for verification that all listed tools has been provided. The list shall then be maintained for use in performing an inventory of the tools when the worker is to leave the site at the end of the worker's assignment and shall be the basis for any claims for loss or damage.

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The Site Supervisor shall ensure that any personal tools brought onto the project site receive a safety inspection. The safety inspection shall include as a minimum, the items addressed in Section 3.3.4 of this procedure.

The Site Supervisor should ensure that secure, lockable facilities are provided for the storage of worker provided personal tools.

The worker shall be responsible for notification of lost or damaged tools immediately on discovery of the loss. The limits of the project's liability (if any) for loss or damage to personal tools provided by the workers should be established at the Pre-Job Conference.

Use of personal tools, other than addressed above, either by manual or by Tetra Tech nonmanual personnel, should not be allowed except as specifically authorized by the Project Manager or Site Supervisor. Project personnel should be notified that Tetra Tech will not be liable for any theft, loss, or damage of unauthorized personal tools on the project site.

### **3.3.4 Tool Safety Inspection**

OSHA 29 CFR Part 1926 Subpart I Tools – Hand and Power provides guidance for tool safety. All tools shall be inspected for the following minimum features by the person using the tool prior to starting the work:

- Proper general condition of tools, electrical cords, and air hoses;
- Presence and serviceability of guards and safety devices;
- Proper electrical grounding or double insulation protection;
- Power tools properly equipped with constant pressure switches;
- Tool retainers installed on pneumatic tools;
- Proper adjustment of the tool; and
- Confirming that the load rating of the tool is sufficient for the work to be performed.

Unsafe tools shall be removed from service and the Site Supervisor advised of the condition for corrective action. An Out of Service tag should be placed on all unsafe or defective tools to prevent their inadvertent use by others. These tools should be physically segregated from the acceptable tools.

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### 3.3.5 Environmental Safety and Quality Policy Implementation

Proper selection of construction equipment can impact employee health; consideration should be given to ergonomic design when selecting construction equipment.

Selection of construction equipment and vehicles may have significant impacts on the environment, either adverse or beneficial. Proper selection of the size and type of equipment and vehicles can reduce the adverse impacts from their operation.

Project procurement practices for construction equipment, parts, supplies, lubricants, and fuel shall be consistent with the principles of pollution prevention. For example, consideration should be given to such factors as rent versus buy options, disposable versus reusable filters, recycled versus virgin oils/fluids, recycling versus disposal of spent fluids and used parts, and fuel efficiency and economy of operation.

Spent fluids, filters, and used parts shall be recycled to the extent practical, or otherwise disposed of in accordance with the environmental compliance elements of the Work Plan or EHS plan.

Proper utilization of construction equipment and vehicles can also reduce adverse impacts on the environment. (For example, it is Tetra Tech's policy to not allow unattended equipment and vehicles to be left with motors running. This is not only a safety consideration; it reduces adverse environmental impacts and is generally cost effective due to reduced fuel consumption.)

### 3.3.6 Insurance

The Project Manager shall ensure that all construction equipment, including Tetra Tech-owned or rental/lease equipment, is covered by appropriate insurance policies for the intended use of the equipment. Property insurance on construction equipment is normally arranged by Tetra Tech if Tetra Tech bears the risk of loss or if Tetra Tech is required to arrange such insurance. However, all rented/leased construction equipment valued in excess of \$100,000, and all cranes regardless of their value shall be reported to the Administration and Compliance Department via the 'Insurance Request for Leased Equipment' (Attachement 5, and available in Tetra Links and from procurement) for specific inclusion under the Tetra Tech property insurance policy. The procurement representative should be contacted to ensure that this occurs in each case. Notification is not required for equipment valued under \$100,000 except

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when the construction equipment provider requests a certificate of insurance be provided, or the equipment is a crane.

The Project Manager, usually through the designated procurement representative, should ensure that duplicate insurance coverage is not provided through the equipment provider since this will increase the rental rates. In those cases where the provider requires insurance certificates to verify coverage by Tetra Tech, the procurement representative should be contacted to obtain the appropriate documentation.

A Vehicle Insurance Form (available from the Vehicle Insurance Coordinator, Tetra Links or procurement) shall be processed and sent to the Vehicle Insurance Coordinator for all vehicles (leased, rented, or owned) which are registered and operated off jobsites on public highways.

### **3.3.7 Receipt and Inspection**

All construction equipment shall be subject to a receipt inspection by a competent person and any Contract or otherwise required additional person(s) prior to acceptance at the project site. The inspections and tests shall be in accordance with the manufacturer's recommendations. Most vendors provide a form for notation of any existing damage to the equipment to be filled out on receipt. The equipment should be inspected carefully to determine its condition, including any damage, missing or non-functional equipment. The agreement should be used as a basis to determine that everything required (e.g., the equipment, its condition, manuals, spares, documentation of inspections, and certifications) has been provided. All discrepancies should be noted on the form. A pre-inspection of the equipment prior to transport to the Project site should be considered. Particular attention shall be given to the following items:

- All safety equipment and its condition;
- Operator (when provided) certification for the equipment;
- Posted operating and safety instructions;
- All pollution control devices and their condition;
- Safe entry and egress, with steps, ladders, handholds, and platforms provided as required, including safe access to perform routine checks, maintenance, and refueling operations;
- Leaking fluids, such as hydraulic oil, engine oil, transmission fluid, and coolant;
- Deteriorated or cracked hydraulic and coolant hoses which could result in leaks or spills;

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- Guard belts, gears, shafts, pulleys, fly wheels and other reciprocating, rotating or moving parts shall be guarded to protect workers from becoming caught on, in or between machinery; and
- Presence of the manufacturer operation and maintenance manual.

Equipment or vehicles with deficient conditions relating to safety or protection of the environment shall not be placed into service until the deficiencies have been corrected and documented.

All construction equipment shall be subject to an operational check prior to acceptance at the project site. The operational check should verify that the equipment has the capability to function as intended or as required through the full range of its intended use.

Receipt of construction equipment shall be documented; with a copy of the receipt inspection report provided to the Equipment Supervisor and to the equipment purchase order file. Documentation should include entries for date and time of receipt, condition of equipment, mileage or engine hours at time of receipt, information on next scheduled maintenance, and a record of operating and maintenance manuals received with the equipment. Photographs or a video record of the equipment on receipt should be taken if conditions are noted that would warrant further documentation.

Construction equipment providers will often include terms and conditions on receipt documentation to be signed when construction equipment is delivered to the project site. **Project personnel requested to sign this receipt documentation shall not sign any delivery forms unless authorized to do so by Legal of the Project Manager. Further, if they are required to sign delivery forms, they shall be instructed to cross out all terms and conditions, on both the front and back of the forms, before signing.** Alternately, the person receiving the construction equipment should enter the following statement in the immediate vicinity of their signature: "In lieu of the terms and conditions set forth on this document, the Original Purchase Order (or appropriate form of agreement) terms and conditions apply to the receipt of this item(s)." These actions are necessary to avoid acceptance of additional or different terms and conditions.

Construction equipment delivered to the project site should be accompanied with operating and maintenance manuals. Cranes and lifting equipment shall include certification of satisfactory completion of annual inspection and have load charts posted in the cab. Additionally, some construction equipment may be supplied with common replacement parts, such as filters and belts, and any specialized tools required for routine operation or maintenance. (i.e. forks,

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buckets, lift arms, and tool carries) These items should be carefully inventoried upon receipt, and documented on the receipt inspection report. Responsibility for protection and maintenance of the construction equipment shall be verified, and all measures necessary to protect the construction equipment from damage or loss will be instituted in accordance with the agreement, operating, and maintenance manuals or other instructions as appropriate.

Disposition requirements for construction equipment found to not be in accordance with the rental/lease/sale agreement when received shall be confirmed with the vendor immediately.

A sample Equipment/Vehicle Inspection Report is included as Attachment 1 to this procedure.

### **3.3.8 Protection from Environmental Extremes**

Consideration shall be given to the environmental conditions to which the construction equipment will be exposed to during its time at the project site or during transportation. The manufacturer's instructions shall be reviewed and followed to ensure adequate protection from damage due to environmental conditions.

Adequate protection to the construction equipment's cooling system shall be verified by ensuring that the appropriate coolant/antifreeze mixture, as recommended by the manufacturer, has been used.

Appropriate procedures for operating or storing construction equipment, such as water treatment systems, shall be developed in accordance with the manufacturer's instructions. Measures such as draining and venting the system, providing auxiliary heat sources (e.g., heat tape), dry storage, shaft rotation, fluid levels, shall be taken to protect construction equipment subject to damage from environmental conditions.

Manufacturer's instructions concerning periodic operation of construction equipment shall be followed.

A means of ensuring that appropriate protective measures are instituted and performed as required should be implemented through the establishment of site procedures, logs, and/or checklists.

### **3.3.9 Equipment Inspections**

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All construction equipment shall be inspected daily (when in use) for safety and operability, including manufacturer's recommended daily inspections. The inspection form/checklist should note any deficiencies for correction and serve as documentation of the inspection performance. The Equipment Supervisor shall be notified of any deficiency immediately. A Daily Equipment Inspection form, a sample of which is included as Attachment 2 to this procedure, should be filled out at the start of the shift and provided to the Equipment Supervisor. Other supplemental forms which may be used in conjunction with Attachment 2 are the equipment specific "Pre-operation Inspection" and/or "Function Tests" forms, which are normally supplied by the equipment manufacturer. This information is usually found in the equipment's Operation Manual.

Government property control procedures usually require the implementation of a vehicle utilization log for vehicles when used on government projects; other projects should also implement a similar system for logging use of these vehicles. The log should be kept in the vehicle and an entry made for each use, including name of the driver, purpose of the trip, starting mileage, ending mileage, fuel purchased, maintenance performed, and any damage incurred. The log sheets should be transmitted to Tetra Tech as required in the contract documents and the project's documentation plan. Copies of the log sheets will be maintained and filed as discussed in Section 3.3.12 of this procedure.

A separate Daily Equipment Inspection Report should be filled out for each shift if construction equipment is utilized on multiple shifts.

The Equipment Supervisor should use the information on Daily Equipment Inspection forms to schedule any repairs or preventive maintenance required for the equipment. Equipment with missing or defective safety features should not be put in service until repairs have been performed to bring the equipment into compliance with any applicable Tetra Tech H&S Program and/or regulatory requirements.

Implementation of the daily equipment inspections should be the subject of periodic verification inspections performed by the Project Manager, Site Supervisor, and/or the Site Safety Coordinator (SSC). These periodic inspections should include verification that the required maintenance is being performed in a timely manner to ensure that unsafe conditions or impacts to the environment (e.g., spills, releases, and discharges) are not created by delays in correcting deficiencies noted on the Daily Equipment Inspection Forms.

Rigging equipment, wire rope, nylon or KEVLAR slings and chokers shall be inspected by a competent person prior to use each shift; particular attention shall be paid to the rigging

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condition and presence of load/certification tags.

Cranes (weight handling equipment) shall be subjected to annual and certification inspections per OSHA guidelines. Mobile and crawler cranes shall be inspected on a monthly basis; a sample checklist form is included as Attachment 3 to this procedure.

Construction equipment to be demobilized shall be given a final inspection, similar to the receipt inspection, to identify and document, by means of written description and pictures, the condition of the equipment as it leaves the project site. Where possible, a concurrent inspection by the vendor is preferred. Additionally, some projects, particularly USACE projects, require a certificate of decontamination prior to the equipment leaving the site.

### **3.3.10 Operator Qualifications**

Tetra Tech employees operating vehicles or construction equipment on public rights of way shall be required to have in their possession a valid driver's license appropriate to the location where the item is being operated and containing the appropriate endorsement for the type of vehicle or construction equipment being operated. A Commercial Driver's License (CDL) may be required for operation of some construction equipment on public rights of way, or as a specific requirement of a client's safety program. In addition, individual states may require specific licenses or certifications for operators of certain equipment, such as forklifts, and hoisting equipment. Additionally, the client's safety program may include license or certification requirements for personnel operating equipment on their property. The contract documents should be reviewed carefully to ensure that any such requirements are incorporated into the project's Work Plan or HASP. The Site Supervisor shall verify that the operator possesses the required license(s). Copies of licenses should be maintained in the on-site project employee file.

Any agreements for the rental or lease of vehicles or equipment should be reviewed for any provider's requirements for licensing or certification of operators to ensure that any such requirements are incorporated into the project's Work Plan or HASP.

Operators shall be required to demonstrate their proficiency in operating the construction equipment to be assigned to them prior to being allowed to work. Crane operators shall have qualifications for the type of crane to be operated.

Operator proficiency may be demonstrated through a performance test such as those developed by the International Union of Operating Engineers, or by equipment manufacturers such as Caterpillar. These performance tests include exercises developed to demonstrate

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operator proficiency in various aspects of equipment operation, including daily operator inspections, ability to follow directions, ability to understand equipment limitations and operating guidelines, safety, and productivity. Also included are checklists that assist an observer in evaluating all of the various aspects of equipment operation. Attachment 4 is an example of Operator/Driver Observation Checklist.

Where it is not possible or practical to demonstrate operator proficiency through a performance test as described above, there should be a period of observation of the operator during the initial period of performance, whether the operator is a new employee or a current employee who is being assigned to a different type of equipment than previously operated on the project site. This observation may be performed by a knowledgeable member of the management team or a designated craft employee such as a foreman or steward. The above referenced checklists could be used for this observation in lieu of the performance test.

Operators shall be physically fit to perform their duties and may be required to participate in the Tetra Tech Medical Surveillance program.

### **3.3.11 Refresher Training and Evaluation**

Refresher training in relevant topics shall be provided to Crane (as defined by OSHA 1910.180(a) operators, and Powered Industrial Truck (PIT) as defined by OSHA 1910.178(a)(1) operators prior to be allowed to continue operating when:

- The operator has been observed to operate the PIT/Crane in an unsafe manner.
- The operator has been involved in an accident or near-miss incident.
- The operator has received an evaluation that reveals that the operator is not operating the PIT/Crane safely.
- The operator is assigned to operate a different type of PIT/Crane; or
- A condition in the workplace changes in a manner that could affect safe operation of the PIT/Crane.

An evaluation of each PIT/Crane operator's performance shall be conducted at least once every three years.

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Refresher training in relevant topics shall be provided to all other construction equipment operators when:

- The operator has been observed to operate the equipment in an unsafe manner.
- The operator has been involved in an accident or near-miss incident.
- The operator has received an evaluation that reveals that the operator is not operating the equipment safely.
- The operator is assigned to drive a different type of equipment; or
- A condition in the workplace changes in a manner that could affect safe operation of the equipment.

The employer shall certify that each operator has been trained and evaluated. The certification shall include the name of the operator, the type of equipment, the date of the training, the date of the evaluation, and the identity of the person(s) performing the training or evaluation.

### **3.3.12 Repairs**

All construction equipment shall be repaired as necessary and maintained in good working order. Repairs to rented/leased construction equipment shall be in accordance with the terms of the rental/lease agreement. Repairs to rented/leased and Tetra Tech's construction equipment shall be documented and a record of the repairs maintained in the project files. Copies of the repair records are to be forwarded to the equipment yard for Tetra Tech-owned equipment.

Construction equipment with deficiencies noted on the Daily Inspection Report should be repaired promptly. The Equipment Supervisor, with input from the Environmental and Safety Supervisor as appropriate, should evaluate if a piece of equipment or a vehicle should be removed from service until the deficiency is corrected.

Construction equipment that develops a fluid leak such as engine oil, hydraulic oil, transmission fluid, or coolant shall be removed from service until the deficient condition has been corrected.

Construction equipment with missing or inoperable exhaust systems, including spark or flame arrestors, mufflers, and catalytic converters, shall be removed from service until the deficient condition has been corrected.

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Tampering with, removal, modification, or otherwise rendering inoperable any pollution control device on construction equipment shall not be allowed except as specifically authorized by the equipment manufacturer or appropriate authority and the Project Manager or Supervisor's concurrence

Only trained, qualified personnel shall be allowed to repair equipment. The project's Work Plan should address repairs to equipment by designating required actions in the event of an equipment failure.

An Authorization for Capital Expenditure or Lease (AFCEL) is to be completed for all major repair work (i.e., \$1500.00 and over) performed on Tetra Tech-owned construction equipment in accordance with Accounting/Finance Procedure AF-8, Fixed Assets. (Note that on some construction equipment, the cost of a specific item, a replacement tire for example, may require the processing of an AFCEL due to the item cost.)

Costs for major repairs, as well as repairs for deficiencies, to Tetra Tech-owned construction equipment shall be charged back to the project releasing the equipment if the need for repairs is identified within 30 days of the equipment's release and removal from a project and there are indications that the repairs are needed as the result of lack of maintenance or failure of the releasing project to otherwise keep the equipment in good working order.

No repair shall be undertaken for damage covered by an insurance claim until the damage is reported to the Administration and Compliance Department and the insurer approves the repairs.

### **3.3.13 Documentation and Record Keeping**

A file shall be established and maintained for each operator which contains documentation that the operator has the proper qualifications, licenses/certificates, and training to perform his/her job function. Records may include training identified in the HASP (e.g., OSHA, DOT, Waste Management training), vehicle operator licenses, results of site-administered proficiency testing, and any other special licenses/certificates required by state/local law or the client.

A file shall be established and maintained for each piece of construction equipment, and all records relating to that equipment shall be placed in the file, including the Receipt Inspection Report, annual inspections (for cranes), record of the date the equipment was first placed in service, Daily Equipment Inspection records, maintenance records, repair records, record of the

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last date that the equipment was in service, demobilization inspection report, and the decontamination certificate, if applicable. For ease of retrieval, all records pertaining to pieces of equipment should be maintained in separate folders for each piece of equipment.

Additional copies of inspection reports and records may be required to be maintained in other project files, such as the procurement files and/or the Environmental Health and Safety files, based on the project's Documentation Plan.

The Equipment Supervisor should ensure that complete and accurate record of equipment utilization, including a list of idle equipment, is provided to the Quality Control Site Manager on a daily basis...

It may be useful to maintain equipment utilization information on a spreadsheet depending on the size of the project. Information such as equipment mobilization date, date of first use, utilization of equipment by rental period (for example, if rental rate is based on hourly usage and is billed on a monthly cycle, there should be an entry for the number of hours the equipment was used in each billing period), scheduled equipment release date, actual release date, and demobilization date. This information may be useful in verification of vendor invoices, in review of production rates, for preparation of requests for change orders or equitable adjustment, or for backup for use in support of (or defense against) claims.

Copies of all maintenance and repair records for Tetra Tech-owned construction equipment shall be forwarded to the Tetra Tech Equipment Manager at the regional equipment yard on a periodic basis. This period should be monthly, and in no circumstances should it exceed quarterly. An Equipment Service Form is available from the Equipment Manager. This form shall be used to report unscheduled and preventative maintenance on Tetra Tech-owned construction equipment.

The Equipment Manager produces a spreadsheet for Tetra Tech-owned construction equipment that is distributed to the projects on a monthly basis. The Equipment Supervisor shall ensure that reports of mileage or meter readings and routine maintenance for all Tetra Tech-owned construction equipment and vehicles assigned to the project are provided to the Equipment Manager for inclusion on the spreadsheet on a monthly basis. A Meter/Mileage Reading Update Form, available from the Equipment Manager, shall be used to report the required information.

The Equipment Supervisor should review the availability date included on the spreadsheet for Tetra Tech-owned equipment and vehicles assigned to the project and inform the Equipment Manager of any required revisions to these dates.

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The Equipment Supervisor shall complete an Equipment Transfer Report, available from the Equipment Manager, for all Tetra Tech-owned construction equipment and vehicles to be mobilized to, and demobilized from the project. Copies of the Equipment Transfer Reports shall be provided to the Equipment Manager at the regional equipment yard.

There shall be no equipment disposal action (junk or sale) for Tetra Tech-owned construction equipment or vehicles without prior notification and approval from the Tetra Tech President.

## **4.0 GUIDANCE**

### **4.1 Additional Considerations**

#### **4.1.1 Control of Government Property**

Activities involving the use of Government property are to be controlled by specific procedures negotiated with the Client in accordance with the contract's terms and conditions; such procedures shall be consulted where appropriate. Such activities may involve the handling or installation of Government property, whether furnished by the Government to Tetra Tech or acquired by Tetra Tech for use in the performance of work and for which the Government has retained title.

Government property may include construction tools and equipment purchased as a project cost, as well as permanent materials or equipment purchased for incorporation into the work. Project-specific procedures for control of Government property are to address issues relevant to the use, storage, inventory control, maintenance, and/or final disposition of the Government property.

#### **4.1.2 Spill Control and Emergency Response Dedicated Tools and Equipment**

The project's Emergency Response Plan, or Emergency Action Plan is to identify dedicated personal protective equipment and emergency response tools and equipment to be available for an emergency response to a spill or discharge of hazardous material.

Dedicated emergency response tools and equipment are to be segregated and identified for use in emergency response situations. The use of dedicated emergency response tools or equipment for any other activity is not to be permitted.

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#### **4.1.3 Inventory Control**

An individual should be designated as the Material Control Supervisor and should be responsible for inventory control of all tools issued from the tool control area. A log should be maintained for all tools issued and should record, as a minimum, the identification by name and employee number of the individual signing out the tool, the date and time the tool was signed out, the intended use of the tool (by area or system), an indication of when the tool is to be returned, and the time and date when the tool is returned.

Inventory control of tools assigned to individuals or crews should be performed on a daily basis as the tools are returned to the gang box or storage area. The crew foreman should be responsible for inventory control of tools assigned to the foreman's crew.

The Site Supervisor should immediately be made aware of any missing tools and should take the appropriate action to investigate and/or replace the missing tools.

#### **4.1.4 Disposition of Tools at Project Completion**

The Project Manager should make a determination of the disposition of tools remaining at the end of the project. The project may not be reimbursed by the client for the purchase of tools on certain cost reimbursable and lump sum projects. On other projects, a dollar value for individual tools may establish whether or not the client provides any reimbursement. The terms and conditions of the contract should provide direction as to the required disposition of the tools. Tools for which the project has been reimbursed by the client are to be dispositioned in accordance with the client's preferences and the contract terms and conditions.

Tools purchased for the project as a project cost, and which are not to be turned over to the client, should be dispositioned by the Project Manager. Means of disposition may include, but not be limited to, declaring the tools surplus, sale of the tools, or providing the tools to another project. The Project Manager should consult with the appropriate Business Line Executive Vice Presidents, concerning disposition of project tools.

Tetra Tech owned tools (i.e., not purchased as a project cost) should be dispositioned by the Project Manager based on consultation with the appropriate Business Line Executive Vice Presidents. Means of disposition of Tetra Tech-owned tools may include, but not be limited to, declaring the tools surplus, sale of the tools, return of the tools to an equipment yard, or providing the tools to another project.

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#### **4.1.5 Company-Owned Equipment**

Tetra Tech utilizes regional equipment yard(s) for the temporary storage and maintenance of Tetra Tech-owned construction equipment and vehicles when not currently assigned to a project. Available Tetra Tech-owned equipment should be considered for support of a project's construction effort based on an analysis of the benefits to the project and/or Tetra Tech. When evaluating Tetra Tech owned equipment the requirements discussed in 4.1.6 below should be considered when making the equipment selection.

#### **4.1.6 Rental/Lease Equipment**

Agreements for rental/lease of construction equipment should be coordinated through an authorized procurement representative to ensure that appropriate terms and conditions are included in the agreement. The Scope of Work for the agreement should be developed and reviewed carefully, including review by the Site Supervisor or Equipment Supervisor for inclusion of sufficient detail in order to clearly define the scope of work.

The Equipment Supervisor, or requisitioner if there is no designated Equipment Supervisor, should review the terms and conditions of all rental/lease agreements to determine that the following topics are adequately addressed:

- Receipt and return of the rental or leased equipment and any required accessories;
- Inspection and documentation of receipt and release;
- Provision of documentation required to be submitted, such as Occupational Safety and Health Administration (OSHA) accredited inspection reports, NDE reports, test reports (i.e. load test for cranes), typically annual inspections, and wire rope certification.
- Provision of all safety equipment and accessories, as required, such as fire extinguishers, seat belts, Roll Over Protection Structures (ROPS), Falling Object Protection Structures (FOPS), access steps, handholds, platforms, and anti two-block devices and load moment indicator (cranes);
- Provision of documentation demonstrating operator certification;
- Provision of Certificate of Compliance when required, for instance by NAVFAC P-307 Management of Weight Handling Equipment, Appendix P - Contractor Crane Requirements.

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- Provision and requirements of routine and non-routine maintenance and repairs, including payment for labor, parts, filters, lubricants, and fluids;
- Documentation requirements for the above maintenance and repairs;
- Disposal/recycling requirements for used parts, filters, lubricants, and fluids;
- Items such as point of delivery, costs of delivery and return, rental charges during idle time, notification requirements for demobilization, and point of return;
- Appropriate rental rate provisions for straight time and overtime;
- Responsibility for damage to equipment;
- Insurance;
- Indemnification (if included);
- Payment for replacement of parts subject to normal wear and tear, such as tires, tracks, Tetra Teching edges, and teeth; and
- Documentation requirements required in support of invoices for basic rental rates and overtime rates, as well as labor, parts, filters, lubricants, and fluids.

Rental agreements should be structured to include normal wear and tear on the equipment in the basic rental rate. In all cases, there should be mutual agreement with the equipment vendor as to the condition of the equipment as it is delivered. This should include items such as the life expectancy of the parts subject to wear and tear, their condition on receipt (i.e., percentage of usable life remaining), and the expected condition on return of the equipment. There should be agreement on minor versus major repairs and on what constitutes normal wear and tear. Mutual agreement is essential to mitigate potential claims from vendors for excessive wear and tear.

#### **4.1.7 Mobilization of Equipment**

Mobilization of construction equipment may be a long lead time item and may require client or third party involvement or approvals to gain site access, depending on the required equipment. The Site Supervisor or Equipment Supervisor should determine the lead time required, including Contract submitted and advance notice/approval requirements, and plan for the mobilization of equipment to support the project's schedule.

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- Planning for mobilization of equipment should include a thorough review of Contract requirements for utilization of each equipment and site access requirements.
- Documentation of certification, and OSHA compliant annual inspection, load testing, safety devices (e.g., anti two-block) installed, wire rope certification, and operator's certification for cranes (weight handling equipment) should be reviewed prior to initiating mobilization of cranes.

#### **4.1.8 Equipment Maintenance**

The Equipment Supervisor should be responsible for administration of a construction equipment maintenance program for the project. A spreadsheet of all Tetra Tech-owned equipment, titled the Status of All Project Equipment, is maintained by the Construction Department providing notification of the scheduled maintenance requirements for each piece of equipment. Either this spreadsheet, or a project specific spreadsheet, should be maintained and statused on a periodic basis. Specific maintenance requirements may also be contained in specific contract negotiated property procedures or in other Tetra Tech corporate procedures.

As construction equipment is received on site, it should be added to the spreadsheet for tracking of the required maintenance.

A review of the scheduled maintenance should be performed for all construction equipment to be used in the Exclusion Zone to determine the desirability of performing any upcoming scheduled maintenance prior to placing the equipment in service. It may be difficult and expensive to perform the maintenance under the conditions required in the Exclusion Zone, or to decontaminate the construction equipment in order to perform the maintenance under clean conditions. When the maintenance of equipment in the Exclusion Zone is anticipated, the Site Supervisor should ensure that qualified personnel are available with the appropriate medical clearances and certifications to work in the Exclusion Zone.

#### **4.1.9 Construction Equipment Safe Operation Requirements**

Standards for safe operation of equipment are contained in the documents identified herein, inclusive and in particular of the requirements for safe operation of lifting and rigging equipment and weight handling equipment. The Contract typically will specify certain documents/codes to be followed for the project.

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- The United States Army Corps of Engineers (USACE) Safety and Health Requirements Manual, EM 385-1-1, Chapters 16, 17, and 18, provide guidance concerning the safe operation of construction equipment.
- Safe operation of earth drilling equipment is addressed in SWP 5-36 Drill Rigs.
- Safe operation of hand and power tools is addressed in OSHA standard 29CFR Part 1926 Subpart I.
- Safe operation of cranes, derricks, hoists, elevators and conveyors is addressed in OSHA standard 29CFR Part 1926 Subpart N.
- Safe operation of motor vehicles, mechanized equipment and marine operations is addressed in 29CFR Part 1926 Subpart O.
- Rollover protective structures and overhead protection is addressed in 29CFR Part 1926 Subpart W.
- The American Society of Mechanical Engineers (ASME) provides guidance in the B30 commiee Tetra Teche volumes – Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings.
- The United States Department of Energy (DOE) provides guidance for safe lifting operations in Technical Standard DOE-STD-1090 – Hoisting and Rigging.
- The United States Navy publication NAVFAC P-307 – Management of Weight Handling Equipment includes requirements for Contractor Cranes (see appendix P). Navy facilities issue Instructions specific to particular facilities such as ‘NAVSHIPYDPUGET INSTRUCTION 11262.4A’ which provides requirements for weight handling equipment at all Navy facilities within the Puget Sound.

Construction Equipment safety requirements shall be met before any task can be safely and properly performed, including

- Equipment will be used only in the manner in which it was designed.

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- Vehicles and equipment shall be kept in the appropriate gear or drive range when in motion, specifically when ascending or descending a grade. Freewheeling or coasting is prohibited.
- Steps, handrails and grab irons shall be used and equipment shall be faced when mounting or dismounting equipment. When climbing onto or from equipment a 3-point contact shall be maintained. Steps, handrails and grab rails shall be kept maintained, clean and free from slip, trip and fall hazards. Allow extra time in winter or rainy conditions to clean ice, snow and mud from equipment.
- Operators shall wear seat belts before starting and while in operation if the equipment is supplied with seat belts.
- Eye protection is mandatory if the equipment does not have an enclosed cab.
- Passengers shall not ride on equipment unless the equipment is designed to accommodate passengers.
- Before dismounting, the operator shall secure the equipment from movement by lowering all ground-engaging attachments, if so equipped (i.e., setting the parking brake, placing the transmission in park, disabling the hydraulics and activating any other elements of the equipment per the operator's manual).
- Wheeled equipment, without ground-engaging attachments, shall be chocked immediately following dismount with chock blocks that are adequate for the wheel size and equipment weight.
- Blades, buckets and other materials shall be in contact with the ground before the operator dismounts the equipment.
- Equipment should not be left unattended while the engine is running. If conditions exist that make it necessary for equipment to be left running in an unattended state (i.e., cold weather and certain start-ups), do not allow the general public entrance to the area unless the area can be clearly delineated. If the area cannot be clearly delineated to preclude casual entrance by the general public, unattended equipment shall not be left running.

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- The work site around equipment shall be clear prior to moving equipment. The operator shall be attentive to people and any vehicles that may have entered the area during the walk-around inspection.
- All operations shall be in accordance with manufacturers Standard Operating Procedures (SOPs).
- All ground disturbance operations shall comply with the DCN 4-5 Trenching and Excavation Practices.
- Proper working distances shall be maintained when operating equipment that is near electrical lines, as defined in DCN 5-9 Safe Electrical Work Practices.
- Employees shall not get on or off a vehicle or piece of equipment while it is moving.

#### **4.1.10. General Traffic Requirements**

The traffic rules in this section shall be followed, at a minimum, when heavy equipment and haul trucks are operated on project sites. The PM or SSC shall implement new traffic rules as conditions or project changes dictate.

- All applicable local governing authority driving rules shall be followed when driving heavy equipment and haul trucks on public or project sites.
- Operators shall understand and adhere to the site traffic right-of-way rules and work zone configurations.
- Speed limits, dependent on the risk associated with the site, shall be posted for the location and shall always be observed. Violation of speed limits shall result in disciplinary actions, which shall be posted and discussed with the workforce. Appropriate signage shall adequately communicate haul roads and traffic hazards.
- Vehicles and equipment shall follow at a safe distance as determined by road conditions, the specific vehicle and loading. The site shall define a minimum following distance.

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- Passing shall be limited to areas of adequate clearance, visibility and where marked accordingly. Passing may be prohibited completely on some sites or areas.
- Lights should be used to direct equipment at night; work zone lighting shall be sufficient for the work being performed.
- Adequate equipment spotters and ground employees should be deployed in conjunction with the job zone and traffic control plan. Spotters shall be not in the path of equipment travel while equipment is backing into a dump or loading area. Spotters shall wear bright, reflective clothing and be competent in directing and signaling equipment. Spotters and operators shall have a clear understanding of signal protocol for the site. When applicable, equipment will be equipped with a working signal alarm while backing up.
- A communications plan shall be developed by the site to allow the workforce to have communications with operators and spotters. A direct communication technique such as radio communication is preferred. If noise may impede operators to hear radios, then visual alerts (e.g., warning lights) inside the cab that are visible to the operator shall be considered.

#### **4.1.11 Road Construction and Maintenance**

For the safest and most efficient worksite, these construction and maintenance rules shall be followed when applicable:

- Elevated haul roads and roads, where risk is high from activities such as building dikes shall have side berms or barriers that are axle height or greater to accommodate for the largest type of equipment that normally occupies the road. Drainage shall be allowed.
- All curves shall have open sight lines and have as large a radius as practical.
- Haul road/traffic changes shall be communicated to all affected personnel.
- Roadways shall be constructed with a slight crown to facilitate drainage.

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- All roadways, including haul roads, shall be routinely maintained in a safe condition, including the elimination or control of dust, ice or similar hazards. Adequate dust control equipment shall be provided on the job site and shall be utilized to control the hazards.

#### 4.1.12 Demobilization of Equipment


Construction equipment should be demobilized when no longer required for the work. The Executive Vice President of Construction should be provided with a status of Tetra Tech-owned construction equipment and scheduled release dates in order to coordinate availability of equipment with other projects.

The Project Manager or designee should request demobilization instructions from the Executive Vice President of Construction or designee to determine the location to receive Tetra Tech-owned equipment.

Construction equipment leaving the Exclusion Zone of a remediation construction project will be decontaminated in accordance with the requirements of DCN 3-9 Decontamination and the site specific HASP.

Individual state regulations may require cleaning of construction equipment leaving a site, not limited to remediation construction, in order to control the spread of microorganisms contained in the soil. Such requirements are to be identified in the project HASP plans.

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2/16/2012	Chris McClain	Content & Format Revision

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## 1.0 PURPOSE

Tt employees may use portable electric tools at project sites, may work near high-voltage or overhead power lines at construction or environmental sites, and may use fixed electric tools and machines in Tt facilities. Tetra Tech employees may also be involved monitoring electrical equipment installations that fall under the scope of the National Fire Protection (NFPA) Standard 70e Part I. This safe work practice (SWP) establishes standards to prevent injuries to Tetra Tech, Inc. (Tetra Tech), employees resulting from electrical work.

## 2.0 RESPONSIBILITIES

### 2.1 Project Manager Responsibilities

The project manager (PM) is responsible for ensuring that work areas and tasks are evaluated for the presence of high-voltage or other hazardous electricity sources and that all electrical equipment and circuits are de-energized prior to any normal electrical maintenance work. Any site-specific safe electrical work 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 PM or his/her designee will notify the local utility company when elevated work occurs (including equipment with masts and booms) near their overhead power lines and guy wires. The voltage of the lines should be verified when the communication with the utility occurs, and the PM should ask about any permits that may be necessary.

The PM should also evaluate the risk associated with the work as it pertains to overhead power lines or other electrical sources. If the risk is deemed high, and the work cannot be avoided or changed to reduce or avoid the risk, Corporate Tetra Tech Health & Safety personnel will be consulted and a permit system shall be implemented. The permit would include information specific to the equipment being used, the operators, roles of field personnel, and limitations to reduce risk. In many cases, Tetra Tech will elect to not perform high risk work.

It is the responsibility of the Project Manager to provide ground-fault circuit interrupters for use by Tt employees in the field. The PM will identify, specify, and purchase the GFCI needed.

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The Project Manager will provide training to employees regarding the necessity and use of GFCI through the monthly safety meeting program or other established safety training forum. On a project basis, refresher training in GFCI can be provided through tailgate safety meetings. According to Tt's HSMS all safety meetings will be documented.

## **2.2 Site Safety Coordinator Responsibilities**

The site safety coordinator (SSC) is responsible for ensuring that on-site work is performed in accordance with this SWP. This will include conducting daily safety meetings that will include a discussion of this SWP. In some cases, work will be performed at a facility where client procedures require coordination with on-site client representatives. These representatives could include trained Permit Issuing Authorities. The SSC will be the Tetra Tech point of contact for the on-site client representatives.

## **3 Employee Responsibility**

It is the responsibility of each Tt employee to use the equipment provided in the manner and for the purpose it was intended. Power cords and extension cords must be maintained in a safe manner, free from nicks, cuts, and frays. Ground plugs shall never be removed from equipment power cords or extension cords. If an employee finds equipment in poor electrical condition, he/she shall mark it "Out Of Service" or repair or replace it before use. A daily visual inspection of the following will be made by the user prior to use to identify any external visual defects or indications of internal damage; cord sets, attachment caps, plug and receptacle of cord sets and any other equipment connected by exposed cords or plugs.

## **3.0 HEALTH HAZARDS FROM ELECTRIC SHOCK**

The severity of the shock received when a person becomes a part of an electric circuit is affected by three factors:

- The amount of current flowing through the body (measured in amperes)
- The path of the current through the body
- The length of time the body is a part of the circuit

Other factors that may affect the severity of the shock are the frequency of the current, the phase of the heart cycle when shock occurs, and the general health of the person prior to shock.

The affects experienced as a result of electric shock depend upon the type of circuit; its voltage, resistance, and amperage; the pathway through the body; and duration of the contact. Effects can range from a barely perceptible tingle to immediate cardiac arrest (Table 3.1).

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**Table 3.1 Effects of Electric Current on the Human Body**

Current	Health Effect
1 milliampere	Perception of a faint tingle.
5 milliamperes	Slight shock, not painful but disturbing. Involuntary reactions to shock in this range can lead to injury.
6 – 25 milliamperes	Painful shock; muscular control is lost.
9 – 30 milliamperes	The freezing current or “let go” range.
50 – 150 milliamperes	Extreme pain, respiratory arrest, severe muscular contractions. Individual cannot let go; death is possible. If extensor muscles are excited by the shock, the person may be thrown away from the circuit.
1000 – 4300 milliamperes	Ventricular fibrillation (rhythmic pumping action of the heart ceases), muscular contraction, and nerve damage occur. Death is likely.
10,000+ milliamperes	Cardiac arrest; severe burns, and probable death.

As the table illustrates, a difference of less than 100 milliamperes exists between a current that is barely perceptible and one that can kill. Muscular contraction caused by stimulation may not allow the victim to free him/herself from the circuit, and the increased duration of exposure increases the dangers to the shock victim. For example, a current of 100 milliamperes for three seconds is equivalent to a current of 900 milliamperes applied for 0.03 seconds in terms of causing ventricular fibrillation. Low voltage can be extremely dangerous because, all other factors being equal, the degree of injury is proportional to the length of time the body is in the circuit.

In other words, **LOW VOLTAGE DOES NOT IMPLY LOW HAZARD!**

### 4.0 CIRCUIT PROTECTION DEVICES

When a low resistance path from a tool or machine to the ground is established, the worker using these tools and machines is less vulnerable to electric shock. This is accomplished through the use of an equipment-grounding conductor, that is, a low resistance wire that causes the unwanted current to pass directly to the ground, thereby greatly reducing the amount of current passing through the body of the person in contact with the tool or machine. If the equipment-grounding conductor has been properly installed, it has a low resistance to ground and the worker is protected. However, the worker may suffer electric shock if the insulation or grounding is compromised.

The responsibility for ground-fault protection rests with Tt, even when Tt employees are operating portable electric tools at a client site. Therefore, in accordance with Occupational Safety and Health Act (OSHA) regulations, Tt will provide a ground-fault circuit interrupter (GFCI) for receptacle outlets when the client does not provide them. GFCIs will be used in all

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situations where equipment is connected by a cord and plug and all cord sets and receptacles unless it is verified that they are part of the building grounding structure.

Circuit protection devices are designed to automatically limit or shut off the flow of electricity in the event of a ground-fault, overload, or short-circuit in the wiring system. Fuses, circuit breakers, and GFCI are three well-known examples of such devices.

Fuses and circuit breakers are over-current devices that are placed in circuits to monitor the amount of current that the circuit will carry. They automatically open or break the circuit when the amount of current flow becomes excessive and, therefore, unsafe. Fuses are designed to melt when too much current flows through them. Circuit breakers are designed to trip open the circuit by electro-mechanical means.

Fuses and circuit breakers are intended primarily for the protection of conductors and equipment. They prevent overheating of wires and components that might otherwise create hazards for operators. They also open the circuit under certain hazardous ground-fault conditions.

The GFCI is designed to shut off electric power within as little as 1/40th of a second. It works by comparing the amount of current going to electric equipment against the amount of current returning from the equipment along the circuit conductors. The GFCI is used in high-risk areas such as wet locations, outdoor locations, and construction sites.

## **5.0 CORRECTING ELECTRICAL HAZARDS**

The following describes various means of protecting against electrical hazards.

### **5.1 Insulation**

Before beginning work that presents electrical hazards (i.e., requires power cords or use/maintenance of electric tools or machines), employees must inspect the tools, equipment, or machines. Tools and parts must be clean, dry, and free of oily film or carbon deposits. All hand tools should have insulated grips installed by the manufacturer. Under no circumstances should a tool be used that has cracks, tears, or gaps in the insulation. Tool insulation should not be improvised or modified in any way.

Employees should use non-conductive (fiberglass or wood) ladders if electric shock may be a hazard; aluminum ladders will conduct electricity.

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## 5.2 Guarding

Employees should inspect tools and machines prior to use to verify that electrical and other safety guards are in place.

If moisture is a hazard in the work environment, in addition to using GFCI, electrical receptacles and power cords should be protected from rain, drips, leaks, or any other contact by water.

## 5.3 Grounding

OSHA Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.304(f) requires grounding of exposed non-current carrying metal parts of cord- and plug-connected equipment that may become energized if it meets one of the following criteria:

- It is operated in hazardous environments (where flammable vapors, combustible dusts, or fibers are present).
- It is operated at over 150 volts to ground.
- Refrigerators, freezers, air conditioners, clothes- or dish-washing or drying equipment, aquariums, hand-held motor-operated tools, equipment used in wet or damp locations, equipment used by employees standing on metal floors (e.g., tanks or boilers), and portable lamps.

Employees should use grounded outlets and a standard plug adapter. They should NEVER remove the grounding post from a three-prong plug and NEVER use more than one adapter for each duplex outlet.

Employees should not overload electrical outlets. Extension cords should be the correct size and rating for the tool or equipment.

OSHA requirements for grounding on construction sites are detailed in 29 CFR 1926-404(b) and provided in Appendix A of this SWP.

## 6.0 TRAINING

Training will be provided to all Tt personnel who may be exposed to electrical hazards. Affected personnel will be designated as either a “Qualified Person” or “other personnel” as defined below.

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## 6.1 Qualified Person

A Qualified Person, according to OSHA, is an electrical worker who has formal training in hazard recognition and proper safe work practices, and environmental knowledge of the work area. This person must be trained on the equipment and familiar with its construction and operation. It is possible to be considered a Qualified Person on one type of equipment and not on another.

The Qualified Person may:

- Work on energized circuits or on equipment within 10 feet of energized power lines.
- Use test equipment on circuit elements and equipment parts, as well as other hazardous tasks for which he is fully qualified.

Unless Tt has a “Qualified Person” as defined above available to perform the task, work requiring a Qualified Person will typically be done by a qualified subcontractor.

## 6.2 Other Personnel

Other personnel who face the risk of electric shock, but who do not meet the definition of a Qualified Person, will receive training in electrical hazard recognition and related safe work practices. Most Tt field personnel fall into this category.

As outlined in Section 2.1 of this SWP, supervisors / project managers will provide training through monthly safety meetings or other pre-approved means. In addition, project-specific training will be conducted during daily safety tailgate meetings and will be addressed as part of the site-specific health and safety plan on a project-by-project basis.

## 7.0 SAFE WORK PRACTICES – RECOGNITION AND CONTROLS

The following sections provide guidance in assessing electrical hazards and establishing appropriate precautionary measures.

### 7.1 Hazard Recognition

The single most successful defense against electrical accidents is effective use of hazard assessment to remove the hazards. Some indicators of electrical hazard are as follows:



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- Any type of moisture may provide a conductive path, which may result in electric shock. This includes wet clothing, wet hands, working in the rain, or standing in standing water.
- Electrical sparks or motors may ignite flammable gases, combustible dust or fibers, and excess oxygen.
- Poor lighting may cause a hazard at the job site. Drilling should cease when ambient natural light is insufficient for safe work. If portable lighting is used at any job site, it must be National Electric Code (NEC)-approved for the application.

### **7.2 Protective Equipment**

Employees whose job requires them to work directly with electricity must use personal protective equipment required for the job. For certain tasks, this may include insulating boots and gloves. At a minimum, all Tt employees are issued and should wear non-conducting hard hats (type A or B) and American National Standards Institute (ANSI)-approved safety glasses.

### **7.3 De-Energizing Electrical Equipment**

The accidental or sudden starting of electrical equipment can cause severe injury or death. Before any inspections or repairs are made, the current should be turned off at the switch box and the switch locked out and tagged. Even if conductors or parts of electrical equipment have been de-energized, they shall be treated as live parts unless they have been locked or tagged out. DCN 2-16 Control of Hazardous Energy Program contains further information on lock out / tag out procedures.

### **7.4 Tools**

Employees are responsible for care and maintenance of their tools. Tools should be inspected before use for cut or frayed insulation on power cords, exposed terminals, and loose connections. Power tools should meet NEC standards.

### **7.5 Lock Out / Tag Out**

Using locks and tags before working on circuits and equipment has proven to be a safe and effective way of reducing electrical accidents. Physically locking out a piece of equipment prevents unauthorized personnel from inadvertently activating equipment. All power equipment should be locked out before the commencement of work by following Tetra Tech DCN 2-16, "Control of Hazardous Energy (Lockout/Tagout)." These procedures shall apply to all electrical circuits, electrical power equipment, steam systems, hydraulic systems, compressed air and gas systems, and any other systems that have the potential for causing injury or damage if they are improperly or accidentally energized.

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### 7.6 Distance

All qualified employees must adhere to the approach distances shown in the table below:

Voltage Range (phase to phase)	Minimum Approach Distance
300 V and less	Avoid Contact
Over 300V, not over 750V	1 ft. 0 in. (30.5 cm).
Over 750V, not over 2kV	1 ft. 6 in. (46 cm).
Over 2kV, not over 15kV	2 ft. 0 in. (61 cm).
Over 15kV, not over 37kV	3 ft. 0 in. (91 cm).
Over 37kV, not over 87.5kV	3 ft. 6 in. (107 cm).
Over 87.5kV, not over 121kV	4 ft. 0 in. (122 cm).
Over 121kV, not over 140kV	4 ft. 6 in. (137 cm).

### 7.7 The 10-Foot Rule

Workers not qualified to work near exposed energized or de-energized overhead lines must stay a minimum of 10 feet away from any unguarded equipment. Vehicles and mechanical equipment must also maintain a 10-foot safe distance. Masts of drill rigs should maintain 30 horizontal feet (or the height of the mast) distance from overhead power lines.


### 7.8 Enclosed Work Spaces

Enclosed workspaces containing exposed energized parts present unique hazards as a result of limited workspace and poor lighting. Appropriate illumination must be provided to enable the employees to work safely and visually locate the exposed parts, their equipment, and themselves. Protective shields, barriers, or insulating materials will be provided and should be used in enclosed workspaces to prevent accidental contact between workers and hazardous parts.

### 7.9 Use of Conducting Objects

When employees are required to work around energized equipment while handling long dimensional conducting objects, at a minimum the following steps will be followed:

- De-energize equipment, if possible.
- Wear insulated boots and gloves.
- Use protective shields, barriers, or insulating materials whenever possible.
- If the objects cannot be moved and installed or worked on safely discontinue work until another, safer approach is available.

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- Employ the buddy system.

### **7.10 Conductive Apparel**

Large metal belt buckles may contribute to accidental electrical contact. Jewelry may also contribute to electrical accidents and should not be worn on job sites where such hazards exist. Whenever there is the potential for conductive articles of jewelry and clothing to come in contact with exposed energized parts, these articles should be removed or rendered nonconductive by covering, wrapping or otherwise insulating the conductive apparel from energized parts. Potentially conductive articles include but are not limited to belt buckles, watch bands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, and metal headgear.

### **7.11 Additional General Safe Work Practices**

The general procedures below shall be implemented, depending on site location, equipment, and work to be performed.

- Site team members should locate and ensure that there will be no adverse contact with overhead utilities prior to positioning or moving any elevated work platform. Drill rigs or other boomed equipment shall not be moved with the mast or boom in the raised position. Except for unloading, dump trucks shall be moved with the beds in the lowered position. Dump trucks, when unloading their contents, should be facing away from overhead utilities or parallel to them so that the truck is not moving toward the overhead lines.
- Boomed equipment shall not be left overnight underneath overhead power lines.
- Equipment shall not be serviced underneath overhead utilities.
- Only non-conductive ladders with non-conductive side rails may be used in areas with potential for contact with electric circuits. Metal ladders shall not be used.
- Electric lines, cables, and extension cords shall be guarded and maintained in good condition.
- All underground power lines should be identified and maintained before any ground-breaking work is performed.
- All temporary electrical equipment used on a project should conform to the NEC, the National Electrical Safety Code, and other site requirements for that specific application. No damaged or defective tools shall be used.
- Extension cords should be used with portable electric tools of the three-wire type, protected from damage, and not fastened with staples, hung from nails, or suspended from wires. Splices should be soldered wire connections with insulation equal to the cable. Worn or frayed cables shall not be used.
- Extension cords shall not be used in lieu of permanent wiring applications.

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- Portable task lights should be equipped with guards. Temporary lights should not be suspended by electric cords unless designed for suspension. Broken or burned out lamps must be replaced immediately.
- Receptacles for attachment plugs of the approved, concealed-contact type should be used. Where different voltages, frequencies, or type of current are supplied, receptacles should be of such design that attachment plugs are not interchangeable.
- Each disconnecting means for motors and appliances and each service feeder or branch circuit should be marked legibly at the point where it originates to indicate its purpose unless such devices are located and arranged so that the purpose is evident.
- Cables passing through work areas should be covered or elevated to protect them from damage. Cables and cords should be kept clear of walkways and other locations where they may be damaged or create tripping hazards.
- Boxes for disconnecting electricity should be secured, rigidly fastened, and fitted with covers.
- Appropriate warning signs should be posted in high-voltage areas, which should also be barricaded.
- Energized wiring in boxes, circuit breaker panels, and similar places should be covered at all times.
- Tetra Tech shall not permit any employee to work near any part of an electric power circuit that the employee could contact in the course of work unless the employee is protected against electric shock by de-energizing the circuit and grounding it, or by guarding it effectively by insulation, barricades, or other means.

## **8.0 OVERHEAD LINES**

The minimum clearances summarized below will be maintained between equipment and energized overhead power lines. Additional distances may be required depending on equipment in use, wind conditions, sway distance of lines and the equipment, and other factors causing changes in the spatial relationship of the equipment and power line. Local regulations, including those of the utility company, may require greater clearances. The more stringent guidelines will be followed.



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<u>Voltage</u>	<u>Working Clearance</u>	<u>Equipment Clearance (feet)</u>
Less than 50 kilovolts (kV)	10 feet	4
50 to less than 345 kV	10 feet, plus 4 inches per extra kV (50 kV or more)	10
345 to 750 kV	10 feet, plus 4 inches per extra kV (50 kV or more)	16

If site activities nearer power lines are required, the lines should be de-energized and grounded by the owner or utility operator, or other protective measures should be provided before work is started. Necessary arrangements to turn off the power will be coordinated by the project manager. If that is not possible, insulating blankets may be used to shield the lines. These must be installed by the utility company. Care must still be taken to avoid damaging the lines, even if they are de-energized or shielded. Protective measures (e.g., guarding or insulating the lines) must be designed to prevent employees from contacting the lines or arcing of the lines to equipment.

Guy wires present additional hazards and will be flagged when they are within the work area. The working distances in the table above will also be used for safe working distances when working near guy wires. Additional precautions are needed when heavy equipment is being moved near guy wires. This will include either barriers to prevent equipment from contacting the wires, or dedicated spotters who will monitor the distances and provide warning to equipment operators.

Electrical service shall be provided by certified electricians in accordance with all applicable local and National Electric Codes (NEC) when high-voltage electrical service is required for site or project activities. Before work begins, Tetra Tech shall ascertain by inquiry, direct observation, or instruments, whether any part of an energized electric power circuit, exposed or concealed, is located so that the performance of work may bring any person, tool, or machine into physical or electrical contact with the electrical power circuit. The location shall be posted wherever such a circuit exists. All employees shall be advised of the location of such lines, the hazards involved, and the protective measures to be taken.

OSHA states that unqualified employees and mechanical equipment must maintain at least 10 horizontal feet distance from overhead lines. If the voltage in the lines is over 50,000 volts, the horizontal distance should be increased by 4 inches for each additional 10,000

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volts. However, Tt requires a minimum of 30 horizontal feet between overhead power lines and equipment.

## 9.0 DEFINITIONS

**Conductor:** A substance, which offers very little resistance to current flow (e.g., a material that allows electrical current to freely pass, such as aluminum ladders.)

**Current:** Measured in amperes or milliamps

**Electromotive Force (EMF):** Measured in volts

**Electric Shock:** Electric shock normally occurs when a person comes in contact with wires of an electric circuit. The body becomes a part of the electric circuit, and the current enters the body at one point and leaves at another.

**Ground-fault Circuit Interrupt (GFCI):** GFCI is a fast-acting circuit breaker that senses small imbalances in the circuit caused by current leakage to ground, and in a fraction of a second shuts off the electricity. The GFCI continually matches the amount of current going to an electrical device against the amount of current returning from the device along the normal electrical path. Whenever the amount "going" differs from the amount "returning" by approximately 5 milliamps, the GFCI interrupts the electric power within as little as 1/40th of a second.

**Insulator:** An insulator is a substance that offers a high resistance to current flow, such as Bakelite, porcelain, pottery, and dry wood.

**Resistance:** Resistance is measured in ohms, and is determined by the nature of the conductor, the length and cross-sectional area of the conductor, and the temperature of the substance.



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**APPENDIX A  
29 CFR 1926-404 (b)  
BRANCH CIRCUITS**

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## 29 CFR 1926-404 (b) – BRANCH CIRCUITS

### 1) Ground-Fault Protection

#### (i) General

The employer shall use either ground-fault circuit interrupters as specified in paragraph (b) (1) (ii) of this section or an assured equipment grounding conductor program as specified in paragraph (b)(1)(iii) of this section to protect employees on construction sites. These requirements are in addition to any other requirements for equipment grounding conductors.


#### (ii) Ground fault circuit interrupters

All 120-volt, single-phase, 15- and 20-ampere receptacle outlets on construction sites that are not part of the permanent wiring of the building or structure and that are in use by employees shall have approved ground-fault circuit interrupters for personnel protection. Receptacles on a two-wire, single-phase portable or vehicle-mounted generator rated not more than 5 Kw, where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces, need not be protected with ground-fault circuit interrupters.

#### (iii) Assured equipment grounding conductor program


The employer shall establish and implement an assured equipment grounding conductor program on construction sites covering all cord sets, receptacles that are not part of the building or structure, and equipment connected by cord and plug that is available for use or used by employees. This program shall comply with the following minimum requirements:

- (A) A written description of the program, including the specific procedures adopted by the employer, shall be available at the job site for inspection and copying by the Assistant Secretary and any affected employee.
- (B) The employer shall designate one or more competent persons to implement the program.
- (C) Each cord set, attachment cap, plug and receptacle of cord sets, and any equipment connected by cord and plug, except cord sets and receptacles which are fixed and not exposed to damage, shall be visually inspected before each day's use for external defects (e.g., deformed or missing pins or insulation damage) and indications of possible internal damage. Equipment found damaged or defective shall not be used until repaired.
- (D) The following tests shall be performed on all cord sets, receptacles that are not part of the permanent wiring of the building or structure, and cord- and plug-connected equipment required to be grounded:
  - 1) All equipment-grounding conductors shall be tested for continuity and shall be electrically continuous.

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- 2) Each receptacle and attachment cap or plug shall be tested for correct attachment of the equipment-grounding conductor. The equipment-grounding conductor shall be connected to its proper terminal.
- (E) All required tests shall be performed:
- 1) Before first use,
  - 2) Before equipment is returned to service following any repairs,
  - 3) Before equipment is used after any incident that can be reasonably suspected to have caused damage (e.g., when a cord set is run over),
  - 4) At intervals not to exceed three months. Cord sets and receptacles that are fixed and not exposed to damage shall be tested at intervals not exceeding six months.
- (F) The employer shall not make available or permit the use by employees of any equipment that has not met the requirements of this paragraph (b)(1)(iii) of this section.
- (G) Tests performed as required in this paragraph shall be recorded. This test record shall identify each receptacle, cord set, and cord- and plug-connected equipment that passed the test and shall indicate the last date it was tested or the interval for which it was tested. This record shall be kept by means of logs, color-coding, or other effective means and shall be maintained until replaced by a more current record. The record shall be made available on the job-site for inspection by the Assistant Secretary and any affected employee.

Revision Date	Document Authorizer	Revision Details
11/4/2013	Chris McClain	ISN Required Updates

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## 1.0 INTRODUCTION

This safe work practice (SWP) addresses situations during which heat illness is likely to occur and provides procedures for preventing and treating heat-related injuries and illnesses. This SWP is applicable to all Tetra Tech employees performing outdoor activities at both domestic and international project locations. This SWP incorporates safety regulations of the States of California and Washington to protect outdoor workers from heat-related illness. An “outdoor place” is an open area such as an agricultural field, forest, park, equipment and storage yard, outdoor utility installation, tarmac, and road. An outdoor workplace also can include a construction site at which no building shell has been completed, and areas of a construction site outside of any building shells that may be present.

Many factors contribute to heat illness and UV exposure, including personal protective equipment (PPE), ambient temperature and humidity, workload, sun exposure, and the physical condition of the employee, as well as predisposing medical conditions. However, the primary factors of heat illness are elevated ambient temperatures in combination with fluid loss. Because heat illness is one of the more common health concerns during field activities, employees must be familiar with the signs, symptoms, and various treatment methods of each form of heat illness. Health effects from heat illness may range from transient heat fatigue or rashes to serious illness or death. Tracking the weather is imperative during outdoor field projects because heat-related illness and fatalities occur primarily during heat waves.


## 2.0 Definitions

The following are typical terms and definitions associated with heat illness prevention and monitoring activities:

**Acclimatization** – Gradual adaptation of the body to work under temperature conditions to which it is exposed. Acclimatization peaks in most people within 4 to 14 days of regular work taking up at least 2 hours per day in the heat.

**Ambient Temperature** – Temperature of the surroundings.

**Electrolytic Sports Drink** – A beverage containing sodium and potassium salts that replenish the body’s water and electrolyte levels after dehydration caused by physical activity.

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**Environmental Risk Factors for Heat Illness** – Working conditions under which heat illness could occur. Environmental risk factors include air temperature, relative humidity, radiant heat from the sun and other sources, conductive heat sources such as the ground, air movement (or lack of), workload severity and duration, and protective clothing and PPE worn by employees.

**Heat Illness** – A serious medical condition resulting from the body’s inability to cope with a particular heat load. Symptoms include heat cramps, heat exhaustion, and heat stroke (see Table 1).

**Heat Index** – An index that combines air temperature and relative humidity to indicate the human-perceived equivalent temperature (i.e., how hot it feels outdoors).

**Heavy Work** – Digging/hand-auguring, heavy lifting, cutting trees, using heavy hand tools, and similar tasks.

**Light Work** – Walking, writing notes, handling samples, and similar tasks.


**Medium Work** – Bailing wells, moving light equipment, driving nails, and similar tasks.

**Personal Risk Factors for Heat Illness** – Factors such as an individual’s age, degree of acclimatization, health, water consumption, alcohol consumption, caffeine consumption, and use of prescription medications that affect the body’s water retention or other physiological responses to heat.

**Preventive Recovery Period** – Period of time needed to recover from the heat in order to prevent heat illness.

**Relative Humidity** – The amount of water vapor that exists in a gaseous mixture of air and water vapor.

**Shade** – Blockage of direct sunlight. Canopies, umbrellas, and other temporary structures or devices may be used to provide shade. One indicator that blockage is sufficient is absence of a shadow of an object within the area of blocked sunlight. Shade is not adequate when heat in the area of shade defeats the purpose of shade, which is to allow the body to cool. For example, a

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car sitting in the sun does not provide acceptable shade to a person inside it unless the car is running with air conditioning.

**Wet Bulb Globe Temperature (WBGT)** - a measurement used to indicate heat stress. WBGT takes into account the effects of humidity


### 3.0 Employee Duties and Responsibilities

Written procedures help Project Managers (PM), Site Safety Coordinators (SSC), and field team members reduce the risk of heat-related illnesses, and ensure that emergency assistance is provided without delay to all Tetra Tech employees. The following are the duties and responsibilities of the Project Team for implementing and managing the Heat Illness Prevention and Monitoring SWP.

#### 3.1 Project Management

The PM must understand and agree to the responsibility for implementing this SWP for worker safety. The PM will assure that all employees at the work site comply with this SWP.

- The PM must designate an appropriate field team member to serve as the SSC who will implement this SWP and who will perform and document necessary monitoring requirements for worker safety.
- The PM will ensure necessary resources required to implement this SWP and necessary monitoring resources for worker safety are acquired and present at the work site prior to initiation of project activities in hot environments.
- The PM will work with the Director of Health and Safety and identify at risk employees.
- The PM will ensure all field team members are trained in heat illness management and emergency response procedures prior to working outdoors.
- The PM and SSC will modify working hours to schedule work during the cooler hours of the day, when possible. When a modified or shorter work-shift is not possible, more water and rest breaks shall be provided.

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- The PM and SSC will verify that the elements of this SWP are documented in the Health and Safety Plan, as necessary.

### 3.2 Site Safety Coordinator

- The SSC must understand and agree to the responsibility for implementing this SWP in the field, and implement the necessary monitoring requirements for worker safety during outdoor activities.
- The SSC must have appropriate Occupational Safety and Health Administration (OSHA)-related training and experience to understand and implement this SWP, and to ensure required monitoring for worker safety during outdoor activities.
- The SSC must ensure that resources needed to implement this SWP and required monitoring for worker safety are acquired and present at the work site prior to initiation of project activities in hot environments.
- The SSC must maintain all necessary resources required under the SWP during project activities in hot environments.
- The SSC must ensure implementation and appropriate documentation of required monitoring for worker safety during site activities.
- The SSC must be familiar with and continuously monitor all employees, and must remain alert for onset of heat-related symptoms.
- The SSC and co-workers are encouraged never to discount any signs or symptoms of heat-related illness shown by one or more project team members, and to immediately report these signs or symptoms.
- The SSC will carry a cell phone or other means of communication to ensure that emergency services can be contacted, and will verify that these resources are functional at the worksite prior to each shift.

### 3.3 Field Team

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- The field team will be able to recognize the hazards of working in warm environments.
- Co-workers will use a “buddy system” to monitor each other closely for discomfort or symptoms of heat illness.
- Every morning, workers must attend a daily tailgate safety meeting to be reminded of site-specific emergency procedures.
- A copy of site specific heat illness procedures shall be available for employee review.

## **4.0 Description and Requirements**

### **4.1 Effects of Hot Weather**


As the environment heats up, the body tends to warm up as well. The body’s internal thermostat maintains a constant temperature by pumping more blood to the skin, which is cooled by evaporation from increasing perspiration production. In this way, the body increases the rate of heat loss to balance the heat burden created by a hot environment. Such situations generally do not cause harm, as long as the body is allowed to adjust to cope with the increasing heat.

In a very hot environment, however, the rate of heat gain exceeds the rate of heat loss. In this situation, the body’s coping mechanisms can be overwhelmed, resulting in heat illness and leading to a range of serious and possibly fatal conditions.

### **4.2 Preparation for Hot Weather Work**

The following list describes the process for preparing to work in hot weather conditions:


- Identify work that can pose a risk of heat stress and Ultraviolet (UV) exposure.
- Identify at-risk employees.
- Identify possible controls:
  - Establish controls for hot weather situations

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- Determine mandatory work and rest regimens based on current conditions, workload, clothing requirements, temperature and humidity for Threshold Limit Value (TLV).
- Identify required fluid and food replacement schedules.
- Provide a location to cool down during breaks.
- Establish requirements to address UV exposure.
- Monitor workers in extreme heat conditions.
- Establish emergency response procedures to be followed for heat-related emergency situations.
- Provide for first aid and establish the requirement that first aid be administered immediately to employees displaying symptoms of heat-related illness.
- Provide training to employees and verify training records about site legal and regulatory requirements and about the characteristics and effects of heat stress and the recognition and prevention of heat-related injuries (See Table 1).

## 5.0 Employee Training


Training is an important component of heat illness prevention. Employees are instructed to recognize and treat heat-related illnesses during 8-hour health and safety refresher and first aid training courses. The conditions, symptoms, and treatment for heat-related illnesses are listed below in Table 1.

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**TABLE 1**  
**HEAT ILLNESS CONDITIONS**

Condition	Causes	Signs and Symptoms	Treatment
Heat cramps	Fluid loss and electrolyte imbalance from dehydration	<ul style="list-style-type: none"> <li>Painful muscle cramps, especially in legs and abdomen</li> <li>Faintness</li> <li>Profuse perspiration</li> </ul>	<ul style="list-style-type: none"> <li>Move affected worker to cool location</li> <li>Provide sips of liquid such as Gatorade®</li> <li>Stretch cramped muscles</li> <li>Transport affected worker to hospital if condition worsens</li> </ul>
Heat Exhaustion	Blood transport to skin to dissipate excessive body heat, resulting in blood pooling in the skin with inadequate return to the heart	<ul style="list-style-type: none"> <li>Weak pulse</li> <li>Rapid and shallow breathing</li> <li>General weakness</li> <li>Pale, clammy skin</li> <li>Profuse perspiration</li> <li>Dizziness</li> <li>Unconsciousness</li> </ul>	<ul style="list-style-type: none"> <li>Move affected worker to cool area</li> <li>Remove as much clothing as possible</li> <li>Provide sips of cool liquid or Gatorade® (only if conscious)</li> <li>Fan the person but do not overcool or chill</li> <li>Treat for shock</li> <li>Transport to hospital if condition worsens</li> </ul>
Heat Stroke**	Life threatening condition from profound disturbance of body's heat-regulating mechanism	<ul style="list-style-type: none"> <li>Dry, hot, and flushed skin</li> <li>Constricted pupils</li> <li>Early loss of consciousness</li> <li>Rapid pulse</li> <li>Deep breathing at first, and then shallow breathing</li> <li>Muscle twitching leading to convulsions</li> <li>Body temperature reaching 105 or 106 degrees Fahrenheit (°F) or higher</li> </ul>	<ul style="list-style-type: none"> <li>Immediately transport victim to medical facility</li> <li>Move victim to cool area</li> <li>Remove as much clothing as possible</li> <li>Reduce body heat promptly by dousing with water or wrapping in wet cloth</li> <li>Place ice packs under arms, around neck, at ankles, and wherever blood vessels are close to skin surface</li> <li>Protect patient during convulsions</li> </ul>

**\*\* Any of these symptoms require immediate attention. If heat stroke is suspected, emergency medical personnel should be immediately contacted and on-site first aid provided.**

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Employee training procedures include, but are not limited to, the following:

- All employees (including and especially newly hired employees) will receive heat illness prevention training prior to working outdoors.
- SSCs will hold short tailgate meetings daily to review important heat illness and prevention information with all field team members.
- All workers will be assigned a “buddy” or experienced coworker to ensure that they understood the training and follow the company procedures.
- PMs and SSCs will be trained before assignment to supervise outdoor workers.

## **6.0 Heat Illness Prevention and Monitoring Requirements**


### **6.1 Identification of Work Conditions**

Hot weather is a condition that will be encountered during Tetra Tech operations. When work takes place outdoors during warm weather, working conditions shall be identified for both heat stress conditions and UV exposure.

### **6.2 Heat Index**

The Heat Index (HI) can be used as a first indicator of thermal comfort. The HI can be obtained by directly measuring the dry bulb temperature and relative humidity. The dry bulb temperature and relative humidity forecast can be obtained by checking the local weather station information or measured by using a wet bulb thermometer. A direct reading of HI can be obtained by placing a heat stress monitor in full shade at the workplace.

The HI does not take into account acclimation, clothing or nature of work; therefore, if the HI is at 80°F (26.7°C) or above, further evaluation is required to adjust workload and clothing.

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### 6.3 Heat Exposure Limits and Measurement

The TLV is a means of providing heat exposure limits and gauging potential heat impacts. To determine the TLV, the Wet Bulb Globe Temperature (WBGT) index is measured. The WBGT is calculated using a formula that takes into account air temperature, speed of air movement, radiant heat from hot objects, sunshine and body cooling due to sweat evaporation. WBGT direct reading meters, often called 'heat stress analyzers,' are also available. These meters give direct WBGT readings; no calculations are necessary.

A trained person shall take WBGT measurements. If a WBGT direct reading meter is not available, two different methods are used to calculate WBGT in the workplace: one for workplaces with direct sunlight, and the other for workplaces without direct sunlight. In addition, when conditions of the workplace fluctuate widely, time-weighted WBGT is often used. The WBGT calculation is used in determining heat stress exposure guidelines and heat stress and clothing guidelines. Table 2 presents approximate WBGT values.



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Dry Bulb Temperature		APPROXIMATE WBGT VALUE (°F) TABLE																			
		Relative Humidity																			
		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
18.33	65	59	59	60	61	62	62	63	64	64	65	66	67	67	68	69	70	70	71	72	73
18.89	66	59	60	61	61	62	63	64	65	65	66	67	68	68	69	70	71	71	72	73	74
19.44	67	60	61	61	62	63	64	65	65	66	67	68	69	69	70	71	72	72	73	74	75
20.00	68	60	61	62	63	64	64	65	66	67	68	69	69	70	71	72	73	74	74	75	76
20.56	69	61	62	63	63	64	65	66	67	68	69	69	70	71	72	73	74	75	75	76	77
21.11	70	62	62	63	64	65	66	67	68	69	69	70	71	72	73	74	75	76	77	77	78
21.67	71	62	63	64	65	66	67	68	69	69	70	71	72	73	74	75	76	77	78	79	79
22.22	72	63	64	65	66	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
22.78	73	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
23.33	74	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83
23.89	75	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
24.44	76	65	66	67	68	69	71	72	73	74	75	76	77	78	79	80	81	82	83	85	86
25.00	77	66	67	68	69	70	71	72	74	75	76	77	78	79	80	81	82	84	85	86	87
25.56	78	66	67	69	70	71	72	73	74	76	77	78	79	80	81	82	84	85	86	87	88
26.11	79	67	68	69	71	72	73	74	75	76	78	79	80	81	82	84	85	86	87	88	90
26.67	80	68	69	70	71	72	74	75	76	77	79	80	81	82	84	85	86	87	88	90	91
27.22	81	68	69	71	72	73	75	76	77	78	80	81	82	83	85	86	87	89	90	91	92
27.78	82	69	70	71	73	74	75	77	78	79	81	82	83	85	86	87	88	90	91	92	94
28.33	83	69	71	72	73	75	76	78	79	80	82	83	84	86	87	88	90	91	92	94	95
28.89	84	70	71	73	74	76	77	78	80	81	83	84	85	87	88	90	91	92	94	95	97
29.44	85	71	72	73	75	76	78	79	81	82	84	85	87	88	89	91	92	94	95	97	98
30.00	86	71	73	74	76	77	79	80	82	83	85	86	88	89	91	92	94	95	97	98	100
30.56	87	72	73	75	76	78	80	81	83	84	86	87	89	90	92	93	95	97	98	100	101
31.11	88	72	74	76	77	79	80	82	84	85	87	88	90	92	93	95	96	98	100	101	103
31.67	89	73	75	76	78	80	81	83	85	86	88	90	91	93	94	96	98	99	101	103	104
32.22	90	74	75	77	79	80	82	84	86	87	89	91	92	94	96	97	99	101	103	104	106
32.78	91	74	76	78	80	81	83	85	87	88	90	92	94	95	97	99	101	102	104	106	108
33.33	92	75	77	79	80	82	84	86	88	89	91	93	95	97	98	100	102	104	106	107	109
33.89	93	76	77	79	81	83	85	87	89	90	92	94	96	98	100	102	103	105	107	109	111
34.44	94	76	78	80	82	84	86	88	90	92	93	95	97	99	101	103	105	107	109	111	113
35.00	95	77	79	81	83	85	87	89	91	93	95	97	99	101	103	105	107	108	110	112	114
35.56	96	77	79	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116
36.11	97	78	80	82	84	86	89	91	93	95	97	99	101	103	105	108	110	112	114	116	118
36.67	98	79	81	83	85	87	90	92	94	96	98	100	103	105	107	109	111	113	116	118	120
37.22	99	79	82	84	86	88	91	93	95	97	99	102	104	106	108	111	113	115	117	120	122
37.78	100	80	82	85	87	89	91	94	96	98	101	103	105	108	110	112	115	117	119	121	124
38.33	101	81	83	85	88	90	92	95	97	100	102	104	107	109	111	114	116	119	121	123	126
38.89	102	81	84	86	89	91	93	96	98	101	103	106	108	111	113	116	118	120	123	125	128
39.44	103	82	84	87	89	92	94	97	100	102	105	107	110	112	115	117	120	122	125	127	130
40.00	104	83	85	88	90	93	96	98	101	103	106	108	111	114	116	119	121	124	127	129	132
40.56	105	83	86	89	91	94	97	99	102	105	107	110	113	115	118	121	123	126	129	131	134
41.11	106	84	87	89	92	95	98	100	103	106	109	111	114	117	120	122	125	128	131	133	136
41.67	107	84	87	90	93	96	99	101	104	107	110	113	116	119	121	124	127	130	133	136	138
42.22	108	85	88	91	94	97	100	103	106	108	111	114	117	120	123	126	129	132	135	138	141
42.78	109	86	89	92	95	98	101	104	107	110	113	116	119	122	125	128	131	134	137	140	143
43.33	110	86	90	93	96	99	102	105	108	111	114	117	120	124	127	130	133	136	139	142	145
43.89	111	87	90	93	97	100	103	106	109	113	116	119	122	125	128	132	135	138	141	144	148
44.44	112	88	91	94	98	101	104	107	111	114	117	121	124	127	130	134	137	140	143	147	150
45.00	113	88	92	95	99	102	105	109	112	115	119	122	126	129	132	136	139	142	146	149	153
45.56	114	89	93	96	99	103	106	110	113	117	120	124	127	131	134	138	141	145	148	152	155
46.11	115	90	93	97	100	104	108	111	115	118	122	125	129	133	136	140	143	147	150	154	158
46.67	116	90	94	98	101	105	109	112	116	120	123	127	131	134	138	142	146	149	153	157	160
47.22	117	91	95	99	102	106	110	114	118	121	125	129	133	136	140	144	148	152	155	159	163
47.78	118	92	96	100	103	107	111	115	119	123	127	131	134	138	142	146	150	154	158	162	166
48.33	119	92	96	100	104	108	112	116	120	124	128	132	136	140	144	148	152	156	160	164	168
48.89	120	93	97	101	105	110	114	118	122	126	130	134	138	142	147	151	155	159	163	167	171

**Notes:** Calculated values assume outdoor work in full sun, with a light (<5 mph) wind.  
WBGT of green-shaded cells is less than dry-bulb temperature.

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## 6.4 Heat Stress Exposure Guidelines

Heat stress exposure guidelines recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) are shown in Table 3: ACGIH Screening Criteria for Heat Stress Exposure. This table is used to determine the allocation of work in a work/rest cycle, which is dependent on the type of work and WBGT values.

**Table 3: ACGIH Screening Criteria for Heat Stress Exposure**

PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUE															
Clothing Type	Summer Lightweight			Cotton Coveralls			Winter Work			Permeable Water Barrier (Tyvek)			Fully-Encapsulating Suit (Level 4)		
Work Load	Light	Moderate	Heavy	Light	Moderate	Heavy	Light	Moderate	Heavy	Light	Moderate	Heavy	Light	Moderate	Heavy
Work/Rest Schedule / WBGT	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)
Continuous Work	86	80	77	82	76	73	79	73	70	75	69	66	68	62	59
75% Work, 25% Rest / Hr	87	82	79	83	79	75	80	75	71	76	72	68	69	64	61
50% Work, 50% Rest / Hr	89	85	82	85	81	79	81	78	75	78	74	71	71	67	64
25% Work, 75% Rest / Hr	90	88	86	86	84	82	83	81	79	79	77	75	72	70	68
<b>Notes:</b> Temperature is approximate WBGT from accompanying tables, based on outdoor work, temperature, and relative humidity measurement during work activities. Light Work includes walking, writing notes, handling samples, and similar activities (metabolic rate up to 200 kilocalories [kcal]/hour). Medium Work includes bailing wells, moving light equipment, driving nails, and similar tasks (metabolic rate of 200-350 kcal/hour). Heavy Work is digging, heavy lifting, cutting trees, using heavy hand tools, and similar tasks (metabolic rate above 350 kcal/hour).															

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Table 3 is based on five-day work weeks and eight-hour work days with conventional breaks. Conventional breaks include a 15-minute break in a four-hour period and a half-hour lunch in an eight-hour period. The ACGIH exposure limits are intended to protect most workers from heat-related illnesses. The limits are higher than that if they had been developed to prevent discomfort. A safety factor should be used to protect sensitive individuals or increase comfort. Examples to clarify work load intensity:


- Rest: sitting (quietly or with moderate arm movements).
- Light work: sitting or standing to control machines, performing light hand or arm work (e.g., using a table saw), occasional walking, driving.
- Moderate work: walking about with moderate lifting and pushing or pulling, walking at a moderate pace, scrubbing in a standing position.
- Heavy work: digging, carrying, pushing/pulling heavy loads, walking at a fast pace, pick and shovel work, carpenter sawing by hand.
- Very heavy: very intense activity at a fast to maximum pace (e.g., shoveling wet sand).

For example, in order to minimize heat stress exposure, an employee who is acclimated and is performing heavy work such as shoveling dirt in a temperature of 78°F (25.6°C), would fall into a work/rest regimen of 100% work.

TLVs assume that workers who are exposed to these conditions are adequately hydrated, are not taking medication, are wearing lightweight clothing and are in generally good health. When the WBGT is at a temperature that exceeds the TLV, 'Stop Work' should be enforced.

## 6.5 Heat Stress and Clothing Guidelines

The exposure limit should be adjusted for workers wearing heavy clothing. ACGIH recommendations for these conditions are listed in Table 4: Correction of TLV for Clothing.

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**Table 4: Correction of TLV for Clothing**

<b>Clothing Type</b>	<b>WBGT Correction (in °F [°C])</b>
Work Clothes (long-sleeved shirts and pants)	0 (0)
Cloth coveralls (woven material)	+3 (0)
Spunbonded Meltdown Spunbonded polypropylene coveralls	+6 (+0.5)
Polyolefin coveralls	+8 (+1)
Double-layer woven clothing	+9 (+3)
Limited-use vapor-barrier coveralls	+18 (+11)

For example, an acclimated worker wearing double-layer woven clothing doing moderate work in 30°C would have a corrected exposure level of  $30 + 3 = 33^{\circ}\text{C}$  (91.4°F). This would lower the allowable exposure to 0-25% work from 25-50% work.


For Fire Retardant Clothing (FRC), there is no WBGT correction. FRC can be obtained in various weight materials. The lightest weight FRC should be worn during work in warm environments. No second layer of clothing should be worn except for cotton undergarments.

These values are not to be used for completely encapsulating suits. The assumption is that coveralls are worn with only modest clothing underneath, not a second layer of clothing.

## **6.6 Identifying At-risk Employees**

A screening program for identifying at risk employees shall include identification of health conditions that are aggravated by extreme environmental temperatures. How a person functions under conditions of heat stress will be unique that person and will depend on:

- Age.
- Weight.
- Metabolism.
- Alcohol or drug use.
- Pre-existing medical conditions.

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- Level of physical fitness.
- Use of medications.
- Individual sensitivity to heat.
- Possibility of hypertension.

Note: Employees with any ‘at-risk’ conditions shall have more stringent work/rest regimens or controls

## **6.7 Health and Safety Controls**

Controls shall be based on a risk assessment approach. Conditions and available controls will vary from site to site. Therefore, the HASP shall define and document the site specific control plan. Controls shall be appropriate for the risks that are associated with heat hazards.

### **6.7.1 Acclimation**

The human body can adapt to heat exposure to some extent. This physiological adaptation is called acclimation. Acclimation is a response by the body that results in increased heat tolerance.


People differ in their ability to acclimate to heat. Usually, acclimation is obtained in four to five days. However, it is lost in approximately the same amount of time. After a period of acclimation, the same activity will produce fewer cardiovascular demands. The worker will perspire more efficiently, leading to better evaporative cooling, and thus will more easily be able to maintain normal body temperatures.

All site workers who could be exposed to hot weather conditions shall be acclimated or go through an acclimation process, as necessary. Where workers are already acclimated, no acclimation process is necessary. A previously acclimated person is someone who has already been in similar working and heat conditions.

### **6.7.2 Fluid and Nutrient Replacement**

Cool (50°-60°F [10°-15°C]) water or other cool liquid, except alcoholic beverages, should be made available to workers.


#### Provision of Water (Not Temperature Dependent)

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Water is the principal preventive measure to minimize the risk of heat-related illnesses. Tetra Tech employees shall have access to potable drinking water (or electrolytic sports drink). Where the supply of water is not plumbed or otherwise continuously supplied, water shall be provided in sufficient quantity at the beginning of the work shift to provide **1 quart per employee per hour for drinking for the entire shift**. Frequent drinking of water shall be encouraged by the SSC. Water provision requirements include the following:

- At least 2 quarts of water per employee will be available at the start of the shift.
- The SSC will monitor water containers every 30 minutes, and employees are encouraged to report low levels or dirty water to the SSC when observed.
- The SSC will provide reminders to the field team members to drink frequently, and more water breaks will be provided as needed.
- During the daily tailgate safety meeting each morning, the SSC will remind the field team about the importance of frequent water consumption throughout the shift.
- Water containers will be placed as close to the workers as safety conditions allow.
- When drinking water levels within a container drop below 50%, the water shall be replenished immediately.
- If a common water source is used, disposable/single-use drinking cups will be provided to employees each day.
- Communication devices such as radios, cell phones, or air horns may be used to remind field team members to take water breaks.

Although some commercial replacement drinks contain salt, this is not necessary for acclimated people, because most people have enough salt in their normal diets. Commercial replacement drinks contain high amounts of sugar and may contribute to an individual's inability to cope with the warm environment. If used, commercial replacement drinks should not be used at full strength and should be diluted with water on at least a one-to-one ratio.

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Energy drinks shall not be used while working in warm environments.

Poor nutrition, over eating and under eating are factors contributing to heat stress. During hot conditions, employees should eat small, regular meals.

### 6.7.3 Additional Control Measures


Outdoor workers are exposed to not only potential heat illness, but also UV radiation. Long-term exposure to UV radiation poses additional risks and can lead to a variety of skin disorders, including skin cancer and cataracts of the eyes.

Protection from UV exposure, sunscreen and appropriate eye protection should be considered in addition to the additional controls listed below:

#### Access to Shade (Not Temperature-Dependent)

Access to rest and shade or other cooling measures are important preventative steps to minimize the risk of heat-related illnesses and exposure to UV radiation. Tetra Tech employees suffering working in extreme temperatures for any period of time shall be provided access to an area with shade that is either open to the air or provided with ventilation or cooling. Such access to shade shall be permitted at all times. Procedures for the provision of shade include the following:

- SSC will set up an adequate number of shaded areas as needed. Examples of shaded areas include vehicles with air conditioning, umbrellas, canopies, or other portable devices. Shading should be placed in close proximity to the work activity (no more than 50-100 yards away, or at the closest location safety conditions allow).
- Employees should have access to an office, construction trailer, or other places with air conditioning.
- Every morning a short tailgate meeting will occur to remind workers about the importance of rest breaks and the location of shade.

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- Other cooling measures may be used **if (and only if)** these can be deemed effective as shade.
- As safety conditions allow, SSCs shall provide areas for employee breaks that are:
  - Readily accessible
  - In the shade, open to air, and ventilated
  - Near sufficient supplies of drinking water

## 7.0 Heat Illness Monitoring

A medical monitoring program shall be planned with the assistance of a medical or industrial hygiene professional. The monitoring program shall specify the leading indicators to be used (e.g. heart rate, body temperature, blood pressure, respiration rate, and other) and frequency of measurement.

Heat illness monitoring will be conducted by the SSC or his/her designee when work conditions warrant implementation of a work/rest schedule based on temperature conditions and PPE requirements associated with project activities. Monitoring will be conducted as follows:

- 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 without changing the rest period.
  - If the heart rate still exceeds 110 beats per minute at the next period, shorten the following work cycle by one-third.
- Body Temperature: If body temperature exceeds 99.6 degrees Fahrenheit (°F) (37.6 degrees Celsius [°C]), shorten the next work cycle by one-third without changing the rest period. If body 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 body temperature exceeds 100.6 °F (38.1 °C). Use any of the following thermometers:

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- Oral Thermometer – Use a clinical thermometer (3 minutes under the tongue) to measure the oral temperature at the end of the work period.
- Tympanic (ear) Thermometer
- Temporal (swipe) Thermometer


The SSC will document throughout the entire work shift results of heat illness monitoring for each team member participating in work activities.

## 8.0 EXTREME CONDITIONS

### Extra Measures During Heat Waves

Extreme environmental conditions during a heat wave can cause an employee's physical and mental conditions to change rapidly into a serious medical condition. Workers previously fully acclimatized are at risk for heat illness during a heat wave because during a heat wave, the body does not have enough time to adjust to a sudden, abnormally high temperature or other extreme conditions. The onset of heat illness may be confused with other problems and may not always be obvious before it becomes life-threatening. Therefore, the following extra measures may be required to prevent and/or respond to heat illness during heat waves or when temperatures exceed 95 degrees Fahrenheit.

- **Alertness to the Weather** – Make sure to monitor the weather and the specific locations where work activities are occurring. Continue to stay updated throughout the work shift on the changing air temperatures and other environmental factors.  
Use current weather information to make the appropriate adjustments in work activities throughout the workday.
- **Extra Vigilance** – Apply real-time communication and the “Buddy System” to account for the whereabouts of employees at more frequent intervals throughout the work shift and at the end of the work shift.
- **Additional Water Consumption** – Encourage employees to drink small quantities of water more frequently, and have effective replenishment measures in place for provision of extra drinking water to ensure available supplies.

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- **Additional Cooling Measures** – Other alternative cooling measures may be necessary in addition to shade (e.g., allowing employees to spend time in air conditioned places or having them spray themselves with water).
- **Additional and/or Longer Rest Breaks** – Allowing employees to take more frequent and longer breaks may be necessary.
- **Change of Work Scheduling and Assignments** – One or more of the following additional measures may be necessary:
  - Start the work shift earlier in the day or later in the evening.
  - Cut work shifts short or stop work altogether.
  - Bring in more personnel to accommodate longer, more frequent breaks as necessary to meet production requirements.
  - Reduce the severity of work by scheduling slower paced, less physically demanding work during the hot parts of the day, and the heaviest work activities during the cooler parts of the day (early morning or evening).

## 9.0 Establish Emergency Response

Specific procedures to be followed for heat related emergency response shall be established and documented in the HASP.

## 10.0 Variation to the Heat Illness Prevention and Monitoring Program


Before deviation from the requirements of this document, a designated manager shall authorize the variation. The exception process does not need to be followed for variations that impose more stringent requirements than those outlined in this document.

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## 11.0 Disclaimer

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Revision Date	Document Authorizer		Revision Details
	Name	Approval Date	
4/27/2011	Chris McClain	4/27/2011	Update from 1998 format

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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.


## 1.0 Training

Training is an essential component of cold stress prevention. Employees are taught to identify and treat cold-related injuries during various mandatory training events such as, but not limited to, the 8-hour HAZWOPER refresher, site-specific training, tailgate meetings, and first aid training courses.

## 2.0 Cold stress assessment

If a worker is or may be exposed to cold stress conditions, employees should conduct a cold stress assessment to determine the potential for hazardous exposure of workers. The first step in a cold stress assessment is to determine the areas, occupations, or tasks that place workers at risk of hypothermia or cold-related injuries. Consider factors such as the following:

- Areas with an equivalent chill temperature (ECT) below 19.4 °F (see below)
- Fine dexterity tasks that require work with bare hands
- Contact with metal surfaces or use of evaporative liquids (gasoline, alcohol, or cleaning liquids)
- Working on or near bodies of water

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- Areas about which employees have expressed concern

Once the areas or tasks that should be monitored are determined, the risk of developing hypothermia or a cold-related injury should then be evaluated. A cold stress assessment shall include determining the air temperature (below 45°F) and wind speed (to determine the "equivalent wind chill temperature"). This information is available by obtaining weather, temperature, and wind information from a local weather source, or if there is a monitoring station close to the area in which the work is to be conducted. The site safety officer (SSO) shall check temperature, wind speed, and the conditions of the worker every hour to determine appropriate controls.

Wind chill is a concern when the equivalent chill temperature is less than 19.4°F (See Table 1). The conditions when this occurs are:


- The air is calm and the temperature falls below 19.4°F
- The wind speed is 5 mph or greater and the air temperature is 23°F
- The wind speed is 10 mph or greater and the air temperature is 32°F
- The wind speed is 20 mph or greater and the air temperature is 41°F

As part of the risk assessment, the potential for worker exposure to artificially generated air velocities should also be considered, for example when working in walk-in refrigerators and freezers, when riding all-terrain vehicles or snowmobiles, or when exposed to helicopter rotor downwash.

A general assessment of contact cooling for exposed skin, particularly the hands, should consider the following when workers are in contact with metal:

- Below 59°F - Prolonged contact may impair dexterity.
- Below 44°F - Prolonged contact may induce numbness.
- Below 32°F - Prolonged contact may induce frostnip or frostbite.
- Below 19.4°F - Brief contact with may induce frostnip or frostbite.

For materials other than metal, such as plastics and wood, the temperatures will be lower than those noted above since they are less conductive than metal. Contact with metal or other like-conductive materials should be avoided if possible. Any contact with liquids at subzero temperature is also of concern and should be avoided if possible.

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Workers should be provided with gloves or other method of warming the hands when the air temperature is below:

- 61°F for sedentary work
- 39°F for light work
- 19.4°F for moderate work

### **3.0 Cold Exposure Control Plan**

If a worker is or may be exposed to cold stress conditions, the employer shall assign a buddy system and develop and implement a cold exposure control plan on site. Some specific components of the cold exposure control plan, as they relate to education and training of workers are described below.


#### **3.1 Control Plan Education and training**

This element should contain initial and ongoing training and education that will be provided to all workers who work in areas where there is a reasonable likelihood of exposure to conditions that could cause cold stress.

The training and education material provided to workers who have not previously worked in a cold stress environment should include the following information:

- Recognition of the signs and symptoms of impending hypothermia or excessive cooling of the body even when shivering does not occur
- Recognition of impending frostbite
- Proper re-warming procedures and appropriate first aid treatment
- Proper use of clothing
- Proper eating and drinking practices
- Safe work practices appropriate to the work that is to be performed

As previously noted, those workers exposed to cold-stress environments, Tetra Tech provides refresher training and education to ensure that workers remain knowledgeable about the above-mentioned items.

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### 3.2 Engineering controls

Tetra Tech reduces the exposure hazard of workers to thermal conditions that could cause cold stress or injury using a hierarchy of control methods: engineering controls, followed by administrative controls and, as a last resort, personal protective equipment.

Here are some examples of engineering controls Tetra Tech uses to reduce cold exposure:


- Isolate the worker from the environment, where possible.
- Use local heating for the body and especially bare hands. This may include the use of warm air jets, radiant heaters, or contact warming plates.
- Provide barricades or other structures to block air or reduce air velocities at the work location.
- Provide a designated shelter to warm up during breaks.
  - At extreme temperatures employees will be directed to the warm shelters at regular intervals, or anytime cold stress signs or symptoms develop.
  - The shelter will be the designated area to change into dry clothing
- Provide heated metal tools and equipment handles or cover them with thermal insulating materials.
- Use machine controls and tools designed so that workers do not have to remove mittens or gloves to use them.

### 3.3 Administrative controls

If the above action is not practicable, Tetra Tech will reduce the exposure hazard by providing effective administrative controls to reduce the exposure hazard of workers to thermal conditions that could cause cold stress or injury.


Several administrative controls Tetra Tech commonly uses to reduce worker exposure to cold stress are described below:

- Work/warm-up schedules
  - A work/warm-up schedule (see Table 3) refers to the period a worker spends working in a cold environment and the time spent in a warm area.
  - Worker acclimatization should be a major factor in determining work/rest schedules for extreme cold (ECT of 10°F or less)

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- Scheduling and organization of work – Tetra Tech will schedule tasks so as to minimize the length of time of exposure and to maximize the temperatures to which workers may be exposed. For example:
  - Schedule tasks for the warmest part of the day or when the wind is the most calm.
  - Minimize standing or sitting still for long periods in cold conditions (ECT of 10°F or less).
  - Identify employees with conditions and risk factors which could contribute to cold stress
    - Require more frequent work/warm up schedule, mandatory insulated clothing, and establish a “buddy system”.
    - These individuals shall be excluded from work in temperatures of 30°F or below.
  - Schedule routine maintenance and repair work for warmer seasons of the year.
  - Postpone non-urgent tasks when equivalent chill temperatures are in the "great danger" portion of the "Cooling Power of Wind" ACGIH table (Table 1).
  - Take the equivalent chill temperature (Table 1) into account when planning or scheduling work activities.
  - Warm shelters are made available when work is performed continuously in cold weather with an ECT at or below 20 °F
- Fluid replacement and diet
  - An ample supply of warm drinks and/or soup should be available, and workers encouraged to drink them in order to replace fluids lost through breathing and perspiration.
  - Workers should restrict their intake of coffee because of diuretic and circulatory effects.
  - A diet high in fats and carbohydrates will help to maintain body temperature.
- Appropriate measures such as warm vehicles/shelters, clothing and blankets will be available for cold related injuries.
- Heavy work shall not be assigned as to cause heavy sweating that will result in wet clothing.
- 

Employees should be thoroughly cognizant of the signs and symptoms of frostbite and hypothermia (see Table 3) in themselves as well as in coworkers. All instances of cold stress should be reported to the site safety coordinator. If a worker exposed to cold shows signs or reports symptoms of cold stress or injury, the worker must be removed from further exposure

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and treated by an appropriate first aid attendant, if available, or a physician. Work schedules may be adjusted and warm-up regimes imposed as needed to deal with temperature and wind conditions. Continuous skin exposure is not permitted when air speed and temperature results in an Equivalent Chill Temperature (ECT) of 25 °F (32 °C)

### **3.4 Personal Protective Equipment**

If the above actions are not practicable, Tetra Tech will reduce the exposure hazard by providing effective PPE to reduce the exposure hazard of workers to thermal conditions that could cause cold stress or injury.

Several examples of PPE Tetra Tech commonly uses to reduce worker exposure to cold stress are described below:

- Protecting of exposed skin surfaces with appropriate clothing (such as face masks, handwear, and footwear) that insulates, stays dry, and blocks wind;
- Using adequate insulating clothing to maintain a body core temperature of above 98.6° F (36 °C);
- Providing extra insulating clothing on site in case of extreme temperature drops within a single shift;
- If an employee's clothing becomes wet while working below 40°F, he or she will automatically be given a change of clothing and checked for cold stress symptoms.
- Additional cold weather clothing will be identified for individuals with predisposed conditions that contribute to cold stress situations;



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

The ACGIH criteria, in the Fahrenheit scale, are listed in the following table as it appears in "Cold Stress" portion of the 2011 Threshold Limit Values and Biological Exposure Indices (or most current). The table shows the cooling power of wind on exposed flesh. If there is a wind, use the wind speed in the first column and the actual temperature across the top to find what the equivalent temperature would be under calm conditions.

Estimated wind speed (in mph)	Actual temperature reading (degrees Fahrenheit)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent chill temperature (degrees Fahrenheit)											
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	LITTLE DANGER				INCREASING DANGER				GREAT DANGER			
	In < 1 hour with dry skin. Maximum danger of false sense of security.				Danger from freezing of exposed flesh within one minute.				Flesh may freeze within 30 seconds.			
	Trench foot and Immersion foot may occur at any point on this chart.											

Note: Equivalent chill temperature requiring dry clothing to maintain core body temperature above 36 C (96.8 F) per cold stress TLV.

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**TABLE 2**  
**TWO OF THE MOST COMMON COLD STRESS CONDITIONS**

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



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**TABLE 3**  
**WORK/WARM-UP SCHEDULE FOR A 4-HOUR SHIFT**


A WORK/WARM-UP SCHEDULE IS AN EXAMPLE OF AN ADMINISTRATIVE CONTROL. THE ACGIH STANDARD CONTAINS A WORK/WARM-UP SCHEDULE FOR A 4-HOUR SHIFT FOR WORKERS WHO ARE PROPERLY CLOTHED.

Table 3 TLVs Work/Warm-up Schedule for Outside Workers based on a Four-Hour Shift*											
Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°F (approx)	°C (approx)	Max. work Period	No. of Breaks**	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-15° to -19°	-26° to -28°	(Norm breaks) 1		(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4
-20° to -24°	-29° to -31°	(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-25° to -29°	-32° to -34°	75 min.	2	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease	
-30° to -34°	-35° to -37°	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease			
-35° to -39°	-38° to -39°	40 min.	4	30 min.	5	Non-emergency work should cease					
-40° to -44°	-40° to -42°	30 min.	5	Non-emergency work should cease							
-45° & below	-43° & below	Non-emergency work should cease									

**Notes:**

- Schedule applies to moderate to heavy work activity with warm-up breaks of ten (10) minutes in a warm location. For light-to-moderate work (limited physical movement): apply the schedule one step lower. For example, at -35°C (-30°F) with no noticeable wind (step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with four breaks in a 4-hour period (step 5).
- The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.
- If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be: (1) special warm-up breaks should be initiated at a wind chill cooling rate of about 1,750 W/m<sup>2</sup>; (2) all non-emergency work should have ceased at or below a wind chill of 2,250 W/m<sup>2</sup>. In general, the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges, since windy conditions rarely prevail at extremely low temperatures.
- TLVs apply only for workers in dry clothing.


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	Denny Cox		

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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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## 1.0 PURPOSE

Numerous types of injuries can result from unsafe or improper handling and storing of materials. Workers should be able to recognize the methods for eliminating—or at least minimizing—the occurrence of such incidents. Employers and employees should examine their workplaces to detect any unsafe or unhealthful conditions, practices, or equipment and take corrective action.

This Health and Safety Safe Work Practice (SWP) describes the potential hazards of handling materials and provides information on training, education, and applying general safety principles that will help reduce workplace accidents involving moving, handling, and storing of materials.

## 2.0 POTENTIAL HAZARDS FOR WORKERS

Workers frequently cite the weight and bulkiness of objects that they lift as major contributing factors to their injuries. Bending, twisting, and turning were the more commonly cited movements that caused back injuries. Other hazards include falling objects, improperly stacked materials, and the potential for injury from the use of various types of equipment.


Potential injuries that can occur when manually moving materials include:

- Strains and sprains from lifting loads improperly or from carrying loads that are too large or too heavy.
- Fractures and bruises caused by being struck by materials or by being caught in pinch points.
- Cuts and bruises caused by falling materials that have been improperly stored or by incorrectly cutting ties or other securing devices.

In addition, mechanical handling equipment operation can present hazards. Refer to the Tetra Tech Health and Safety Safe Work Practices (SWP) 05-45; Forklift Safety and SWP 05-37 Critical Lift Safe Practices for information on the training components and safe work practices for operating forklifts and working around cranes.

## 3.0 PRECAUTIONS WHEN MOVING, STACKING AND WORKING WITH STORED MATERIALS

This section describes the precautions workers should take when manually or mechanically moving materials, when stacking materials, and when working with stored materials. In addition, a number of material handling tools are posted online in the toolkit section including 1) Body Strain Risk Worksheet, 2) Back Checklist – Lifting and Material Handling Guide, and 3) Strain Prevention Behavior Checklist. For critical lifts requiring rigging refer to the Tt SWP 05-37; Critical Lifts.

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### 3.1 Moving Materials Manually

Proper lifting technique is critical to back safety, but proper planning may be even more important. Before you lift that box, tool, or piece of equipment, take a moment to consider your action:

- Do you need to lift the item manually?
- How heavy is it?
- Where are you moving the item?
- Where does it have to go?
- What route do you have to follow?

Workers should always wear appropriate personal protective equipment (e.g., gloves, eye protection, steel-toed safety shoes or boots) and use proper lifting techniques when manually moving materials.

#### 3.1.1 Proper Lifting Technique

- Wear shoes with non-slip soles.
- Clear a space around the object.
- Check your route. Make sure that the floors are not slippery and that there are no obstacles to maneuver around.
- Stand close to the object. Keep your feet apart, staggered if possible.
- Keeping your back upright, lower your body by bending your knees.
- Grip the object firmly.
- Tighten your abdominal muscles.
- Lift with a straight back, pushing with your legs for strength. Keep your head up and look straight ahead.
- Do not hold your breath.
- If you must turn - turn with your feet and your ENTIRE body. Never jerk or twist!
- Hold the object close to your body.
- Make sure you can see over the object.
- Lift and lower the load slowly and smoothly.
- Do not rely on a belt.



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- If unsure about technique or weight of the object, ask for help
- If at anytime during lifting there are signs of discomfort or a problem, set down the load and get help.




### **3.1.2 Workers should seek help to lift items in the following circumstances:**

- When a load is too heavy.
- When a load is so bulky that they cannot properly grasp or lift it.
- When they cannot see around or over a load.
- When they cannot safely handle a load.

### **3.1.3 Follow these procedures to prevent injury from oversize loads:**

- Always practice safe lifting techniques
- Position yourself as close to the load as possible when moving an item from a hard-to-reach place. Slide it out to get it closer, and be sure that you have adequate room for your hands and arms.
- Provide sufficient headroom under overhead installations, lights, pipes, and sprinkler systems.


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- Be aware of adjacent obstructions, on either side or above the load. Think about where the item will be placed once you've lifted it. Will it be overhead? Under an overhang? In a narrow spot?
- Allow as much room as possible to set the load down. You can always shift it slightly later.
- Check your path from place to place. Remove tripping hazards.
- Make sure that the lighting is sufficient to see where you are going. Stabilize uneven or loose ground, or choose an alternate route. The shortest way isn't always the fastest, or the safest.
- When loading or unloading equipment or materials from a pickup truck, always do so from the back end with the tailgate down. Do not lift anything over the sides of the bed and never stand on the tires to gain access.
- When possible, attach handles or holders to loads and use blocking materials to manage loads safely. When placing blocks under a raised load, be sure that the load is not released before you can remove your hands from under the load. Blocking materials and timbers should be large and strong enough to support the load safely. Do not use materials with rounded corners, cracks, splintered pieces, or dry rot.
  - Handle only stable or safely arranged loads.
  - When using mechanical help, remember to push, not pull – you'll have more control and greater leverage.
  - Fasten the load to the equipment so sudden stops or vibrations don't jar it off.

### 3.2 Moving Materials Mechanically

Use mechanical help – a dolly, hand truck, or forklift – wherever possible. However, keep in mind that using mechanical equipment to move and store materials may increase the potential for employee injuries due to hazards associated with the equipment being used. Follow these general safety rules.

- Let the weight, size, and shape of the material being moved dictate the type of equipment used. All materials-handling equipment has rated capacities indicating the maximum weight the equipment can safely carry and the conditions under which it can handle the weight. The department or project manager must ensure that the capacity is displayed on each piece of equipment and that it is not exceeded.
- Do not place extra weight on the rear of a counterbalanced forklift to allow an overload.

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- Center the load on the platform as close to the support as possible to minimize the potential for tipping over or the load to fall.
- Adjust the load to the lowest position when traveling.
- Follow the equipment manufacturer's operational requirements.

### 3.3 Stacking Materials

Stacking materials can be dangerous if workers do not follow safety guidelines. Falling materials and collapsing loads can crush or pin workers, causing injury or death. To help prevent injuries, follow these general safety rules:

- Consider the need for availability of the material.
- Paint walls or posts with stripes for quick reference of the maximum stacking heights.
- Ensure that stacks are stable and self-supporting.
- Stack bags and bundles in interlocking rows to keep them secure.
- Step back the layers and cross-key bags at least every 10 layers. To remove bags from the stack, start from the top row first.
- Band or secure boxed materials with crossties or shrink plastic fiber.
- Do not store pipes and bars in racks that face main aisles, where it may create a hazard to passersby when supplies are removed.


### 3.4 Avoiding Storage Hazards

Workers must be aware of the height and weight of stored materials, their accessibility, and the condition of the containers where the materials are being stored. To prevent creating hazards when storing materials, the following guidelines should be used:

- Keep storage areas free from materials that could cause tripping, fires, explosions, or that may harbor rats or other pests.
- Place stored materials inside buildings that are under construction and at least 6 feet from hoist ways, or inside floor openings and at least 10 feet away from exterior walls.
- Separate materials that are not compatible (refer to SWP 05-13; Flammable Hazards and Ignition Sources).

## 4.0 OTHER IMPORTANT SAFETY MEASURES

Injuries from handling and storing materials may be reduced by adopting sound ergonomics practices, taking general fire safety precautions, keeping aisles and passageways clear and using ladders safely. Managers are expected to periodically evaluate current work station configurations

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and employees' work techniques to assess the potential for and prevention of injuries. Injuries caused by improper lifting will be investigated in accordance with Tetra Tech DCN 02-02 Incident Reporting and Investigation Program. Investigative findings will be incorporated into work procedures to avoid future injuries. The following general guidelines are provided to aid managers and workers in these areas.

#### **4.1 Ergonomics**

Ergonomics (the study of work) is based on the principle that the job should be adapted to fit the person rather than forcing the person to fit the job. Workplace conditions should be restructured or changed to make the job easier and reduce stressors that cause musculoskeletal disorders. Ergonomic principles may require reducing the size or weight of the objects lifted, installing a mechanical lifting aid, or changing the height of a pallet or shelf. Although no lifting approach completely eliminates back injuries, a substantial number of injuries can be prevented by implementing sound ergonomic practices and by training employees in appropriate lifting techniques.

Not all back injuries are a result of sudden trauma; most are of a cumulative type, where a repeated minor injury has flared up, continued use of a heavy tool in the same position has caused pain, or a great deal of time is spent in the same position.

#### **4.2 Fire Safety**

Flammable and combustible materials must be stored according to their fire characteristics. Flammable liquids, for example, must be separated from other material by a firewall. Other combustibles must be stored in an area where smoking and using an open flame or spark-producing device is prohibited. Dissimilar materials that are dangerous when they come into contact with each other must be stored apart.

#### **4.3 Aisles and Passageways**

Allow sufficient clearance of aisles at loading docks, through doorways, at turning points, and in other parts of the workplace when mechanically moving materials. Providing sufficient clearance will prevent workers from being pinned between the equipment and fixtures, such as walls, racks, posts, or other machines. Sufficient clearance will also prevent the load from striking an obstruction and falling on an employee.

Ensure that passageways remain clear of obstructions and tripping hazards. Do not store materials in excess of supplies needed for immediate operations in aisles or passageways.

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## 5.0 TRAINING AND EDUCATION


OSHA recommends that employers establish a formal training program to teach workers to recognize and avoid materials handling hazards. Training of Tt personnel on this topic will be implemented through the issuance of this SWP and periodic discussion of the topic during monthly health and safety meetings, as well as during pre-project and tailgate safety meetings. The training should reduce workplace hazards by emphasizing the following factors:

- Avoidance of unnecessary physical stress and strain.
- Awareness of what a worker can comfortably handle without undue strain.
- Proper use of equipment.
- Recognition of potential hazards and how to prevent or correct them.
- Prevention of back injuries

Prevention of back injuries should receive special emphasis because of the high incidence of back injuries. Training on proper lifting techniques should cover the following topics:

- Health risks of improper lifting vs. the benefits of proper lifting.
- Body strengths and weaknesses and determining one's own lifting capacity.
- Physical factors that might contribute to an accident.
- Safe postures and timing for smooth, easy lifting.
- Warning signals from your body to watch for when lifting.

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	<p style="text-align: center;"><b>TETRA TECH, INC.</b> <b>PROTECTION FROM SUN EXPOSURE</b></p>	Revision Date: 10/1/2008
		Document Control Number:
		<b>SWP 5-26</b>
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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:
  - Cover up with a wide brimmed hat and a bandanna for your neck. Wear long-sleeved shirts and pants which the sun cannot penetrate.
  - 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.
  - Apply sunscreen at least an hour before going into the sun and again after swimming or perspiring a lot.
  - 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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10/1/2008	Chris McClain		NEW
	Rick Lemmon		

	<p style="text-align: center;"><b>TETRA TECH, INC.</b> <b>RESPIRATOR CLEANING PROCEDURES</b></p>	Revision Date: 11/21/2011
		Document Control Number:
		<b>SWP 5-27</b>
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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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	<p style="text-align: center;"><b>TETRA TECH, INC.</b></p> <p style="text-align: center;"><b>GENERAL SAFE WORK PRACTICES for USE OF AIR PURIFYING RESPIRATORS</b></p>	Revision Date: 11/22/2011
		Document Control Number:
		<b>SWP 5-28</b>
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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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	<p style="text-align: center;"><b>TETRA TECH, INC.</b></p> <p style="text-align: center;"><b>RESPIRATOR QUALITATIVE FIT TEST PROCEDURES</b></p>	Revision Date: 12/7/2011
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The safe work practice (SWP) addresses the need for proper and thorough procedures for qualitative fit testing of respirators. The Occupational Safety and Health Administration (OSHA) regulates general industrial use of respiratory protection under Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.134. Appendix A of the standard outlines mandatory procedures to use for both qualitative fit tests (QLFT) and quantitative fit tests (QNFT). This SWP was written in accordance with the requirements of Appendix A for QLFTs. This SWP must be used in conjunction with the Tetra Tech, Inc. (Tetra Tech), “Respiratory Protection Program,” Document Control Number (DCN) 2-6.

The following sections describe the SWP’s applicability, qualifications of fit testers, and fit testing procedures for use during QLFTs.

## 1.0 APPLICABILITY

This SWP applies to all Tetra Tech employees who use respirators on the job and to employees who conduct any fit testing. In addition, when a Tetra Tech company or office uses an outside service to perform fit testing, the organization conducting the fit testing shall meet the minimum requirements for QLFT and QNFT procedures specified in Appendix A of the standard.

Respirator fit testing shall be conducted at the following intervals:

- Prior to initial use of a respirator;
- Whenever a different respirator facepiece (size, style, model, or make) is used;
- At least annually thereafter; or
- After any reported or observed changes in an employee’s physical condition that could affect respirator fit. This includes but is not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

If an employee notices that the fit of a respirator has become unacceptable, he or she will be given an opportunity to select another respirator facepiece.

## 2.0 QUALIFICATION OF FIT TESTERS

Tetra Tech employees who conduct QLFTs must demonstrate sufficient understanding and expertise in the required testing procedures. Fit testers shall qualify through appropriate education,

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experience, or both. Qualifications of fit testers shall be determined on a case-by-case basis by operating unit health and safety managers (HSMs) based on the fit tester's demonstrated knowledge of OSHA-mandated fit test procedures and performance of a simulated fit test. The HSM must ensure that persons administering fit tests are able to prepare test solutions, calibrate and operate equipment, perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order. The fit tester must also demonstrate how to clean and maintain equipment to operate within the parameters for which it was designed.


### 3.0 FIT TESTING PROCEDURES

Appendix A of 29 CFR 1910.134 provides instruction for five OSHA-accepted QLFT procedures. Tetra Tech has selected two of these procedures for its fit-test program. The sections below describe general requirements that must be followed during all fit tests and for any fit test method used. The Both Bitrex™ QLFT protocol is discussed below.

#### 3.1 General Requirements

QLFTs must be conducted in accordance with the general requirements discussed below.

- The test subject shall be shown how to put on a respirator, position it on the face, set strap tension, and determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning the facepiece.
- The test subject must be allowed to choose from a sufficient selection of models and sizes to identify a respirator that fits correctly and is comfortable. The subject shall be informed that he or she is being asked to select the respirator that provides the most acceptable fit. The subject shall be asked to hold each chosen facepiece up to the face and eliminate those that obviously do not provide an acceptable fit.
- The subject shall don the most comfortable respirator and wear it for at least 5 minutes to assess comfort. If the subject is not familiar with a particular respirator, the subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper strap tension.
- The tester shall review the following points with the subject and allow the subject adequate time to determine the comfort of the respirator:
  - Position of the mask on the nose

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- Room for eye protection
- Ability to talk
- Position of the mask on the face and cheeks
- The following criteria shall be used to help determine the adequacy of the respirator fit:
  - Chin properly placed
  - Adequate strap tension (not overly tight)
  - Fit across nose bridge
  - Proper size to span distance from nose to chin
  - Tendency of respirator to slip
  - Self-observation in a mirror to evaluate fit and respirator position
- The subject shall conduct a user seal check using the negative- and positive-pressure seal check procedures described in Appendix A of this SWP. Before conducting the check, the subject shall be instructed to seat the mask on the face by moving the head from side to side and up and down slowly while taking a few slow, deep breaths. If the seal checks fail, the subject shall choose another facepiece.
- Seal checks and fit testing shall not be conducted if there is any facial hair growth such as stubble beard growth, beard, mustache, or sideburns that interferes with the facepiece sealing surface. Any interfering apparel shall be altered or removed.
- If the subject experiences difficulty in breathing during testing, the testing shall stop immediately and he or she shall be referred to a company physician for assessment.
- If the subject finds the fit of the respirator unacceptable, the subject shall be given the opportunity to select a different respirator and to be retested.
- Prior to commencement of the fit test, the subject shall be given a written description of the respirator user seal check procedures (see Appendix A) and exercises to perform during the testing. Exercises and a prepared text to be read during the test are included in Appendix B of this SWP.

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- All exercises in Appendix B must be performed for all QLFT methods.

## 3.2 BITREX™ Solution Qualitative Fit Test Protocol

Bitrex™ solution (denatonium benzoate) is a taste aversion agent. To conduct a QLFT using Bitrex™, the test subject must first pass a taste threshold screening. The entire procedure must be explained to the test subject before the screening is conducted. The sections below describe taste threshold screening and fit test procedures. Particulate filters (cartridges) are used during this test.

### 3.2.1 Taste Threshold Screening

The taste threshold screening is intended to determine whether the individual tested can detect the taste of Bitrex™. The procedures below shall be used for the taste screening.

- Prior to testing, the tester shall prepare a quantity of threshold check solution by adding 13.5 milligrams (mg) of Bitrex™ to 100 milliliters (mL) of 5 percent salt solution in distilled water. A nebulizer for taste screening shall be clearly marked to distinguish it from the fit test solution nebulizer. The taste screening nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every 4 hours.
- During the taste screening as well as during the fit testing, subjects shall wear an enclosure around the head and shoulders that is approximately 12 inches in diameter by 14 inches tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts #14 and #15 combined, is adequate.
- The test enclosure shall have a 0.75-inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
- The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he or she detects a bitter taste.
- Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely. The bulb is then

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released and allowed to fully expand. Correct use of the nebulizer means that approximately 1 mL of liquid is used at a time in the nebulizer body.

- The nebulizer should be rapidly squeezed 10 times and then the test subject is asked whether the Bitrex™ solution can be tasted. If the subject reports tasting the bitter taste during the 10 squeezes, the screening test is complete. The taste threshold is noted as 10 regardless of the number of squeezes actually completed.
- If the first response is negative, the nebulizer is rapidly squeezed 10 more times and the test subject is again asked whether the Bitrex™ solution is tasted. If the test subject reports tasting the bitter taste during the second 10 squeezes, the screening test is completed. The taste threshold is noted as 20 regardless of the number of squeezes actually completed.
- If the second response is negative, the nebulizer is rapidly squeezed 10 more times and the test subject is again asked whether the Bitrex™ solution is tasted. If the test subject reports tasting the bitter taste during the third 10 squeezes, the screening test is completed. The taste threshold is noted as 30 regardless of the number of squeezes actually completed.
- If the Bitrex™ solution is not tasted after 30 squeezes, the test subject is unable to taste the Bitrex™ solution and cannot be fit tested using the Bitrex™ solution test.
- The tester will note the number of squeezes required to solicit a taste response. When a taste response has been elicited, the test subject shall be asked to note the taste for reference in the fit test.

### 3.2.2 Bitrex™ Solution Fit Test Procedures


The procedures below must be followed to conduct the actual Bitrex™ solution fit test:

- A fit test solution is prepared by adding 337.5 mg of Bitrex™ to 200 mL of a 5 percent salt solution in warm water. A second nebulizer dedicated to fit testing shall be clearly marked to distinguish it from the taste screening solution nebulizer. The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every 4 hours.
- The test subject shall be instructed not to eat, drink, smoke, or chew gum for 15 minutes before the test.

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- The person being fit tested shall don the respirator without assistance and perform the required user seal check (see Appendix A).
- The fit test uses the same enclosure described for taste threshold screening in Section 3.2.1. The test subject shall don the enclosure while wearing the respirator selected as described in the general requirements in Section 3.1. The respirator shall be properly adjusted and equipped with particulate filter(s).
- As before, the test subject shall breathe through his or her slightly opened mouth with tongue extended, and shall be instructed to report if he or she tastes the bitter taste of Bitrex™
- The nebulizer is inserted into the hole in front of the enclosure, and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20, or 30) based on the number of squeezes required to elicit taste response noted during the screening test.
- After generating the aerosol, the test subject shall be instructed to perform the test exercises provided in Appendix B.
- Every 30 seconds, the aerosol concentration shall be replenished using one half the number of squeezes used initially (such as 5, 10, or 15).
- The test subject shall indicate to the tester if at any time during the fit test the taste of Bitrex™ solution is detected. If the test subject does not report tasting the Bitrex™ solution, the test is passed.
- If the taste of Bitrex™ solution is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried, and the entire test procedure (screening and test) is repeated.

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**APPENDIX A**

**RESPIRATOR USER SEAL CHECK PROCEDURES**

## APPENDIX A

### RESPIRATOR USER SEAL CHECK PROCEDURE

Individuals using tight-fitting respirators must perform a user seal check each time a respirator is put on to ensure that an adequate seal is achieved. Two methods are available for use; one is the positive- and negative-pressure check and the other is the respirator manufacturer's method. Either the positive- and negative-pressure checks described below may be used or, if a manufacturer of a particular respirator brand has developed its own recommended seal check method, that method may be used in place of the negative- and positive-pressure seal checks. User seal checks are not a substitute for qualitative or quantitative fit tests. The user check procedures described below are as described in the mandatory Appendix B-1 of Title 29 of the *Code of Federal Regulations*, Part 1910.134.

- 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. For most respirators, this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replace it after the test.

- Negative-Pressure Check

Close off the inlet opening(s) of the canister or cartridge(s) by covering the opening with the palm of the hand(s) or by replacing the filter seal(s). Inhale gently so that the facepiece collapses slightly, and hold the breath for 10 seconds. The inlet opening of some cartridges cannot be effectively covered with the palm of the hand. In this case, the test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

**APPENDIX B**

**RESPIRATOR FIT TEST EXERCISES**

## RESPIRATOR FIT TEST EXERCISES

Test subjects shall perform the exercises below during fit test process. Prior to the actual fit test, the test subject shall (1) select a suitable and comfortable respirator; (2) don, adjust, and then wear the respirator for 5 minutes to assess comfort; (3) conduct a user seal check in accordance with the procedures outlined in Appendix A, (4) report any difficulties breathing while wearing the respirator, (5) select a different respirator if the fit and level of comfort is unacceptable, and (6) perform the fit test exercises described below in the order listed. The qualitative fit test (QLFT) shall be performed in a test environment.

### Test Exercises

Each exercise below shall be conducted for 1 minute. During testing, the subject will be questioned and observed to determine if the respirator is comfortable. The respirator shall not be adjusted during the fit testing procedure. Any adjustment voids the test, and the test must be repeated from the beginning.

1. **Normal breathing.** In a normal standing position without talking, breathe normally.
2. **Deep breathing.** In a normal standing position, breathe slowly and deeply. Be careful not to hyperventilate.
3. **Turning head from side to side.** Standing in place, slowly turn the head from side to side between the extreme positions on each side. Hold the head at each extreme momentarily and inhale at each side.
4. **Moving head up and down.** Standing in place, slowly move the head up and down. Inhale in the up position (such as when looking toward the ceiling).
5. **Talking.** Talk out loud slowly and loud enough to be heard clearly by the fit tester. Read the entire "Rainbow Passage" on the next page.
6. **Bending over.** Bend at the waist as if to touch the toes.
7. **Normal breathing.** Complete the same exercise as item 1 above.

After these test exercises are completed, the tester shall ask the test subject about the comfort of the respirator. If the respirator is uncomfortable, another respirator shall be tried and the fit test, as well as user check and screening procedures, will be repeated.

## RAINBOW PASSAGE

“When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.”

Source: Appendix A of Title 29 of the *Code of Federal Regulations*, Part 1910.134

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## 1.0 PURPOSE

The purpose of this safe work practice (SWP) is to describe the Job Safety Analysis (JSA) process for identifying and mitigating hazards associated with a specific task.

## 2.0 SCOPE AND APPLICATION

Tetra Tech requires that a hazard assessment of some type be conducted for all projects with field tasks performed by employees. The type of hazard assessment is typically dictated by the project scope of work, regulatory requirements (all HAZWOPER sites require a site specific health and safety plan or HASP meeting OSHA requirements of 29 CFR 1910.120), client requirements and expectations, and anticipated hazards associated with the project/task.

JSAs can be utilized as stand-alone hazard assessments or in conjunction with site specific HASPs or other more comprehensive hazard assessments.


## 3.0 OVERVIEW

Injuries occur if workers do not recognize hazards and follow the proper procedure. Establishing proper procedures is one of the benefits of conducting job safety analysis.

### 3.1 What is a JSA?

A JSA is defined in various ways including:

- A documented review of the hazards associated with execution of a specific task and the required actions taken to reduce the hazards
- A proactive systematic approach for establishing workplace safety
- A technique for:
  - studying and recording each step of a job (task),
  - identifying existing or potential hazards associated with each step, and
  - detailing the precautions necessary to eliminate or reduce risk
- A process that focuses on the relationship between the worker, the task, the tools and the work environment
- A means to integrate accepted health and safety principles and practices into day to day operations
- A team project

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- One of the best ways to determine and establish safe work procedures
- Only one component of a larger committed health and safety management system
- Another term for:
  - JHA – Job Hazard Analysis
  - AHA – Activity Hazard Analysis
  - THA – Task Hazard Analysis

### 3.2 What are the Benefits of a JSA?

There are many benefits to job safety analysis including but not limited to:

- Ensures complete communication on the scope of work.
- Identifies and eliminates/minimizes hazards associated with various jobs.
- Establishes safer more effective job procedures through improvement ideas.
- Reduces frequency and severity of injuries.
- Reduces worker's compensation costs, increases productivity, and puts the company in a better position to obtain work.
- Provides a training tool for new employees and a refresher of needed skills for experienced employees.
- Provides a tool for discussing and documenting pre-task meetings.
- Involves employees at all levels in the safety program.

### 3.3 How do you perform a JSA?

After selecting the task you want to analyze, there are 3 basic steps to conducting a JSA.

1. Breaking each job down into a sequence of steps.
2. Identifying the potential hazards associated with each step.
3. Determining preventative and protective measures to eliminate or minimize the hazard.

## 4.0 RESPONSIBILITIES

The process of job safety analysis is only successful if there is participation by all personnel affected by the particular task. The following details responsibilities with respect to developing and using JSAs.

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#### **4.1 Project Manager (PM)**


The PM is responsible for:

- Determining the appropriate type of hazard assessment for the project scope of work and associated tasks.
- Designating personnel responsible for conducting necessary JSAs and the circumstances under which they will be conducted.
- Assisting in the JSA process.
- Reviewing all JSAs developed prior to use on a project.
- Ensuring that JSAs are developed and implemented on their project sites as designated for the project.
- Ensuring that any Short Service Employees who will participate in the task are identified on the project JSAs

#### **4.2 Health and Safety Personnel**

Health and safety personnel including the unit health and safety representative, office health and safety coordinators, and site safety officers are responsible for:

- Assisting in the JSA process upon request.
- Conducting training in the JSA process with employees.
- Reviewing and approving JSAs
- Assisting with the development of JSAs for any tasks that may involve any of the following:
  - Use of respiratory protection
  - Working in excavations (or within 2 feet of the edge of an excavation)
  - Working at elevated heights of 4 feet or more
  - Work in construction or construction-like activities (e.g., involving the use of heavy equipment)
  - Work involving cranes or slings
  - Work from ladders or scaffolds
  - Tasks that will require industrial hygiene monitoring or sampling

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### 4.3 Site Safety Officer or Task Leader

The site safety office or person designated as the lead on the project site or for the particular task is responsible for:

- Ensuring that there is a JSA available on the job site for all designated tasks.
- Leading a review of the JSA prior to commencing with the task.
- Making changes to the JSA based on discussing with work crew.
- Ensuring documentation of JSA review by all involved employees.
- Facilitating changes to an existing JSA or development of a new one on site in the event that changes occur, other hazards are identified, or a new task needs to be conducted.

### 4.4 Employee

Each individual worker is responsible for:

- Participating in training and becoming familiar with the JSA process.
- Participating in the development of JSAs (upon completion of training).
- Participating in review and discussion of the JSA prior to beginning the task.
- Signing the JSA indicating their understanding and acceptance.
- Complying with the precautionary measures established in the JSA.
- Identifying changes in personnel, hazards, site conditions, and/or equipment and tools needed to complete the task.
- Enacting STOP work authority as specified on the JSAs.
- Ensuring that all tasks that they will participate in have an appropriate JSA, and stopping work if conditions or the scope of work change and a new or modified JSA is necessary.

## 5.0 CONDUCTING A JOB SAFETY ANALYSIS

### 5.1 Selecting Tasks Requiring a JSA

A JSA can be performed for any task in the workplace whether the set of tasks is “special” or “routine”. As previously stated, a hazard assessment of some type is required for all Tetra Tech field tasks. For work not clearly defined as low risk, a JSA or other written hazard assessment method will be required. Hazard assessment identification methods for low risk

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work may include unwritten hazard analysis, job site discussions, personal hazard assessments or other undocumented hazard analysis methods. Additional methods of risk assessment may be conducted once appropriate hazard controls have been implemented on a project.

A JSA may be used to supplement a site specific HASP for unique or specific tasks that may not have been detailed enough in the HASP. Jobs not requiring a HASP may be addressed through a series of JSAs. The following provides some guidance in determining tasks where JSAs should be conducted with priority going to the following:


- Tasks with highest injury or illness rates or near miss reports
- Tasks with potential to cause severe or disabling injuries or illness even if there is no history of previous accidents
- Tasks in which even one simple human error could lead to a severe accident or injury
- Tasks that are new to the operation or have undergone changes in processes or procedures
- Infrequently performed tasks or tasks with repetitive exposures
- Tasks complex enough to require written instruction
- When contractually-required by clients

**KEEP IN MIND:** The perception that we only do JSA's for activities that are commonly considered hazardous fails to recognize that part of the purpose of a JSA is to determine whether or not hazards exist. Sometimes it is important to go through the process to determine that hazards do not exist. ALL tasks contain some level of hazard.

Part of selecting a task for a JSA is properly scoping and defining the task. Narrowly defined activities, such as "opening a valve" or "locking a gate" are termed single actions and although they may be a step in a JSA they should not be considered for a JSA in and of itself. On the other end of the spectrum, a job defined in terms of what is accomplished, like "installing a monitoring well" is too broad to result in a practical JSA. Jobs of this nature should be broken down into multiple tasks each with its own JSA. A good rule-of-thumb to follow is 6-8 steps per JSA and generally no more than 10-12. "Site mobilization" and "collecting groundwater samples" are examples of suitable tasks for a JSA.

## 5.2 Conducting a JSA

The result of conducting a JSA is a list of steps with their associated hazards and preferred mitigation measures. Normally the JSA is constructed in a table format with three columns; 1) job steps, 2) potential hazards, and 3) mitigating or precautionary measures. A JSA form is

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included in the Tetra Tech H&S Programs – Forms and Tools section. However, any form that clearly details the three basic elements of a JSA is acceptable.

NOTE: Completing a JSA may be approached from both a formal as well as an informal standpoint. This SWP approaches the completion of a JSA from the more formal detailed standpoint when a JSA is being developed for a task that will be performed multiple times under similar circumstances. However, a less formalized JSA approach can take place directly on the project site with the task crew as the team developing the JSA prior to performing the task. Many times a JSA is conducted unique to a task in the field on a specific day and may never be utilized under the same conditions again. However if an informal JSA is developed in the field and may be used in the future for other similar tasks, it can be submitted to a team for a more formalized review.

Development of a JSA should be a team approach. It is important to include the employees involved in performing the task. They have a unique insight and their participation will help to minimize oversights ensuring a quality analysis. It will also help with getting worker “buy-in” to the solutions because everyone will share ownership. Other people to consider for the JSA team include:

- Project manager and/or supervisor for the task to be analyzed
- Employees experienced in that task and/or those that routinely do it
- Subject matter experts depending upon the task and anticipated hazards
- Health and Safety for tasks representing potentially significant risks, or when the task is addressed by regulatory requirements (Federal OSHA, State regulations, or others).

Review with the JSA team any accidents, injuries, and near misses that might have occurred in the past surrounding the defined job. These events are indicators that existing controls (if any) may not be adequate and deserve more scrutiny.

Conduct a preliminary job review with members of the JSA team and discuss any hazards that they know exist. Brainstorm for ideas to eliminate or control the hazards. If anyone communicates known hazards posing an immediate danger, immediate actions should be taken to correct the situation before continuing with the JSA process. Also, quick fixes can be done right away as well prior to the JSA being completed and finalized.

Once the team has met and discussed the task to be analyzed, the three formal steps in the JSA process can begin.

### **5.2.1 Break the Task Down into Steps**

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Before searching for hazards, a job must first be broken down into sequential steps. The following provides guidance in effectively breaking the job down.

- A job step is defined as a segment of the operation necessary to advance the work
- Do not make the steps too general. This may result in missing a step with an associated hazard that should be addressed
- Do not make the steps too detailed; there may be too many steps
  - Rule of thumb: Up to 10 – 12 steps More than this and you should consider breaking the jobs down into several JSA's
- Keep steps in the actual sequence otherwise you might miss a hazard or introduce one that does not actually exist
- Use an action verb to begin each step
- Focus on what is actually being done, not how it is being done
- Determine the steps by discussing them with the team as well as observing the work being done
  - Observe the work under normal times and circumstances
  - Make sure the employee knows that you are evaluating the job itself and not their performance
  - It may also be helpful to video tape the job being done and review it as a team to determine the steps
- Upon completing the list of steps review it again with the team to make sure it accurately reflects the job. The remainder of the analysis depends greatly on the list of tasks and how they are described.

### **5.2.2 Identify Potential Hazards**

Review each step and identify the actual and potential hazards associated with it. You may observe the job again with focus on the hazards this time rather than the steps. Keep in mind that accidents are the result of unsafe acts as well as unsafe conditions and do not only result for one factor but also from the relationship between the worker, the task, the tools and the work environment.

#### **5.2.2.1 Types of Potential Incidents**

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Think of each task with respect to the type(s) of incidents that could potentially occur. The following list of questions may be asked with respect to each step to help with identifying potential hazards.

- Is there a danger of striking against, being struck by, or otherwise making harmful contact with an object?
- Can the worker be caught in, by, or in between objects?
- Is there the potential for a slip, trip or fall? Can the worker fall on the same level or to another level?
- Can strain be caused by pushing, pulling, lifting, bending, twisting or otherwise exerting?
- Is the environment hazardous to safety or health? For example are there potential concentrations of toxic gas, vapor, mist, dust, heat, or radiation? Is there potential for excessive noise? Are there weather hazards or other environmental conditions that could affect the task?
- Are there fixed objects that may cause injury such as sharp objects or edges?
- Can moving or rotating machinery or materials injure the worker?
- Will the worker be positioned to the equipment in a way that is potentially dangerous?
- Is the worker wearing clothing or PPE that could potentially cause an injury?
- Do suspended loads or potential energy pose hazards?
- Are there other task specific hazards?

Additionally, some clients have specific processes and tools that must be observed in the process of identifying potential hazards. When these types of client requirements exist, the project manager is responsible for ensuring that they are communicated to the field team and satisfied.

#### 5.2.2.2 Hazard Scenarios

Besides asking the questions related to the types of injuries that could occur it is also helpful to develop hazard scenarios.

Developing hazard scenarios is similar to detective work. Your goal is to discover:

- What could go wrong?
- What are the consequences if something goes wrong?



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- How might something go wrong?
- What are the contributing factors?
- How likely is the hazard to occur?

A good hazard scenario describes:

- Where it could happen (the environment)
- Who or what it could happen to (exposure)
- What precipitates the hazard (trigger)
- The outcome to occur if it were to happen (consequence), and
- Any other contributing factors

Rarely is a hazard a simple case of one singular cause resulting in a singular effect. More frequently many contributing factors tend to line up in a certain way to create the hazard. By identifying all the elements in the hazard scenario you are more likely to not only identify hazards but ways in which they come together to cause accidents. This helps in determining mitigating measures that are most effective.


### ***Define Mitigating Measures***

The final step in the job safety analysis is determining appropriate mitigating measures to eliminate or reduce the hazards identified to an acceptable level. This can be accomplished through the following and preferably in the order listed.

- Engineering Controls (physical change that removes the hazard)
- Administrative Controls (changes in how the job is performed)
- Personal Protective Equipment (PPE)

Engineering controls or elimination of the hazard are the most effective and should be used when feasible. These include:

- Change or modify the process
- Substitution with a less hazardous chemical
- Improve environment (ventilation)
- Modify or change equipment or tools
- If hazards cannot be eliminated they might be controlled through other physical means such as machine guards, worker booths etc.

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Administrative Controls can be used when engineering controls are not feasible and include:

- Change in the work procedures
- Reducing the frequency or exposure hours
- Maintenance and housekeeping
- Training

PPE is utilized when engineering and/or administrative controls do not eliminate or reduce the hazard to an acceptable level. PPE does not typically prevent an accident but in many cases minimizes the severity of an injury. Examples of PPE include:

- Respirators
- Gloves
- Hard Hats
- Steel Toed Boots
- Hearing Protection Devices

In defining the mitigating measures be certain to:

- Clearly define precautions and controls
- Avoid use of general statements such as “use caution”. Instead use statements describing what is to be used and specifically how the work should be performed.
- Incorporate existing regulations and company policies into controls.

### **5.3 Implementing a JSA**

- A JSA is implemented by having all employees involved in the task:
- Review the JSA in detail prior to beginning the task
- Discuss and make changes to the JSA to address any site specific issues that may not have been taken into consideration
- Signing the JSA acknowledging review and understanding of the process
- Stopping work if conditions change and the JSA needs to be revised
- Stopping work if a new task is identified requiring development of a JSA

NOTE: Multiple JSAs for several tasks should not be reviewed at the start of the day. Rather, each specific JSA should be reviewed and discussed immediately prior to the initiation of

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each task. A work day commonly includes several JSA discussions throughout the day as work progresses.

## 6.0 REVISING A JSA

When conditions change during use of a JSA work should stop and the JSA should be marked to include changes or new steps, corresponding and hazards as a result of the changes and additional mitigating measures defined.

If an incident or significant near miss occurs, STOP work and review the JSA to determine what changes may be needed.

Any time a JSA is revised, training in the new job methods or protective measures should be provided to all workers affected by the change.

## 7.0 TRAINING

Field employees are trained in the hazard assessment process including conducting and using JSAs through annual refresher training, monthly office health and safety meetings, and on-the job (OJT) training.

## 8.0 DOCUMENTATION

Completed and implemented JSAs are kept in the related project file. JSAs can also be shared by posting on the health and safety page of the intranet site. This will allow others a basis to start from for the same/similar task and update it for the project team, site and *unique conditions that apply*.

Revision Date	Document Authorizer	Revision Details
	Name	
12/1/2013	Chris McClain	Update from 1998 format



## ACTIVITY HAZARD ANALYSIS (AHA) at the Big River Mine Tailings – OU1 Site

Tetra Tech, Inc.

### 3.0 Monitoring Excavation Activities at Lead Sites

#### Task Description

This Activity Hazard Analysis (AHA) applies to monitoring/oversight of excavation activities at the Big River Mine Tailings – Operable Unit #1 site in St. Francois County, Missouri. It has been developed and approved by the Regional Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.

Hazards		Actions
<b>Task Steps</b> Site preparation: <ul style="list-style-type: none"><li>Obtaining signed access agreement</li><li>Conducting site walk</li><li>Video documentation of existing conditions</li><li>Marking area of excavation</li></ul>	<b>Potential Hazards</b> SLIP/TRIP/FALL  LACERATION	<b>Critical Safety Procedures and Controls</b> <ul style="list-style-type: none"><li>Visually inspect the area for slippery spots or debris and correct if found</li><li>Wear steel-toed, non-skid boots in accordance with Tetra Tech, Inc. policy</li><li>Ensure all debris has been removed from the path of travel</li><li>Check with homeowner regarding dogs or other hazards</li><li>Have a first aid kit available for small cuts</li><li>Have map showing route to hospital in vehicle</li></ul>
Monitoring excavation activities	NOISE HAZARD SLIP/TRIP/FALL HEAVY EQUIPMENT  EMPLOYEE EXPOSURE  LACERATION	<ul style="list-style-type: none"><li>Wear hearing protection</li><li>Wear steel-toed, non-skid boots in accordance with Tetra Tech, Inc. policy</li><li>Wear hard hat and reflective safety vest</li><li>Be aware of truck traffic on the property or site</li><li>Stay within equipment operator's field of vision whenever possible</li><li>Discuss hand signals with equipment operator(s) before commencing work</li><li>Wear safety glasses and nitrile gloves</li><li>Be aware of radioactive source while XRF is in use. Wear TLD badge.</li><li>Have a first aid kit available for small cuts</li><li>Have map showing route to hospital in vehicle</li></ul>
<b>Equipment to be Used</b> <ul style="list-style-type: none"><li>Level D PPE (steel-toed boots, safety glasses, nitrile gloves, hard hat, reflective safety vest, hearing protection)</li><li>TLD badge</li><li>XRF</li><li>First Aid Kit</li></ul>	<b>Inspection Requirements</b> <ul style="list-style-type: none"><li>None</li></ul>	<b>Training Requirements</b> <ul style="list-style-type: none"><li>Personal Protective Equipment</li><li>Hazardous Waste Operations and Emergency Response (40-hour and current 8-hour update)</li><li>CPR/First Aid (one employee on-site must have current CPR/First Aid training)</li><li>Manufacturer's training in use of XRF</li></ul>

Assessed By

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Name

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Signature

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Date

Approved By

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Name

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