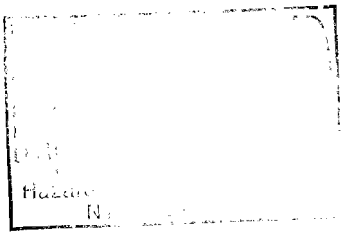
Health and Safety Plan

Former Unisys Facility
Operable Unit No. 1 and
Operable Unit No. 2
Great Neck, New York



Prepared For:

Lockheed Martin Corporation
Bethesda, Maryland

November 2005

BBL
ENVIRONMENTAL SERVICES, INC.
Remedial Management & Construction

REPORT

Health and Safety Plan

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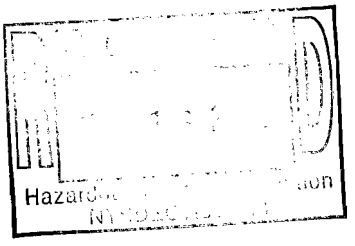

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Remedial Management & Construction

Approvals and Acknowledgments

Approvals

I have read and approved this *Health and Safety Plan* (HASP) with respect to project hazards, regulatory requirements, and BBL Environmental Services, Inc. (BBLES) procedures.

Project Name: Lockheed Martin Corporation.
Project Number: 38031.002

11/14/05
Project Manager/Date

Health and Safety Officer/Date
11/14/05

11/14/05
Health and Safety Supervisor/Date

Acknowledgments

The final approved version of this HASP has been provided to the site supervisor. I acknowledge my responsibility to provide the site supervisor with the equipment, materials and qualified personnel to implement fully all safety requirements in this HASP. I will formally review this plan with the Health and Safety Staff every 6 months until project completion.

11/14/05
Project Manager/Date

I acknowledge receipt of this HASP from the project manager, and that it is my responsibility to explain its contents to all site personnel and cause these requirements to be fully implemented. Any change in conditions, scope of work, or other change that might affect worker safety requires me to notify the project manager and/or the health and safety officer.

11/14/05
Site Supervisor/Date

Health and Safety Plan Acknowledgment

I have read this Site-Specific Health and Safety Plan, or its contents have been presented to me, and I understand the contents and I agree to abide by its requirements.

Name (Print)	Signature	Representing	Date

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1. Introduction

1.1 Objective

This Health and Safety Plan (HASP) has been prepared to provide details of the health and safety procedures, methods and requirements for remedial action activities at the Operable Unit No. 1 (OU-1) and Operable Unit No. 2 (OU-2) Groundwater Treatment Systems located at the Lockheed Martin Corporation's (LMC's) Former Unisys Facility, Great Neck, New York (the site).

Project activities will include the following tasks:

- Mobilization;
- Equipment upgrades;
- Start-Up/Operation and Maintenance;
- Drilling/Direct Push Boring Operations;
- Water Sampling, Groundwater Sampling, Well Development and Well Repair Activities;
- Soil Vapor, Indoor Air and Ambient Air Sampling; and
- Demobilization.

The objective of this plan is to provide a mechanism for establishing safe working conditions at the site. The safety organization, procedures, and protective equipment have been established based on an analysis of potential physical, chemical, and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of accident or injury.

1.2 Site and Facility Description

The Lockheed Martin Corporation (LMC) site consists of two Operable Units.

OU-1, which consists of the "on-site" project area previously owned by LMC, is approximately 94 acres in size. The OU-1 site lies between the Village of Lake Success and the Town of North Hempstead in Nassau County, New York. The mailing address of the OU-1 facility is 1111 Marcus Avenue, Lake Success, New York 11020. The site is bounded by Marcus Avenue to the north, Union Turnpike to the south, Lakeville Road to the west and Triad office park to the east. The site has a main manufacturing building, and six smaller buildings located immediately south of the main building, which totals approximately 1.5 million square feet. Three recharge basins are located in the southwest corner of the property adjacent to Lakeville Road. The majority of the remaining property is used for parking. The site is manned with 24-hour security. The OU-1 treatment system is located on the northeast corner of the OU-1 site.

OU-2 includes the "off-site" areas immediately surrounding the site. The OU-2 site is located in the Village of Lake Success in Nassau County. The mailing address of the OU-2 facility is 365 Lakeville Road, Lake Success, New York 11020. The OU-2 site is located in an area comprised of commercial and residential properties. Commercial facilities surround the property on the east, northeast and northwest. Residential properties border the site to the southeast, south and southwest. Several golf courses are located north and northwest of the site. Lake Success is located within 1,600 feet to the north. There are six schools and one hospital which are located within a 3 kilometer (approximately 2 miles) radius of the site. There are at least 14 public supply wells within a one and half mile radius of the site. Some of the off-site work which has been completed includes installation

of off-site monitoring wells, sampling of off-site wells, and other related activities. The OU-2 treatment system is located at the end of Tanners Road. The OU-2 treatment system includes monitoring wells that are located off-site. A new monitoring well cluster #46 will be installed in the northwest corner of the North Shore Hebrew Academy (NSHA) property. The NSHA property is located at the northwest corner of the North Service Road of the Long Island Expressway and Community Drive Incorporated Village of Lake Success. Cluster #46 will be comprised of a vertical profile boring and 2-3 monitoring wells installed at depths ranging between 250 and 350 feet below ground surface. Additional monitoring well clusters may be installed in the future if determined to be required.

The LMC site has been placed on the New York State Department of Environmental Conservation (NYSDEC) Registry a Class 2 inactive hazardous waste site on May 1, 1991. The site number is 130045. There are no other listed hazardous waste sites in the immediate vicinity of the site.

1.2.1 System Descriptions

1.2.1.1 OU-1 System Description

The On-Site OU-1 Groundwater Treatment System consists of the following major components:

- Three groundwater extraction wells (EW-1, RW-1RS, and RW-1RD) located and designed to efficiently capture and contain on-site volatile organic compound (VOC) impacted groundwater;
- Two air strippers (AS-100 and AS-200) designed to reduce the concentration of VOCs in the recovered groundwater;
- Four diffusion wells (DW-9 through DW-12) located and designed to assist with the re-injection of treated water; and
- Four emission control units (ECU-1 through ECU-4) designed to reduce the concentration of VOCs in effluent vapor.

Groundwater impacted by VOCs is extracted from the subsurface aquifer and pumped to the OU-1 groundwater treatment plant for treatment prior to discharge back to the aquifer. Specifically, the extracted groundwater is pumped through the two air strippers, which are arranged in a series configuration, to remove the VOCs from the groundwater. The treated groundwater is then pumped through a subsurface pipeline to the four diffusion wells and reintroduced back into the aquifer.

During the air stripping process, while the influent groundwater flows downward through the air strippers, the VOCs are transferred from the water to the countercurrent air stream. The stripper off-gas (the VOC laden air stream) is then treated by the four ECUs to remove the VOCs prior to discharge of the air back to the atmosphere. There are two ECUs that are filled with vapor-phase granular activated carbon (VPGAC) and two ECUs that contain potassium permanganate impregnated zeolite (PPZ). The air stripper off-gas enters the VPGAC ECUs first, where the majority of the VOCs are removed, and then passes on to the PPZ ECUs, where vinyl chloride is removed prior to discharge to the atmosphere.

1.2.1.2 OU-2 System Description

The Off-Site OU-2 Remediation System consists of the following major components:

- One groundwater recovery well (RW-100) located and designed to efficiently capture off-site, VOC-impacted groundwater;
- Two air strippers (AS-100 and AS-200) designed to reduce the concentration of VOCs in the recovered groundwater;
- Three diffusion wells (DW-100, DW-101, and DW-102) located and designed to assist with the re-injection of treated water; and
- ECUs to reduce the concentrations of VOCs in effluent vapor.

During operation, groundwater, impacted by VOCs, is extracted from the subsurface aquifer, pumped to the Off-Site Remediation System for treatment, and is then recharged back to the aquifer. Specifically, the extracted groundwater is pumped from the one recovery well (RW-100), through the two air strippers, which are arranged in a series configuration, to remove the VOCs from the groundwater. The treated groundwater is then pumped through a subsurface pipeline to three diffusions wells (DW-100 through DW-102) where it is re-injected back into the aquifer.

During the air stripping process, the VOCs are transferred from the water (which enters the air strippers at the top) to the counter-current air stream (which enters the air strippers at the bottom). The air stripper off-gas vapor is then treated by three ECUs filled with VPGAC and two ECUs filled with PPZ.

1.3 References

This HASP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, United States Environmental Protection Agency (USEPA) regulations, and BBL Environmental Services, Inc. (BBLES) health and safety policies and procedures. This plan follows the guidelines established in the following:

- *Standard Operating Safety Guides*, USEPA (Publication 9285.1-03, June 1992).
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, OSHA, USCG, USEPA (86116, October 1985).
- *Title 29 of the Code of Federal Regulations* (CFR), Part 1910.
- *Title 29 of the Code of Federal Regulations* (CFR), Part 1926.
- *Pocket Guide to Chemical Hazards*, DHHS, PHS, CDC, NIOSH (2003).
- *Threshold Limit Values*, ACGIH (2005).

- *Guide to Occupational Exposure Values*, ACGIH (2005).
- *Quick Selection Guide to Chemical Protective Clothing*, Forsberg, K. and S.Z. Mansdorf, 2nd Ed. (1993).
- *Health and Safety Policies and Procedures Manual*, BBLES (2005).

1.4 Definitions

The following definitions are applicable to this HASP:

- *Site* - The area where the work is to be performed includes on- or off-site areas. On site is defined as on the LMC property within the fenceline.
- *Project* - All work performed under the scope of work for investigation and remediation activities.
- *Subcontractor* - Includes subcontractor personnel hired on-site by BBLES.
- *On-Site Personnel* - All BBLES and BBLES subcontractor personnel involved with the project.
- *Visitor* - All other personnel involved with BBLES project activities, except the on-site personnel as defined above. All visitors must receive approval to enter the work areas and must review or be informed of the contents and requirements of this plan.
- *Exclusion Zone (EZ)* - Any portion of the site where hazardous substances are, or are reasonably suspected to be, present in the air, water, or soil.
- *Contamination Reduction Zone (CRZ)* - Area between the EZ and Clean Zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.
- *Clean/Support Zone (CZ)* - The rest of the site where exposure to site constituents is not anticipated. Support equipment is located in this zone.
- *An affected employee* - Is a person who operates or uses a machine and/or equipment that receives servicing or maintenance under lockout and/or tagout, or who works in an area where such servicing or maintenance is being performed.
- *An authorized employee* - Is a person who locks out and/or tags out a machine and/or equipment in order to perform servicing or maintenance on the machine. An effected employee becomes an authorized employee when that employee's duties include performing service and/or maintenance under lockout/tagout.
- *An energy isolating device* - Is a mechanical device that physically prevents the transmission or release or energy, including but not limited to the following: A manually operated electrical circuit breaker, a disconnect switch, a manually operated switch by which the conductors of a circuit can be disconnected from all underground supply conductors and, in addition, no pole can be operated independently; a line valve; a block; a chain; restraining device to prevent the movement of equipment; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

- *Lockout* - Is the placement of a lock or lockout device on an energy-isolating device, in accordance with an established procedure, ensuring that the energy-isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

- *Tagout* - Is the placement of a tag on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tag is removed.

- *Restraint* - Is the application of a chain, block, or other similar mechanical means to prevent movement of a part of a system/device.

- *Direct-push* - All sampling activities that use equipment that are hydraulically powered and use static force and dynamic percussion force to advance small-diameter sampling tools.

2. Roles and Responsibilities

The following outlines BBLES personnel and subcontractors for investigation activities at the site.

TABLE 2-1
KEY PERSONNEL

Client Key Personnel		
Title/Role	**Name**	**Address/Telephone No.**
Project Coordinator	Tina Armstrong, Ph.D.	6801 Rockledge Drive, CLE-610, Bethesda, MD 20817 Phone: 301-214-9971 Cell: 410-279-8637
BBLES Key Personnel		
Role	**Name**	**Address/Telephone No.**
Project Officer	Lowell W. McBurney, P.E.	6723 Towpath Road, Syracuse, NY 13214 Phone: 315-446-9120
Project Manager	Scott Morris, P.E.	2001 Marcus Avenue, STE S170, New Hyde Park, NY 11042 Phone: 516-328-0464 Cell: 516-592-9355
Site Supervisor / Health & Safety Supervisor (Field Task Manager)	Scott DeCesare	2001 Marcus Avenue, STE S170, New Hyde Park, NY 11042 Phone: 516-328-0464 Cell: 516-459-8848
Health and Safety Officer	Jay D. Keough, CIH	8 South River Road, Cranbury, NJ 08512-3698 Phone: 609-860-0590
Health and Safety Manager	Charles P. Webster, CSP	6723 Towpath Road, Syracuse, NY 13214 Phone: 315-638-0104
Subcontractor Personnel		
Company/Role	**Name**	**Address/Telephone No.**
Arcadis/O&M Support	Nicholas Valkenburg	88 Duryea Road, Melville, NY 11747 Phone: 631-249-7600
Delta Well and Pump Co.	Chris Okon	97 Union Avenue, P.O. Box 1309 Ronkonkoma, NY 11779 Phone: 631-981-2255
Ziegenfuss Drilling Inc.	Mark Ziegenfuss	P.O. Box 308, Ringoes, NJ 08551 Phone: 908-788-5100
United Fence and Guard Rail Corp.	Allan Oakland	25 Mill Road, Ronkonkoma, NY 11779 Phone: 631-467-6677

2.1 BBLES Personnel

2.1.1 Project Officer

The project officer (PO) is responsible for providing resources so that project activities are completed in accordance with this HASP and for meeting all regulatory and contractual requirements.

2.1.2 Health and Safety Officer

The health and safety officer (HSO) or his/her designee (the manager, health and safety) has overall responsibility for the technical health and safety aspects of the project, including review and approval of this HASP. Inquiries regarding BBLES health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSO or his/her designee must approve changes or addenda to this HASP.

2.1.3 Project Manager

The project manager (PM) is responsible for verifying that project activities are completed in accordance with the requirements of this HASP. The PM is responsible for confirming that the site supervisor (SS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this HASP, and/or those subcontractors assigned to this project meet the requirements established by BBLES. It is also the responsibility of the PM to perform the following duties:

- Consult with the HSO on site health and safety issues;
- Verify that subcontractors meet health and safety requirements prior to commencing work;
- Review Loss Prevention Observation (LPO) forms;
- Verify that all incidents are thoroughly investigated;
- Approve, in writing, addenda or modifications to this HASP; and
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance.

2.1.4 Health and Safety Supervisor

The health and safety supervisor (HSS) is responsible for field health and safety issues, including the execution of this HASP. Questions in the field regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSS will advise the PM on health and safety issues, and will establish and coordinate the project air monitoring program if one is deemed necessary

(see Section 6.1, Air Monitoring). The HSS is the primary site contact on health and safety matters. It is the responsibility of the HSS to perform the following duties:

- Provide on-site technical assistance, if necessary;
- Participate in all incident/near miss investigations (II), and confirm that they are reported to the HSM/HSO, client, PO and PM within 24 hours;
- Coordinate site and personal air monitoring, as required, including equipment maintenance and calibration;
- Conduct site safety orientation training and safety meetings;
- Verify that BBLES personnel and subcontractors have received the required physical examinations and medical certifications;
- Review site activities with respect to compliance with this HASP;
- Maintain required health and safety documents and records;
- Assist the Site Supervisor (SS) in instructing field personnel on project hazards and protective procedures; and
- Review LPO forms.

2.1.5 Site Supervisor

The site supervisor (SS) is responsible for implementing this HASP, including communicating requirements to on-site personnel and subcontractors. The SS will be responsible for informing the PM of changes in the work plan, procedures, or site conditions so that those changes may be addressed in this HASP. Other responsibilities are to perform the following duties:

- Consult with the HSS on site health and safety issues (the HSS and SS are likely to be the same person for purposes of this remedial work);
- Conduct LPOs at the site and complete the LPO forms;
- Stop work, as necessary, for personal safety, protection of property, and regulatory compliance;
- Obtain a site map, determine and post routes to medical facilities, and post emergency telephone numbers;
- Notify local public emergency representatives (as appropriate) of the nature of the site operations and post their telephone numbers (e.g., local fire department personnel who would respond for a confined-space rescue);
- Observe on-site project personnel for signs of ill-health effects;
- Investigate and report any incidents to the HSS;

- Verify that all on-site personnel have completed applicable training;
- Verify that on-site personnel are informed of the physical, chemical, and biological hazards associated with the site activities and the procedures and protective equipment necessary to control the hazards; and
- Issue/obtain any required work permits (hot work, confined space, etc.).

2.2 Subcontractors

Subcontractors and their personnel must understand and comply with applicable regulations and site requirements established in this HASP. Subcontractors may prepare their own site-specific HASP that must be consistent with the requirements of this HASP.

All subcontractor personnel will receive training in accordance with applicable regulations and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. All subcontractor personnel will attend an initial hazard briefing prior to beginning work at the site. Additionally, on-site subcontractor personnel must attend and participate in the daily site safety meetings.

Subcontractors must designate individuals to function as the PM, HSO, HSS, and SS. In some firms, it is not uncommon for the duties of the HSO to be carried out by the PM. This is acceptable, provided that the PM has the required knowledge, training, and experience to properly address all hazards associated with the work, and to prepare, approve, and oversee the execution of the site-specific HASP. A subcontractor may designate the same person to perform the duties of both the HSS and the SS. However, depending on the level of complexity of a contractor's scope of work, it may be infeasible for one person to perform both functions satisfactorily.

2.3 All On-Site Personnel

All on-site personnel (including subcontractors) must read and acknowledge their understanding of this HASP before commencing work, and abide by the requirements of the HASP. All on-site personnel must sign the HASP Acknowledgement Form after reviewing this HASP.

All BBLES and subcontractor personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all on-site personnel will attend an initial hazard briefing (prior to beginning work at the site) and the daily safety meetings.

All on-site personnel must perform a safe performance self-assessment (SPSA) prior to beginning each work activity. The SPSA process is presented in Section 4.2.1. This process must be performed prior to beginning each activity and after any near-miss or other incident to determine if it is safe to proceed. On-Site personnel will immediately report the following to the SS or HSS:

- Personal injuries and illnesses, no matter how minor;
- Unexpected or uncontrolled release of chemical substances;
- Symptoms of chemical exposure;

- Unsafe or hazardous situations;
- Unsafe or malfunctioning equipment;
- Changes in site conditions that may affect the health and safety of project personnel;
- Damage to equipment or property;
- Situations or activities for which they are not properly trained; and
- Near misses.

2.4 Visitors

All visitors to BBLES work areas must check in with the SS. Visitors will be cautioned to avoid skin contact with surface soils, sediment, or other materials that may be, or are suspected to be, impacted by constituents of concern (COCs).

Visitors requesting to observe work at the site must don appropriate personal protective equipment (PPE) prior to entering the work area, and must have the appropriate training and medical clearances to do so. If respiratory protective devices are necessary, visitors who wish to enter the work area must have been respirator trained and fit-tested for a respirator within the past 12 months.

2.5 Stop Work Authority

Every BBLES employee and sub-contractor is empowered, expected and has the responsibility to stop the work of another co-worker if the working conditions or behaviors are considered unsafe.

2.6 Short Service Employee (SSE) Program

Recognizing that employees who are new to the Firm are at a greater risk for incidents, the following guidelines are established to identify those employees and ease their transition. Short Service Employees (SSEs) will have an assigned field mentor to assist them in adjusting to the project requirements and procedures. SSEs will be identified in the field by wearing an orange hardhat or baseball-type cap.

- BBLES employees new to the industry and new to BBLES will be designated SSEs for 6 months.
- BBLES employees experienced in the industry but new to BBLES will be designated SSEs for 3-months.

Additionally, the following apply:

- a crew of 2-3 may have 1 SSE on site;
- a crew of 5 may have 2 SSEs on site; and

- a crew of 10 or more may have no more than 3 SSEs on site.

2.7 Near-Miss Reporting Hotline

In an effort to streamline near-miss reporting, especially for employees conducting field work who do not have real-time access to the web, BBLES has established a toll-free Near-Miss Reporting Hotline. The hotline will be checked daily and data will be entered into the BBLES LPS Database with the caller listed as the primary contact for the event. All entries will be saved as initial and can be accessed by the caller when they return to their computers. Entry into the database does not relieve the caller from the responsibility of following through with the near-miss investigation or of notifying other employees in the office or project team of the occurrence.

THE NEAR-MISS REPORTING NUMBER IS 1-866-242-4304

Callers will be prompted to provide the following information:

- Name and phone number;
- Date of near-miss;
- Location;
- Project Number (if applicable);
- A brief description of what happened;
- Name of division or office Vice President;
- What you think could have happened if this situation had resulted in an injury or damage; and,
- Any other information you think may be important.

The intent of this service is to enable employees to phone in near-misses immediately and have the events entered into the BBLES LPS Database. Following all near-misses employees are expected to immediately conduct an SPSA in accordance with Section 4.2.1 to ensure that it is safe to continue with the task.

3. Project Hazards and Control Measures

3.1 Introduction

The scope of construction work for this project includes the following tasks:

- mobilization;
- equipment upgrades;
- start-up/operation and maintenance (O&M);
- drilling/direct push boring operations
- water sampling, groundwater sampling, well development and well repair activities;
- soil vapor, indoor air and ambient air sampling; and
- demobilization.

The following job safety analyses (JSAs) identify potential health, safety, and environmental hazards associated with each activity listed above. Because of the complex and changing nature equipment upgrades, supervisors must continually inspect the site to identify hazards that may affect on-site personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the PM whenever these changes impact employee health, safety, the environment, or performance of the project. The SS will keep on-site personnel informed of the changing conditions and the PM will write and/or approve addenda or revisions to this HASP as necessary.

Each activity is described below, and potential hazards and control measures for each activity are discussed.

3.2 Mobilization

Site mobilization may include establishing EZs, CRZs, and SZs if needed and staging equipment and materials required for equipment upgrades. Mobilization may also involve clearing areas for the SZ and CRZ. During this initial phase, project personnel will walk the site to confirm the existence of anticipated hazards, and identify safety and health issues that may have arisen since the writing of this plan.

The hazards of this phase of activity are associated with equipment movement, manual materials handling, and manual site preparation. Manual materials handling and manual site preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion and laceration hazards.

The site may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil.

Environmental hazards will include: plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat/cold-related illnesses; and, pathogens, such as rabies, lyme disease, and blood-borne pathogens. Control procedures for these hazards are discussed in Section 4.0.

3.3 Equipment Upgrades/Construction-Related Site Safety

Equipment Upgrades/Construction related site activities involve a potential for exposure to many physical and health hazards. Hazards may be associated with the materials used in installing equipment upgrades or the activities themselves.

Physical Hazards: The physical hazards involved with installing equipment upgrades relate to work done with heavy equipment, hand tools, and the construction environment itself. There exists a potential for incidents involving personnel struck by or struck against equipment or materials, resulting in fractures, cuts punctures, or abrasions. Walking and working surfaces during equipment upgrade activities may involve slip, trip, and fall hazards. Working at elevations may create potential fall hazard.

Working Surfaces: Slippery work surfaces can increase the likelihood of back injuries, over extension injuries, and slips and falls. All personnel should frequently inspect working surfaces and keep working surface clear of debris.

High Work Operations: Construction and maintenance workers are exposed to falls when not utilizing fall protection equipment while conducting work at elevations. High work surfaces must be properly protected with railings and tabards, or personnel must wear fall protection devices.

Materials Handling: The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or a toe gets caught between two objects. Extreme care must be taken when loading and unloading material. Proper lifting technique must be employed, and mechanical means must be used to lift objects whenever possible.

Health Hazards: Due to the type of work involved in many equipment upgrade/construction activities, the primary health hazards involve repetitive motion disorders, lifting, and other ergonomic stressors. Noise may also present a hazard. Operation of heavy equipment and power actuated and pneumatic hand tools frequently results in high noise levels. Another health hazard involves the emission of vapors or off-gases during manipulation of certain pieces of equipment and/or construction materials.

Control: Prior to initiating any equipment upgrade/construction activity, the operation will be explained to all employees. Hazards will be identified and protective measures will be explained. Lockout tagout (LOTO) procedures will be followed prior to removing any existing equipment or installing any new equipment. Equipment will be inspected and in proper working condition. Employees should receive training to address the equipment, its operations, and care. If confined space entries are required, confined space entry procedures will be followed prior to any confined spaced entries. Hot work activity procedures will be followed prior to any hot work activities. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods. Mechanical assistance should be provided for large lifting tasks. Hearing protection is required for use when exposed to noise levels exceeding 85 dBA, or a level which commonly results in difficult conversation. Potential exposure to off-gases must be reviewed on an individual basis.

3.3.1 Lockout/Tagout Control of Hazardous Energy/Materials

This section provides information and procedures for protecting employees from injuries associated with hazardous energy, unexpected start-up of equipment, and hazardous material and delineates guidelines for employees and subcontractors to follow when performing work in, on, and around energized equipment as defined in the Occupational Health and Safety Administration Standard, 29 CFR 1910.147, The Control of

Hazardous Energy (Lockout/Tagout). This procedure also assigns responsibility for administration and training with respect to lockout/tagout procedures.

3.3.1.1 Lockout/Tagout Identification and Designation

Identifications: The BBLES HSS is responsible to identify all equipment and hazardous material requiring use of lockout/tagout.

Classifications: All field, servicing, and maintenance activities which require:

- Removal or by-passing of a machine guard or protective enclosure; or
- Personnel to place any part of their body in a place where the accidental energization of equipment, release of stored energy, or release of stored hazardous materials may cause injury.

Hazardous Energy covered by this procedure includes, but is not limited to:

- electrical;
- mechanical;
- hydraulic;
- pneumatic;
- chemical;
- thermal;
- gravitational (stored);
- pressure (stored); and
- hazardous materials.

3.3.1.2 Duties of Personnel

Project Officer Responsibilities

- Verify that all provisions of this procedure are enforced for employees.
- Verify that client contract requirements are consistent with the provisions of this section with respect to lockout/tagout procedures.
- Verify that required lockout/tagout equipment is available for employees.

Project Manager Responsibilities

- Review project work scope to ensure it is consistent with the requirements of this section with respect to lockout/tagout procedures.
- Notify the HSS of any site-specific need for development of additional lockout/tagout procedures.

Health and Safety Officer Responsibilities

- Communicate with HSS concerning the addition of any new lockout/tagout procedures;
- Communicate changes in current lockout/tagout regulations and changes in this procedure to employees; and
- Review and update lockout/tagout procedures at least annually to assure compliance with regulatory requirements.

Health and Safety Supervisor Responsibilities

1. Communicate need for additional lockout/tagout procedures to the HSO;
2. Communicate changes in lockout/tagout procedures to employees; and
3. Enforce applicable lockout/tagout procedures.

Employee Responsibilities

- Must understand and follow lockout/tagout procedures;
- Inform HSS or HSO of any non-compliance with required lockout/tagout procedures; and
- Inform HSS or HSO of need for additional lockout/tagout procedures.

3.3.1.3 Safety Procedures for Lockout/Tagout and Isolation

Use of a lockout device and an attached tag is required on all isolating devices capable of being locked out or accepting lockout devices. If an energy isolating device is not capable of being locked out, use of a tagout system designed to provide full employee protection against equipment start-up is required. When a tagout device is used on an energy-isolating device, the tag shall be attached at the same location that the lockout device would have been attached. Tagout will only be used with the approval of the HSO. Additional precautions will be implemented to provide a level of safety equivalent to that obtained by using a lockout device. Additional safety measures may include such steps as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or removal of a valve handle to reduce the likelihood of inadvertent energization. A Lockout/Tagout Inspection Checklist and a Lockout/Tagout Equipment Specific Energy Control Procedure for site equipment is provided in Attachment A.

Lockout/tagout isolation procedures will be initiated only by authorized personnel. Personnel not trained in lockout/tagout procedures are not authorized to install, inspect, repair, adjust, remove, maintain, or service equipment where the potential for injury due to accidental start-up, energization, or release of stored energy exists.

All affected personnel must be notified prior to equipment deactivation and isolation.

All affected personnel must be notified prior to equipment reactivation after isolation measures have been removed.

Personnel involved with lockout/tagout isolation of equipment shall receive information concerning the specific type and magnitude of energy or hazardous material involved, the hazards involved, and the method of control to be utilized.

Authorized personnel shall de-energize equipment by following a procedure developed specifically for the equipment involved and consistent with 29 CFR 1910.147.

Prior to performing any work on equipment, all isolation devices shall be in place. Locks and tags shall be affixed to each energy-isolating device by authorized personnel. Devices include hasps, locks, tags, circuit breaker locks, locking covers, and chains. These must secure the isolated equipment in the "off" position. Each person involved with servicing the isolated equipment shall attach a lock to the isolating device. In situations involving two or more persons, multiple lock hasps shall be utilized. Tags shall be attached with all locks and must identify the authorized individual responsible for each lock.

All potentially stored or residual energy must be released, relieved, or disconnected. If there is a potential of accumulation, verification of isolation shall be conducted and documented throughout the project.

Prior to work, authorized personnel shall verify and document that the equipment has been disengaged, de-energized, and isolated.

Release of lockout/tagout isolation:

- The work area and equipment shall be inspected to ensure that non-essential items (i.e., tools) are not left in the work area and that the equipment is intact.

- The work area shall be checked to ensure that all personnel are clear. Before lockout/tagout devices are removed, affected personnel shall be notified.

- Removal of lockout/tagout devices shall be performed by the authorized personnel who attached the devices.

If a machine must be re-energized after initial isolation (i.e., for testing or repositioning), then lockout/tagout procedures must be followed as outlined to re-isolate the equipment.

During shift or personnel changes, transfer of control will occur between authorized personnel only. If an authorized person must leave the site, then he/she must remove his/her locks and tags. The new authorized person will then immediately place his/her locks and tags on the equipment and complete the entire lockout/tagout procedure as outlined above.

Use of tagout procedures without the use of locks can only be utilized if the equipment to be de-energized will not accept a lock and the following conditions are met:

- Tagout procedures will provide protection to personnel equivalent to the use of locks.

Additional measures, sufficient to ensure protection of employees, are taken to prevent accidental start-up or energization.

3.3.1.4 Equipment List

- Lockout tagout materials and equipment necessary to execute project work include locks, tags, chains, wedges, key blocks, plug lockouts, adapter pins, self locking fasteners, or other hardware for isolating, securing, or blocking of machines or equipment to prevent energy sources.

- Lockout devices and tags are color coded red, and are the only device(s) used for controlling energy. Locks and tags must not be used for other purposes. All locks and tags provided are capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected. Locks and tags are of substantial construction in order to prevent inadvertent or accidental removal. All tags are required to be marked to identify the employee applying the lock(s)/tag(s).

- Tags are of standard print and format. Tags are constructed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible. Tags will warn against hazardous conditions if the machine or equipment is energized, and will include a legend such as the following: "Do Not Start," "Do Not Open," "Do Not Close," "Do Not Energize," or "Do Not Operate," depending on application.

- When replacement or major repair, renovation, or modification of a machine or equipment is performed, and when new machines or equipment are installed, energy-isolating devices designed to accept a lockout device for such machines or equipment will be installed.

3.3.1.5 Audit of Lockout/Tagout

The BBL Corporate Health and Safety Division reviews the written lockout/tagout SOPs on an annual basis.

The HSO will select an authorized person to conduct an audit to review any equipment-specific SOPs and the general SOP. A designated individual will review the lockout/tagout procedure for a specific machine or general application and complete the Lockout/Tagout Inspection Checklist (Attachment A).

The HSO will review and maintain documentation of each lockout/tagout procedure audit.

3.3.1.6 General Lockout/Tagout

Only employees and subcontractors who have received training as authorized employees are authorized to implement lockout/tagout procedures. Only authorized employees may affix locks/tags to energy-isolating devices on the referenced equipment/machines and conduct the above-referenced service and maintenance activities. Unauthorized employees shall not conduct the above-referenced service and maintenance activities or affix locks/tags to energy-isolating devices on the referenced equipment/machines. All employees, upon observing a machine and/or equipment that is locked and/or tagged out, shall not attempt to start, energize, or use the machine and/or equipment.

All employees affected by implementation of a lockout/tagout must be notified by the authorized employee(s) prior to equipment/machine shutdown and isolation.

Locate and identify type of energy requiring lockout/tagout:

- electrical;
- hydraulic;
- chemical;
- mechanical;
- pneumatic;
- thermal;
- hazardous material; and
- other.

Lockout/Tagout Sequence

- The authorized employee(s) shall notify all affected employees prior to the shutdown and isolation of the equipment/machine. Affected employees should be informed of the reason for shutdown and approximate length of time required for servicing or maintenance.

- The authorized employee(s) shall review the type(s) and magnitude(s) of energy present and the hazards present.

- If the machine/equipment is operating, the authorized employee(s) shall have the machine/ equipment operator explain the standard shutdown procedure and then shut it down according to the procedure.

- The energy isolating devices shall be deactivated so the machine/equipment is isolated from the energy source(s).

- Each isolating device shall be locked out and tagged out. If lockout is not feasible, only tagout of the isolating device will be conducted, and additional precautions will be required to provide employee protection equivalent to the protection provided when lockout procedures are utilized. Each authorized person conducting activities on the equipment/machine shall attach a(n) [individually assigned] safety lock to each isolating device. A standard tag shall also be attached to each individual's lock that identifies, by name, the authorized employee responsible for each lock. For the activities covered by this SOP, safety locks and/or multi-lock hasps must be attached to all energy isolation devices.

- Stored or residual energy must be released or dissipated from each system to reach a zero energy state. Visual inspection shall be made to confirm that all moving parts have stopped. Any stored or residual energy shall be drained, blocked, repositioned, restrained, or bled. Electrical circuits shall be grounded to discharge electricity stored in capacitors.

- To ensure that the equipment is completely isolated from the energy source(s), it is necessary to test the equipment to make certain that it will not operate. The following methods shall be used to test the equipment:

    1. Check the area and equipment to assure that no personnel are exposed to the start-up of equipment;

    2. Activate all start-up devices and operating controls;

    3. Use tic-tracers or voltage indicators to test electrical circuits; and

    4. Return all operating control(s) to the neutral or off position after verifying the isolation of the equipment.

5. Equipment/machine is locked and tagged out.

Release of Lockout/Tagout and Return of Equipment to Service

- When the equipment/machine is ready to be returned to service at the conclusion of work activities, the following steps shall be taken to safely return equipment to service:

  1. Check the machine/equipment and immediate area to ensure that non-essential items and tools have been removed;

  2. Check to ensure that all guards and covers have been replaced;

  3. Check to ensure that all employees are safely positioned or have left the area;

  4. Check to ensure that all operating controls are in the neutral or off position;

  5. All authorized employees shall personally remove their individual locks and tags from the isolation devices; and

  6. All affected employees must be notified that the work activities are completed and the equipment/machine is ready for use.

- If work activities are not completed prior to a shift ending (or other personnel change), then the procedures in "Transfer of Lockout/Tagout during Shift and Personnel Changes" (below) must be followed.

Transfer of Lockout/Tagout during Shift and Personnel Changes

- The HSS shall designate an authorized employee who shall control the lockout/tagout devices at the end of a shift and shall be responsible for transferring lockout/tagout authority to the next shift.

- The designated authorized employee shall not remove his/her lock from any of the isolation devices until at least one of the arriving authorized employees has locked out and tagged out all of the isolation devices.

- If the arriving authorized employees assuming responsibility for lockout/tagout do not attach locks prior to the previous shift employees removing all of their locks, then the employees assuming lockout/tagout authority shall repeat the entire lockout/tagout sequence.

3.3.1.7 Group Lockout/Tagout

- When more than two employees are involved in work activities on the machine or equipment, each authorized employee will attach a lock to a multi-lock hasp on each isolation device.

- When group lockout/tagout is utilized, the last authorized employee with a lock attached to isolation devices will be responsible for removing the isolation devices and restoring equipment to use conditions according to the equipment-specific or general lockout/tagout procedures.

3.3.1.8 Employee Unavailable to Unlock

If the employee who installed a locking device is not available, the following procedure shall be used to unlock the device(s).

The individual requesting device removal will attempt to contact the authorized employee via cell phone, hotel phone or home phone and request the employee return to remove the device. If the authorized employee is contacted but can not come in, the status of the locked equipment will be documented and the requesting entity notified of the equipment status. All of the above to include unanswered attempts at contact will be documented. If contact is not made, a message will be left to indicate that the locking device will be removed. Upon removal a red warning tag will be left where the device was placed indicating to the authorized employee that the device was removed and the equipment is now energized.

- The HSS will verify that the authorized employee is not at the facility and is not potentially in harms way relative to the affected equipment.
- The HSS will notify the HSO or his designee, PM, of the reason for device removal and the status of the affected employee.
- The device shall be removed after verifying that no employees are in harms way.
- The entire sequence of events will be documented in the form of a memorandum addressed to BBLES' Vice-President of Health and Safety.

3.3.1.9 Cautions

If after conducting an SPSA, you are unsure of the correct lockout/tagout procedure or, do not feel that the given procedure is correct, STOP WORK and ask for assistance!

Isolation procedures will be initiated only by authorized personnel trained in lockout/tagout.

All energy sources must be isolated and locked out. Be aware that there can be more than one energy source.

Additional safety precautions must be taken in situations where only a tag can be used.

Stored energy must be released or isolated after applying lockout/tagout devices.

Make sure that all tools and equipment are removed from the work area prior to removing lockout/tagout devices and restoring energy.

3.3.1.10 Quality Assurance (Training)

New Employees

- Receive orientation from the HSS concerning lockout/tagout policies and procedures;
- Receive orientation concerning lockout/tagout responsibilities; and

- Receive update training concurrent with other safety training programs on an as-needed basis.

Existing Employees

- Receive initial information concerning lockout/tagout procedures through the distribution and review of this HASP.
- Receive updated training concurrent with other safety training programs on an as-needed basis.
- Receive retraining whenever inspection reveals inadequacies in employee's knowledge of the program.
- Receive updated training whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.

Training Documentation

Training will be documented on a Lockout/Tagout Training Certification Form provided and maintained by the HSS.

3.3.2 Confined Space Entry

This section provides information and procedures for working in confined spaces. When confined space entry is conducted on the site the following sections and the requirements of 29 CFR 1910.146 must be followed. A confined space is defined as a space large enough and so configured that an employee can bodily enter and perform assigned work, has limited means for entry or exit, and is not designed for continuous employee occupancy. Some confined space work may pose additional hazards such as air contamination, flammable or explosive atmosphere, and oxygen deficiency. Confined space entry may pose the possibility of engulfment. Personnel must be properly trained in order to supervise and participate in confined space entry procedures or serve as standby attendants.

All confined spaces are initially considered permit required. Under certain conditions, a space may be reclassified as a non permit confined space provided the BBLES HSS reviews the reclassification, and the space meets the criteria outlined in 29 CFR 1910.146.

A Job Safety Analysis (JSA) as described in Section 4 shall be referred to prior to entering any confined space.

3.3.2.1 Confined Space Identification and Designation

Identifications: The BBLES HSS is responsible to identify all confined spaces into which BBLES employees or subcontractors will enter. Entry is considered to have occurred as soon as any part of the entrants body breaks the plane of an opening into the space.

The confined space for this project may include manholes, vaults, and tanks.

All confined spaces, shall be identified by posting danger signs or by any other equally effective means, of the existence and location of and the danger posed by the permit spaces.

Note: A sign reading DANGER – PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER or using other similar language would satisfy the requirement for a sign.

Classification: A confined space means a space that is large enough and so configured that an employee can bodily enter and perform assigned work, has limited or restricted means for entry or exit, and is not designed for human occupancy.

A permit-required confined space is a confined space meeting the above definition and also contains or could contain a hazardous atmosphere, or contains a material that has the potential for engulfing an entrant, or has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section, or contains any other recognized serious safety hazard. All confined spaces are initially considered permit required confined spaces.

3.3.2.2 Duties of Personnel

Each confined space being entered shall have a minimum of one (1) dedicated attendant and one other support person (who may have other duties) within sight or call.

Duties of Entrants:

- Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure.
- Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space.
- Alert the attendant whenever:
  - The entrant recognizes any warning sign or symptom of exposure to a dangerous situation; or
  - The entrant detects a prohibited condition;
- Exit from the permit space as quickly as possible whenever:
  - An order to evacuate is given by the attendant or the entry supervisor;
  - The entrant recognizes any warning sign or symptom of exposure to a dangerous situation;
  - The entrant detects a prohibited condition; or
  - An evacuation alarm is activated.

Duties of Attendants:

- Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure.
- Is aware of possible behavioral effects of hazard exposure in authorized entrants.

- Maintains an accurate count of authorized entrants in the permit space.

- Remains outside the permit space during entry operations until relieved by another attendant.

- Communicates with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space.

- Monitors activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions:

  - If the attendant detects a prohibited condition;
  - If the attendant detects the behavioral effects of hazard exposure in an authorized entrant;
  - If the attendant detects a situation outside the space that could endanger the authorized entrants; or
  - If the attendant cannot effectively and safely perform all his duties.

- Summon rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards.

- Takes the following actions when unauthorized persons approach or enter a permit space while entry is underway;

  - Warn the unauthorized persons that they must stay away from the permit space;
  - Advice the unauthorized persons that they must exit immediately if they have entered the permit space; and
  - Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.

- Performs non-entry rescues.

- Performs no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

Duties of Entry Supervisors:

- Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure.

- Verifies by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted, and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin.

- Terminates the entry and cancels the permit as required.

- Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations.

- Determines that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

- Documents on the entry permit any incidents or circumstances requiring review of the confined space entry program. Such incidents include:

  - Unauthorized entry;
  - The detection of a condition/hazard not authorized by the permit;
  - The occurrence of an injury or near-miss during entry;
  - A change in use or configuration of the space; or
  - Employee complaints about the program.

- Prescribes procedures for coordination of entry when personnel from multiple employers will work simultaneously. BBLES subcontractors shall follow BBLES procedures.

3.3.2.3 Procedures for Permit Space Entry

Acceptable Entry Conditions: The atmospheric conditions for entry into each space are outlined in Section 6.

Isolation Requirements: The confined space must be isolated to prevent the introduction of contaminants during entry. Isolation must include disconnecting or installing slip blanks into all lines leading to the space. When isolation is not practical or possible (as in sewer entry) entry conditions must be continuously monitored.

To prevent injury from physical hazards within the space, lockout, tagout, tryout and return to service procedures must be implemented for potential sources of hazardous energy.

Atmospheric Hazard Control: Atmospheric hazards must be eliminated or controlled to meet the requirements specified in section 6. If necessary, the space shall be purged or inerted, then ventilated to extent necessary to meet the criteria in section 6. Ventilation equipment may be needed to maintain these conditions.

Inspecting and Testing Procedures: The following equipment shall be available for testing each confined space:

- RAE systems MultiRAE or equivalent with photoionization detector (PID), lower explosive limit (LEL), O2, hydrogen sulfide (H2S) and carbon monoxide (CO) sensors.

All monitoring equipment shall be maintained in such quantity and condition, per manufacturer recommendations, to adequately monitor and assess all confined space entries.

Testing Procedures: Procedures for inspecting, monitoring and testing the confined space to verify that acceptable conditions exist prior to and continuously during entry.

Priority for atmospheric hazard testing shall be (1) oxygen, (2) combustible gases vapor, (3) toxic gases.

Communications: If verbal/radio communication is not practical, provisions for continuous communication between entrants and attendants may consist of the standard system of lifeline "tugs" below, so long as the attendants continuously hold the lifelines in their hands. If this is not practical or possible, portable air horns must be provided to all entrants and attendants. The same code for rope tugs will be used for air horn blasts:

Lifeline "Tug" Signals or Air Horn Signals

1 Tug/Horn Blast = Are you OK?

2 Tugs/Horn Blast = Yes, I am OK.
3 Tugs/Horn Blast = Exit the confined space immediately.

If the lifeline tug system or the air horn system are not feasible, powered communication equipment with the appropriate NEC rating shall be provided.

Personnel Protective Equipment (see Section 5 for General PPE requirements):

- Protective suits, boots, and gloves - including specifying the material of construction.
- Face, head, and foot protection.
- Specifying chest or parachute harness with approved lifelines at least ½-inch in diameter and 2,000 pounds test. (NOTE: Wristlets may be used only when a harness presents a greater hazard to the employee and wristlets are the safest, most effective alternative).
- All lifelines shall be secured to a mechanical device or fixed point outside the confined space. Mechanical devices shall be used for all vertical entry permit spaces greater than five (5) feet deep.

Other Required Equipment: Lighting and electrical shall be of the appropriate National Electrical Code (NEC) rating. Rating should be Class I, Division I unless the space specifically meets other rating requirements.

Openings to vaults in traffic areas must be protected with traffic cones or a temporary popup railing.

Ingress and Egress Equipment: All lifelines must be attached to a mechanical device or a fixed point outside the space such that a rescue can begin as soon as the rescuer becomes aware that a rescue is necessary. A mechanical device must be available to retrieve personnel from vertical type permit spaces more that 5 feet deep.

3.3.2.4 Permit System

Before entry is authorized, the Entry Supervisor shall complete and sign a Confined Space Entry Checklist and Confined Space Entry Permit to document that pre-entry requirements have been met and that acceptable entry conditions exist. The completed permit shall be posted at the primary entrance to the confined space.

All Entry Permits are valid for a maximum of (1) work shift, and shall be canceled by the Entry Supervisor when the shift ends, confined space operations are complete, or whenever a prohibited condition arises in or near the space. All confined spaces shall be securely closed or barricaded whenever the entry permit is canceled.

The BBLES Confined Space Entry Checklist (Attachment B) and Entry Permit (Attachment C) must be completed with all required information.

3.3.2.5 Training

General: Prior to assignment to confined space entry work, all employees shall receive training in the hazards of confined spaces, work practices to control these hazards, and duties to be performed.

Requirements for Entrants, Attendants: Basic training requirements for entrants and attendants all include 40 Hour (or equivalent) and Confined Space Entry Entrant/Attendant training. Personnel assigned to attendant duties shall be trained in non-entry rescue procedures.

Requirements for Entry Supervisors: Basic training for entry supervisors and personnel conducting atmospheric testing shall include Confined Space Entry Supervisor Training (or equivalent), 8 hour supervisor training, and 40 hour training.

Equivalent training must be approved by the HSM/HSO prior to assignment to entry duties.

3.3.2.6 Non-Permit Confined Space Entry

All confined spaces are initially considered permit required. Under certain circumstances, a space may be reclassified as a non-permit confined space provided the BBLES HSS reviews the reclassification and the space meets the criteria outlined in 29 CFR 1910.146

"Non-permit confined space" means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

A space classified by the HSS as a permit-required confined space may be reclassified as non-permit confined space under the following conditions:

- If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated.

- If it necessary to enter the permit space to eliminate hazards, such entry must be performed using a confined space entry permit. If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated.

Note: Control of atmospheric hazards through forced air ventilation does not constitute elimination of hazards.

- The HSS shall document the basis for determining that all hazards in a permit space have been eliminated, through a certification that contains the date, the location of the space, and the signature of the person making the determination. The certification shall be made available to each employee entering the space.

- If hazards arise within a permit space that has been declassified to a non-permit space, each employee in the space shall exist the space. The HSS shall then reevaluate the space and determine whether it must be reclassified as a permit space, in accordance with 29 CFR 1910.146.

- When there are changes in the use or configuration of a non-permit confined space that might increase the hazards to entrants, the HSS shall reevaluate that space and, if necessary, reclassify it as a permit-required confined space.

Each non-permit confined space being entered shall have a minimum of one dedicated attendant who can summon rescue or other emergency services as soon as the attendant determines that the entrant may need assistance to escape from a non-permit space.

Each non-permit confined space being entered shall be vented using forced air ventilation for one full minute prior to, and during the entire time the entrant is within the non-permit confined space. In addition, prior to entering, the non-permit confined space shall be tested for atmospheric hazards as described in Section 3.3.2.3.

3.3.3 Hot Work Activities

The purpose of the site hot work safety program is to protect all employees against hazards associated with activities producing sparks, flames or other ignition sources, and to prevent the loss of property due to fire. To effectively comply with the provisions of the OSHA standards governing fire prevention and hot work activities, the Hot Work safety program establishes policy and procedures to ensure that physical and chemical fire hazards present in the workplace are isolated from hot work activities. The hot work safety program is applicable to all welding, cutting, burning, grinding, and other spark-generating work activities. Each subcontractor may utilize their own hot work safety procedures as long as the requirements of this section and the applicable OSHA standards are met.

3.3.3.1 Designated Hot Work Areas

Each subcontractor may establish designated hot work areas on the site. Hot work conducted within a designated hot work area does not require a hot work permit. Designated hot work areas must be delineated, and all site personnel informed of their location.

All site personnel are responsible for keeping flammable and combustible materials out of designated hot work areas. All hot work conducted outside of designated hot work areas requires a hot work permit.

3.3.3.2 Conditions Prohibiting Hot Work

Hot work activities are prohibited in any areas of the site where the following conditions exist:

- If the requirements outlined in the hot work permit cannot be met, then hot work is prohibited and alternative methods shall be employed;
- In areas potentially containing explosive atmospheres due to the presence of flammable gases, vapors, liquids, or dusts; and
- Within 50 feet of an area where flammable or combustible liquids or gases are stored.

Hot work activities shall not be conducted within the areas outlined above. All on-site personnel are responsible for preventing hot work activities within prohibited areas.

3.3.3.3 Hot Work Permit

A hot work permit is required for welding, cutting, burning, grinding, or spark-generating hot work conducted outside of designated hot work areas. This section outlines the preparation, issuance, use, and tracking of hot work permits. BBLES' subcontractors may utilize their own hot work permits if they meet the requirements of this section. This procedure has been developed to ensure that basic precautions for fire prevention and employee safety are implemented prior to and during hot work activities conducted outside of designated hot work areas. A copy of the BBLES hot work permit is in Attachment D. Hot work must be considered in the task-specific JSA. The hot work permit contains a checklist to be completed by authorized personnel conducting the hot work; the checklist must be reviewed by the HSS prior to the start of hot work activities. The checklist is designed to ensure the measures outlined below are implemented prior to the start of hot work activities.

- If possible, the object or equipment on which hot work is to be conducted shall be moved to a designated hot work area.
- If an object or equipment on which hot work is to be conducted cannot be moved, all moveable fire hazards shall be moved at least 50 feet from the hot work operation.
- If the object or equipment on which hot work is to be conducted can not be moved, or all fire hazards cannot be removed, then guards, barriers, or screens shall be used to confine any heat, sparks, and slag, and to protect the immovable fire hazards.
- All floor, wall, and window openings or cracks within a 35-foot radius shall be protected to prevent exposure of combustible material to heat, sparks, flying sparks, or slag.
- Suitable fire extinguishing equipment shall be on-hand and ready for immediate use.
- If hot work will take place in an area where flying sparks and slag may injure employees working near, above, or below the hot work operation, then additional precautions shall be implemented to prevent injury to the employees (i.e., screens, barriers, caution tape, personal protective equipment, etc.).
- A fire watch will begin before hot work is initiated and will continue during and for a minimum of 30 minutes after the hot work concludes to ensure that there are not any smoldering fires. A fire watch is required whenever hot work is performed outside of designated hot work areas.
- Verify that combustible materials adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and which are likely to be ignited by conduction or radiation are protected by guards, barriers, screens, or moved 50 feet away from the metal partition, wall, ceiling, or roof.
- If hot work is to be conducted in a confined space, the requirements for confined space entry will be reviewed and followed.
- Hot work will not be performed in areas where other workers may be affected unless adequate engineering controls (local exhaust ventilation) or administrative controls (removed from area during hot work) are used to prevent personnel exposure.
- Welding, cutting, and other hot work will not be undertaken unless adequate ventilation, personal protective equipment, and well-maintained welding equipment are used by trained and authorized personnel.

- After welding or cutting has been completed, the work area will be thoroughly cleaned, and equipment returned to the proper location.

- Appropriate personal protective equipment and respiratory protection shall be used by all employees involved in hot work activities.

If any of the basic precautions for fire prevention can not be implemented prior to or during hot work which is conducted outside of designated hot work areas, then the hot work activities may not be conducted. At the conclusion of the hot work activities the hot work permit will be provided to the contractor's HSS for record keeping.

3.3.3.4 Fire Watch Procedures

A fire watch is required whenever hot work is performed outside of designated hot work areas. Fire watch personnel are required to meet the following requirements:

- Fire watch personnel must have fire extinguishing equipment readily available and ready for immediate use;

- Fire watch personnel must be trained in the use of the fire extinguishing equipment provided;

- Fire watch personnel must be familiar with the procedure to sound the fire alarm in the event of a fire and know the location of the nearest telephone;

- Appropriate personal protective equipment and respiratory protection shall be used by all fire watch personnel involved in hot work activities;

- Fire watch personnel must watch for fires in exposed areas, try to extinguish a fire when safe to do so, or otherwise activate the fire alarm system; and

- Authorized personnel must maintain a fire watch for at least 30 minutes after the hot work operations are completed.

If any of the above requirements can not be met, hot work shall not be conducted.

3.3.4 Materials Handling Safety

To protect all employees against hazards associated with materials handling, and to prevent injury due to unsafe heavy equipment operation, only properly trained and authorized operators will be allowed to operate heavy equipment. All materials handling equipment will be maintained in safe operating condition and inspected daily prior to use.

General heavy equipment safety requirements include the following:

- Prior to operating any heavy equipment, the authorized operator must conduct a pre-operation inspection to determine if the heavy equipment is in safe operating condition prior to each work shift;

- All mobile equipment will be equipped with an audible back-up alarm;
- Personnel will not be allowed to stand or pass under the elevated portion of any heavy equipment, whether loaded or empty;
- Personnel will not place arms or legs between pinch or scissors points of the equipment or outside the operator enclosure;
- A safe distance will be maintained from the edge of ramps or platforms;
- Operators will maintain sufficient headroom under overhead utilities, lights, pipes, sprinkler systems, etc.;
- Heavy equipment must never be used for lifting or transporting personnel;
- The operator is required to look in the direction of, and maintain a clear view of, the path of travel;
- Heavy equipment will not be operated without an overhead guard and roll-over protection to protect the operator against falling objects and roll-over;
- Heavy equipment must not be driven up to anyone standing in front of any object;
- Stunt driving and horseplay are strictly prohibited;
- Operators will yield the right-of-way to other site vehicles;
- Other heavy equipment traveling in the same direction, at intersections, blind spots, or other dangerous locations must not be passed;
- A safe distance will be maintained from other heavy equipment, and the equipment must be kept under control at all times;
- The heavy equipment operator must slow down for wet and slippery conditions. Under all travel conditions the equipment will be operated at a speed that will permit it to be brought to a stop in a safe manner;
- Operators will avoid running over loose objects on operating surfaces;
- Grades or ramps must be ascended or descended slowly;
- On all grades the load will be tilted back, and raised only as far as necessary to clear the operating surface;
- The operator will slow down and sound the horn at intersections, entering buildings, and other locations where vision may be obstructed;
- If the load being carried obstructs forward view, the operator will travel with the load trailing;
- While negotiating turns, speed will be reduced to a safe level, and turning will be in a smooth, sweeping motion to avoid abrupt turns and potential upset; and
- Authorized operators will only handle stable or safely arranged loads and loads within the rated capacity of the heavy equipment and will not affect the stability of the heavy equipment.

When a piece of heavy equipment is left unattended, hydraulics will be fully lowered, controls will be neutralized, power will be shut off, and brakes set. Wheels will be blocked or chocked if the heavy equipment is parked on an incline. If internal combustion engine-powered heavy equipment is utilized indoors, carbon monoxide levels shall be monitored to prevent personnel exposure.

3.4 Start-up/O&M-Related Site Safety

Start-up/O&M-related site activities involve a potential for exposure to physical and health hazards. Hazards may be associated with the materials used during the start-up/O&M activities or the activities themselves.

Physical Hazards: The physical hazards involved with system start-up/O&M relate to work done with hand tools and the work environment itself. There exists a potential for incidents involving personnel struck by tools, resulting in fractures, cuts, punctures, or abrasions. Walking and working surfaces during construction activities may involve slip, trip, and fall hazards.

Working Surfaces: Slippery work surfaces can increase the likelihood of back injuries, over extension injuries, and slips and falls. All personnel should frequently inspect working surfaces and keep working surface clear of debris.

Materials Handling: The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Extreme care must be taken when loading and unloading material. Proper lifting technique must be employed, and mechanical means must be used to lift objects whenever possible. Material handling procedures are described in Section 3.4.

Health Hazards: Due to the type of work involved in the start-up/O&M activities, the primary health hazards involve repetitive motion disorders, lifting, and other ergonomic stressors. Noise may also present a hazard. Operation of heavy equipment and power actuated and pneumatic hand tools frequently results in high noise levels. Another health hazard involves the emission of vapors or off-gases during manipulation of certain materials.

Control: Prior to initiating any start-up/O&M activity, the operation will be explained to all employees. Hazards will be identified and protective measures will be explained. Equipment will be inspected and in proper working condition. Employees should receive training to address the equipment, its operations, and care. LOTO procedures discussed in Section 3.3.1 will be followed prior to servicing any equipment requiring maintenance. If confined space entries are required, confined space entry procedures described in Section 3.3.2 will be followed prior to confines space entry. If hot work activities are required, hot work procedures described in section 3.3.3 will be followed prior to commencing hot work activities. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods. Mechanical assistance should be provided for large lifting tasks. Hearing protection is required for use when exposed to noise levels exceeding 85 dBA, or a level that commonly results in difficult conversation. Potential exposure to off-gases must be reviewed on an individual basis.

3.5 Drilling/Direct Push Boring Operations

3.5.1 Drilling/Direct Push Boring Operations for Soil Vapor Sampling

Site personnel will be responsible for drilling activities and the installation of soil vapor sampling points. Drilling activities for monitoring well or piezometer installation and the installation of soil vapor sampling points will involve the use of either a truck-mounted drill rig or direct push boring equipment (PowerProbe™ or equivalent) to install soil borings. The equipment poses a hazard if it is not properly operated. Hazards and control procedures for truck mounted drill rig and direct-push equipment are provided below.

Hazards – The primary physical hazards for this activity are associated with the use of the drill rig/direct push boring equipment. Both types of equipment are hydraulically powered, and the direct push boring equipment uses a hydraulic percussion hammer to drive small-diameter sampling tools. Accidents can occur as a result of improperly placing the equipment on uneven or unstable terrain, or failing to adequately secure the equipment prior to the start of sampling operations. Overhead utility lines can create hazardous conditions if contacted by the equipment. Underground installations such as electrical lines, conduit, and product lines pose a significant hazard if contacted. Pinch points on the equipment and the direct push equipment percussion hammer pose a risk to personnel operating the equipment.

Additional hazards associated with truck mounted drill rigs such as elevators, cat lines, and wire rope have the potential for striking, pinning, or cutting personnel. Worn or frayed wire rope presents a laceration hazard if loose wires protrude from the main bundle. Cat lines are used on drilling rigs to hoist material. Accidents that occur during cat line operations may injure the employee doing the rigging as well as the operator. Minimal hoisting control causes sudden and erratic load movement, which may result in hand and foot injuries. An additional physical hazard associated with truck mounted drill rigs is the rotation of the drill stem/casings, which may catch on loose fitting clothing, jewelry, and/or long hair (if not tied back). Drilling conducted via the Barber method requires use of welding equipment; all welding will be done in accordance with procedures specified in Section 3.3.3. Eye hazards are also a concern when using the Barber method of drilling, as cuttings are removed from the borehole using compressed air.

Working Surfaces - Walking and working surfaces may involve slip, trip, and fall hazards. Working at elevations may create a potential fall hazard. Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls.

Materials Handling – The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Pipes and tools can shift and or fall from a pipe rack or truck bed. During cleaning activities, personnel may handle chemical cleansers. The specific material may present a potential for inhalation, skin contact, and eye contact hazard.

Noise – Direct push drilling equipment produces impact noise from the action of the soil-probing hammer. Truck mounted drilling equipment procedures noise the operation of circulation pumps and/or air compressors. The operator and all personnel working around the equipment should wear appropriate hearing protection.

Truck Mounted Drill Rig and Direct Push Boring Safety Procedures – The operator of the equipment must possess the applicable state or local licenses to perform such work. All members of the crew shall receive site-specific training prior to beginning work. The operator is responsible for the safe operation of the equipment, as

well as the crew's adherence to the requirements of the HASP. The operator must ensure that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the operator, wear all personnel protective equipment, and be aware of all hazards and control procedures. The operator and crew must participate in the Daily Safety Meetings and be aware of all emergency procedures.

Equipment Inspection – Each day, prior to the start of work, the drill rig/direct-push boring equipment must be inspected by the operator and/or the operating crew. The following items must be inspected:

- Equipment condition;
- Proper storage of tools and sampling equipment;
- Condition of all wire rope (drill rig only);
- Condition of all hydraulic lines;
- Fire extinguisher; and
- First aid kit.

Equipment Set Up – Drill rig/direct push boring equipment must be properly leveled prior to beginning work. The wheels must be chocked. All sampling locations will be inspected to verify a stable surface exists. This is especially important in areas where soft, unstable terrain is common. All drill rigs or direct push boring equipment will be properly blocked and leveled prior to raising the derrick or using equipment. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking ensures that differential settling of the rig does not occur.

When the ground surface is soft or otherwise unstable, wooden blocks, at least 24" by 24" and 4" to 8" thick shall be placed between the jack swivels and the ground. The emergency brake shall be engaged, and the wheels are on the ground shall be chocked.

Hoisting Operations – Drillers should never engage the rotary clutch without watching the rotary table, and ensuring it is clear of personnel and equipment.

Unless the drawworks is equipped with an automatic feed control, the brake should not be left unattended without first being tied down.

Cat Line Operations – Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operation of the cat lines.

The operator should not use more wraps then necessary to pick up the load. More than one layer of wrapping is not permitted.

Personnel should not stand near, step over, or go under a cable or cat line which is under tension.

Employees rigging loads on cat lines shall:

- Keep out from under the load;
- Keep fingers and feet where they will not be crushed;
- Be sure to signal clearly when the load is being picked;
- Use standard visual signals only and do not depend on shouting to co-workers for communication; and
- Make sure the load is properly rigged, since a sudden jerk can cause the load to shift or drop.

Wire Rope – When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope shall be removed from service or resocketed. Special attention shall be given to the inspection of end fittings on boom support, pendants, and guy ropes.

Wire rope removed from service due to defects shall be cut up or plainly marked as being unfit for further use as rigging.

Wire rope clips attached with U-bolts shall have the U-bolts on the dead or short end of the rope; the clip nuts shall be re-tightened immediately after initial load carrying use and at frequent intervals thereafter.

When a wedge socket fastening is used, the dead or short end of the wire rope shall have a clip attached to it or looped back and secured to itself by a clip; the clip shall not be attached directly to the live end.

Protruding ends of strands in splices on slings and bridles shall be covered or blunted.

Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads, shall consist of one continuous piece without knot or splice.

An eye splice made in any wire rope shall have not less than five full tucks.

Wire rope shall not be secured by knots. Wire rope clips shall not be used to splice rope.

Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire clips or knots.

Pipe, Rod, or Auger Handling – Pipe and auger sections shall be transported by cart or carried by two persons. Individuals should not carry auger or pipe sections without assistance. Workers should not be permitted on top of the load during loading, unloading, or transferring of pipe or other rolling stock.

Employees should be instructed never to try to stop rolling pipe casing; they should be instructed to stand clear of rolling pipe. Pipe and augers stored in racks or on flatbed trucks should be secured to prevent rolling.

Overhead Electrical Clearances – If drilling is conducted in the vicinity of overhead power lines, the power to the lines must be shut off or the equipment must be positioned and blocked so that no part, including cables, can come within the minimum clearances as follows:

Nominal System Voltage	Minimum Required Clearance
0-50kV	10 feet
51-100kV	12 feet
101-200kV	15 feet
201-300kV	20 feet
301-500kV	25 feet
501-750kV	35 feet
751-1,000kV	45 feet

When the drill rig in is transit, with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50kV, and 16 feet for voltages above 345kV.

Rules for Intrusive Activity – Before beginning any intrusive activity, the existence and location of underground utilities (pipe, conduit, electrical equipment) and other installations will be determined. This will be done by contacting the appropriate state underground facilities location organization (e.g., Dig Safely New York), and appropriate client representative to mark the location of the lines. If the client's knowledge of the area is incomplete, a locating device, such as ground penetrating radar, will be used to locate the line. The Underground/Overhead Utility Checklist shall be used to document that nearby utilities have been marked on the ground, and that the drill site has been cleared.

Combustible gas readings of the general work area will be made regularly in the general work area (see Section 8). Operations must be suspended and corrective action taken if the airborne flammable concentrations reach 10% of the lower explosive limit (LEL) in the immediate area (a 1-foot radius) of the point of probing, or near any other ignition sources.

Cuttings – Cuttings must be containerized in New York State Department of Transportation (NYSDOT) approved 55 gallon drums and/or roll-off containers as they are generated. Cutting containers are to be handled using a drum dolly and loaded onto a truck using a lift gate or by using a fork lift. All containerized cuttings are to be transported to a LMC approved facility.

External hazards - Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, and rain; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Night Work – Adequate generator powered aerial lighting must be provided for drilling activities conducted after daylight hours. During night activities all personnel will wear reflectorized vests.

Control – The following controls will be instituted during truck mounted drill rig/direct-push boring operations:

- Equipment will be inspected and in proper working condition – manufacturer's guidance on safe operation of the rig will be reviewed prior to beginning work;
- Employees shall receive training to address the equipment's operation and care;
- Employees will avoid steep slopes, large rocks, and other obstructions when setting up the equipment;
- Employees will verify that all overhead and underground utilities have be identified and cleared prior to beginning work;
- Gasoline and other hazardous fluids must be appropriately labeled be stored in an approved safety canisters;
- Hearing protection is required for use when operating the equipment;
- Employees will avoid hazardous plants and insects; if necessary, employees may wear a dust mask to limit exposure to pollen and airborne dust; and
- Unless otherwise directed, the drill mast must be lowered between the hours of 7:00 am and 7:00 pm.

Additional Drilling Safety Guidelines are presented in Attachment L.

3.5.2 Utilities Clearance/Identification

Per New York State Code Rule 53, BBLES will contact the appropriate following organizations prior to the commencement of subsurface activities at the site (e.g., borehole drilling/monitoring well/Piezometer installation, fence post installtion):

- Underground Facilities Protective Organization, Inc. (UFPO);
- Underground Utilities Locating Service (UULG); and
- Appropriate municipal utility service providers (Town of Lake Success).

The above organizations will delineate and mark in the field the approximate location of utility service lines within the vicinity of the proposed subsurface activities. Care will be taken during drilling operations to minimize any potential disturbances to the encountered utility lines. Any encountered utility lines will be exposed by hand and will be inspected and documented in the field for the following items:

- size/diameter of the line;
- orientation and direction of the line;
- nature/purpose of the line;
- construction materials/features of the line;
- physical condition/integrity of the line; and
- depth of the encountered line.

3.6 Sound-Barrier Fence Installation

Installation of 10-foot-high fence along the north, west and east borders of the site to provide a sound barrier.

Hazards

Exposure to material handling hazards. The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a foot or toe gets caught between two objects. Extreme care must be taken when loading and unloading material. Proper lifting techniques must be employed;

Exposure to post-hole drilling accidents. The primary physical hazards for this activity are associated with the use of drill rig boring equipment. Drill rig equipment is hydraulically powered. Accidents can occur as a result of improperly placing the equipment on uneven or unstable terrain. Overhead utility lines can create hazardous conditions if contacted by the equipment. Underground installations such as electrical lines, conduit, and product lines pose a significant hazard is contracted. Pinch points on the equipment pose a risk to personnel operating the equipment.

- Exposure to physical hazards resulting in personnel being struck by or struck against objects resulting in fractures, cuts, punctures or abrasions;
- Exposure to inclement weather (heat, cold, rain, snow, high wind, etc.);

- Exposure to flora and fauna (poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders and snakes);
- In winter, slipping on the ice;
- Uneven walking and working surfaces;
- Electrical shock/burns; and
- Exposure to noise.

Control:

- Don appropriate personal protective equipment;
- Wear proper attire for weather conditions;
- Sturdy work boots or shoes with a rugged sole will be used;
- Become familiar with fencing installation components and only use the proper tools that are in good condition; and

Wear proper ear protection (as necessary).

3.7 Water Sampling, Groundwater Sampling, Well Development, and Well Repair Activities

These operations consist of the collection of water samples, groundwater samples, development of monitoring wells, and repair of existing wells. The hazards of these operations are primarily associated with the sample collection methods, mechanical/electrical hazards and physical work required.

Samples of water and groundwater will be obtained to evaluate effectiveness of the groundwater treatment system and the migration of constituents. Inhalation and absorption (contact) of constituents are the primary routes of entry associated with sampling activities due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. To control dermal exposure during sampling activities, a minimum of modified Level D (see Section 5) protection will be worn. Air samples may be conducted during sampling activities to assess the potential for exposure to airborne contaminates. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 8 for a description of air monitoring requirements and action levels. A description of each level of protection is included on Section 5.

Hazards – The primary physical hazards for sampling activities, well development and well repair activities involve slip, trip and fall hazards and inhalation, ingestion or transdermal exposure to potentially toxic constituents. Appropriate PPE, as specified in the HASP, must be worn.

In addition to the safety hazards specific to sampling operations, hazards associated with the operation of vehicles, particularly large vehicles, in a small area will be a concern. Of particular concern will be the backing up of trucks, and other support vehicles.

The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitos, wasps, spiders and snakes. The work area presents slip, trip and fall hazards from scattered debris and irregular walking surfaces. Freezing-weather hazards include frozen, slick and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil.

Working Surfaces – Slippery or uneven work surfaces can increase the likelihood of back injuries, over extension injuries, and slips, trips and falls. All personnel should frequently inspect working surfaces and keep working surfaces clear of debris.

Material Handling – The most common type of accident that occurs in material handling operations is the "caught between" situations when a finger or toe gets caught between two objects.

Control – A Safe Performance Self Assessment (SPSA) as described in the HASP will be performed prior to conducting sampling activities, well development and well repair activities. Appropriate PPE, as specified in the HASP, must be worn.

3.8 Soil Vapor, Indoor Air, and Ambient Air Sampling

Site personnel will be responsible for the collection of soil vapor, indoor air and ambient air samples using 5-liter Summa™ air canisters. Hazards for soil vapor, indoor air and ambient air sample collections are provided below.

Hazards – The primary physical hazards for air sampling activities involve slip, trip and fall hazards and inhalation, ingestion or transdermal exposure to potentially toxic constituents. Appropriate PPE, as specified in the HASP, must be worn.

Working Surfaces – Slippery or uneven work surfaces can increase the likelihood of back injuries, over extension injuries, and slips, trips and falls. All personnel should frequently inspect working surfaces and keep working surfaces clear of debris.

Material Handling – The most common type of accident that occurs in material handling operations is the "caught between" situations when a finger or toe gets caught between two objects. In addition, proper lifting techniques must be employed when handling the Summa™ air canisters.

Control – SPSA as described in the HASP will be performed prior to conducting soil vapor, indoor air or ambient air sampling activities. Appropriate PPE, as specified in the HASP, must be worn.

3.9 Chemical Hazards

3.9.1 Materials Chemical Hazards

The chemical hazards associated with materials that may be encountered are related to inhalation, ingestion, and skin exposure to various materials containing hazardous compounds including, but not limited to, PVC pipe solvent/primer, PVC pipe glue, caulking compounds, paints, and epoxy coatings. During use of these materials, the manufacturer's instructions will be followed and adequate ventilation will be provided to minimize worker exposure. Materials brought on site will be accompanied with Material Safety Data Sheets (MSDS). The

MSDS for materials brought on site will be kept in a file to be located in the office area of the OU-1 and OU-2 treatment buildings.

3.9.2 Site Chemical Hazards

The chemical hazards associated with site operations are related to inhalation, ingestion, and skin exposure to site soil and ground water contaminated with COCs. Site COCs include but are not limited to: particulates and the contaminants listed in Attachment E.

The potential for inhalation of COCs during site operations is low with the exception of drilling using a Barber Rig where the potential for inhalation of COCs is moderate (the Barber Rig utilizes compressed air to blow drill cuttings/groundwater out of the borehole as the borehole is drilled. Air monitoring requirements for site tasks are outlined in Section 6. The potential for dermal contact with materials containing COCs during equipment upgrade/construction activities and materials handling operations is moderate.

A MSDS for each COC is also included in Attachment E.

3.10 Demobilization

Demobilization involves removing all tools, equipment, supplies, and vehicles brought to the site. The hazards of this phase of activity are associated with heavy equipment operation and manual materials handling.

Manual materials handling may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy and slick walking surfaces. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include plants such as poison ivy and poison oak; aggressive fauna such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens such as rabies, Lyme disease, and blood-borne pathogens. Control procedures for these hazards are discussed in Section 4, General Safety Practices.

If an EZ is established, all equipment used in the EZ will be decontaminated before leaving the site. Personnel involved in decontamination activities may be exposed to skin contact with materials containing site constituents of concern (COCs), water spray, and cold stress from the water spray. Personnel involved in decontamination activities must wear PPE as specified in Section 5.0.

4. General Safety Practices

4.1 General Safety Rules

General safety rules for site activities include, but are not limited to, the following:

- At least one copy of this HASP must be kept in a location at the OU-1 and OU-2 treatment buildings that is readily available to personnel, and all project personnel must review the plan prior to starting work.
- Consume or use food, beverages, chewing gum, and tobacco products only in the SZ or other designated area outside the EZ and CRZ. Cosmetics must not be applied in the EZ or CRZ.
- Wash hands before eating, drinking, smoking, or using toilet facilities.
- Wear all PPE as required, and stop work and replace damaged PPE immediately.
- Secure disposable coveralls, boots, and gloves at the wrists and legs, and confirm closure of the suit around the neck, if needed (Modified Level D or higher PPE).
- Upon skin contact with materials that may be impacted by COCs, remove contaminated clothing and wash the affected area immediately. Contaminated clothing must be changed. Any skin contact with materials potentially impacted by COCs must be reported to the SS or HSS immediately. If needed, medical attention should be sought.
- Practice contamination avoidance. Avoid contact with surfaces either suspected or known to be impacted by COCs, such as standing water, mud, or discolored soil. Equipment must be stored on elevated or protected surfaces to reduce the potential for incidental contamination.
- Remove PPE as required in the CRZ to limit the spread of COC-containing materials.
- At the end of each shift, or as required, dispose of all single-use coveralls, soiled gloves, and respirator cartridges in receptacles designated for this purpose (if used).
- Do **not** remove soil or other material containing site COCs from protective clothing or equipment with compressed air, by shaking, or by any other means that disperses contaminants into the air.
- Inspect all non-disposable PPE for contamination in the CRZ. Any PPE found to be contaminated must be decontaminated or disposed of appropriately.
- Recognize emergency signals used for evacuation, injury, fire, etc.
- Report all injuries, illnesses, near misses, and unsafe conditions or work practices to the SS or HSS.
- Use the "buddy system" during all operations requiring Level C or B PPE and, when appropriate, during Modified Level D operations.

- Obey all warning signs, tags, and barriers. Do not remove any warnings unless authorized to do so.
- Use, adjust, alter, and repair equipment only if trained and authorized to do so and in accordance with the manufacturer's directions.
- Personnel are to perform only tasks for which they have been properly trained, and will advise their supervisor if they have been assigned a task for which they are not trained.
- The presence or consumption of alcoholic beverages or illicit drugs during the workday, including breaks, is strictly prohibited. Notify your supervisor if you must take prescription or over-the-counter drugs that list drowsiness as a side-effect or indicate that heavy equipment should not be operated while taking the medication.

4.2 Loss Prevention System (LPS)

LPS is a behavior based safety system meant to prevent or reduce the occurrence of injury, illness, or other incident. This program seeks the prevention or reduction of losses by:

- Emphasizing proactive activities;
- Capitalizing on the on-the-job expertise of field employees;
- Maximizing the use of positive reinforcement;
- Integrating with daily field operations; and
- Solving problems from the bottom up while providing direction from the top down.

Prior to assignment on a HAZWOPER project, BBLES personnel that will be performing or overseeing work on this project must attend a LPS training session. This training session explains the objectives, elements, and requirements of LPS. Elements of the LPS program are briefly outlined below.

4.2.1 Safe Performance Self-Assessment

All on-site personnel are required to perform an SPSA prior to beginning any activity. Each individual must perform the following three-step process:

- *Assess* the risk of the task to be performed. Ask the following questions:
  - What could go wrong?
  - What is the worst thing that could happen if something does go wrong?
- *Analyze* the ways the risk can be reduced. Ask the following questions:
  - Do I have all the necessary training and knowledge to do this task safely?
  - Do I have all the proper tools and PPE?

- *Act* to control the risk and perform the task safely:

  - Take the necessary action to perform the job safely.
  - Follow written procedures and ask for assistance if necessary.

This process must be performed prior to beginning any activity and after any near miss or other incident to determine if it is safe to proceed.

4.2.2 Incident Investigation/Near Miss Reporting

An incident includes any of the following events:

- First-aid cases;
- Injuries;
- Illnesses;
- Near misses;
- Spills or leaks;
- Equipment and property damage;
- Motor vehicle accidents;
- Regulatory violations;
- Fires; and
- Business interruptions.

All incidents must be investigated within 24 hours, and reported to the PM, PIC, Client and the HSO. Incident Investigations (IIs) are conducted to prevent the recurrence of a similar hazardous event. IIs review all incidents in the same manner. Using the information gathered during an II, appropriate measures are to protect personnel from the hazard in question.

As a part of the philosophy that work-related accidents and losses are preventable, we believe that the practices and standards used to conduct work could sometimes lead to an incident and that changing these practices and standards will reduce the potential for an incident. To achieve this end, we use the practice of "near-miss" reporting. Near-misses are situations where no injury or property damage occurred; however, under slightly different circumstances an injury or property damage could have occurred. The near miss report should identify the work that was conducted, what actually happened, discuss the "what could have happened" had the circumstances been slightly different, and recommend a change to procedures to prevent an incident from occurring from similar work in the future. Near miss reporting is encouraged for all workers at any level in the work force. The worker may feel comfortable completing the report themselves or may seek assistance from their HSS or supervisor. Near miss reporting and job safety assessments can be particularly useful after any changes to work practices are implemented, including changes to personnel, equipment, or means and methods.

The Incident/Near-Miss Investigation Form is included as Attachment F.

4.2.3 Loss Prevention Observation

The SS or the HSS will perform the LPO (see Attachment G for the LPO Form) at pre-determined frequencies with a minimum of once per week. LPOs are conducted to identify and correct potential hazards, and to positively reinforce behaviors and practices that are correct. The SS or HSS must identify potential deviations from safe work practices that could possibly result in an incident, and take prompt corrective action. The LPO process includes the following steps:

- Identify tasks that have the greatest potential for hazardous incidents.
- Review the standard procedure for completing the task.
- Discuss with the observed employee the task and the SS/HSS role in observing the task.
- Observe the employee completing the task.
- Reference the LPO form for criteria. Complete the form, documenting positive actions, as well as areas in need of improvement.
- Discuss the results of the LPO with the employee. Discuss corrective action necessary.
- Implement corrective action.
- Communicate the results of the LPO and corrective action to the PM and the HSO.

4.2.4 Job Safety Analysis

JSA is a tool used to identify potential hazards, and to develop corrective or protective systems to eliminate the hazard. A JSA lists all potential hazards associated with an activity. Hazards may be physical (such as lifting hazards or eye hazards), environmental (such as weather), or biological (stinging insects, snakes, etc.). After identifying the hazards associated with an activity, control measures are evaluated and protective measures or procedures are then instituted. JSAs are reviewed periodically so that the procedures and protective equipment specified for each activity are current and technically correct. Any changes in site conditions and/or scope of work may require review of and modification to the JSA in question. During this review process, comments on the JSA and its procedures should be obtained from personnel associated with the activity being analyzed.

4.3 Buddy System

On-Site personnel must use the buddy system as required by operations. Use of the "buddy system" is required during all operations requiring Level B and C PPE, and when appropriate, during Level D PPE operations. Personnel must observe each other for signs of chemical exposure and heat or cold stress. Indications of adverse effects include, but are not limited to:

- Changes in complexion and skin coloration;

- Changes in coordination;
- Changes in demeanor;
- Excessive salivation and pupillary response; and
- Changes in speech pattern.

Personnel must also be aware of the potential exposure to possible safety hazards, unsafe acts, or noncompliance with safety procedures. Field personnel must inform their partners or fellow workers of nonvisible effects of exposure to toxic materials that they may be experiencing. The symptoms of such exposure may include, but are not limited to:

- Headaches;
- Dizziness;
- Nausea;
- Blurred vision;
- Cramps; and
- Irritation of eyes, skin, or respiratory tract.

If protective equipment or noise levels impair communications, pre-arranged hand signals must be used for communication. Personnel must stay within line of sight of another team member.

4.4 Heat Stress

Heat stress is caused by several interacting factors, including environmental conditions, clothing, and workload, as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be able to recognize the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses, and be able to recognize the signs and symptoms of these illnesses in themselves and their co-workers.

4.4.1 Heat Rashes

Heat rashes are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

4.4.2 Heat Cramps

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much or too little salt.

Cramps appear to be related to a lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

4.4.3 Heat Exhaustion

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include:

- Pale, cool, moist skin;
- Heavy sweating;
- Dizziness;
- Nausea;
- Headache;
- Vertigo;
- Weakness;
- Thirst; and
- Giddiness.

Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, given fluid replacement, and be encouraged to get adequate rest.

4.4.4 Heat Stroke

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails, and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are:

- Confusion;
- Irrational behavior;
- Loss of consciousness;
- Convulsions;

- A lack of sweating (usually);
- Hot, dry skin; and
- An abnormally high body temperature (e.g., a rectal temperature of 41°C [105.8°F]).

If body temperature is too high, it can result in death. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first-aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

4.4.5 Heat Stress Safety Precautions

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. Screening criteria for heat stress exposure are described in Table 4-1 and examples of activities within metabolic rate categories are provided in Table 4-2.

TABLE 4-1
SCREENING CRITERIA FOR HEAT STRESS EXPOSURE
FOR 8 HOUR WORK DAY FIVE DAYS PER WEEK WITH CONVENTIONAL BREAKS

Work Demands	Acclimatized				Unacclimatized			
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
100% Work	85.1°F (29.5°C)	81.5°F (27.5°C)	78.8°F (26°C)		81.5°F (27.5°C)	77°F (25°C)	72.5F (22.5°C)	
75% Work; 25% Rest	86.9°F (30.5°C)	83.3°F (28.5°C)	81.5°F (27.5°C)		84.2°F (29°C)	79.7°F (26.5°C)	76.1°F (24.5°C)	
50% Work; 50% Rest	88.7°F (31.5°C)	85.1°F (29.5°C)	83.3°F (28.5°C)	81.5°F (27.5°C)	86°F (30°C)	82.4°F (28°C)	79.7°F (26.5°C)	77°F (25°C)
25% Work, 75% Rest	90.5°F (32.5°C)	87.8°F (31°C)	86°F (30°C)	85.1°F (29.5°C)	87.8°F (31°C)	84.2°F (29°C)	82.4°F (28°C)	79.7°F (26.5°C)

Source: 2004 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists (ACGIH), 2004 - page 171.

TABLE 4-2
EXAMPLES OF ACTIVITIES WITHIN METABOLIC RATE CATEGORIES

Categories	Example Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
Moderate	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on a level at 6 Km/hr while carrying 3 Kg weight load
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a noncontinuous basis
	Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work)
Very Heavy	Shoveling wet sand

Source: 2004 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists (ACGIH), 2004 - page 172

Acclimatization

Acclimatization is a set of physiological adaptations, which allows the body to react to heat stress conditions. Full-heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days. With a recent history of heat stress exposures (e.g., 5 of the last 7 days), a worker can be considered acclimatized for the purpose of using the table Screening Criteria for Heat Stress Exposure.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.
- On-Site drinking water will be kept cool (50 to 60°F).
- A work regimen that will provide adequate rest periods for cooling down will be established, as required.
- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.
- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat.

- Employees should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary.
- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Employees must not be assigned to other tasks during breaks.
- Employees must remove impermeable garments during rest periods. This includes white Tyvek™-type garments.

All employees must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress disorders.

4.5 Cold Stress

Cold stress normally occurs in temperatures at or below freezing, or under certain circumstances in temperatures of 40°F. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Body areas that have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. Two factors influence the development of a cold-weather injury: ambient temperature and wind velocity. For instance, a temperature of 10°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F. An equivalent chill temperature chart relating the actual dry-bulb temperature and wind velocity is presented in Table 4-3, below.

TABLE 4-3
CHILL TEMPERATURE CHART

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	**Little Danger Maximum danger of false sense of security.**				**Increasing Danger Danger from freezing of exposed flesh within one minute.**			**Great Danger Flesh may freeze within 30 seconds.**				
	Trench foot and immersion foot may occur at any point on this chart.											

(This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA [Source: ACGIH *TLV Handbook, ACGIH, 2002a*]).

Local injury resulting from cold is included in the generic term "frostbite." There are several degrees of tissue damage associated with frostbite. Frostbite of the extremities falls into the following categories:

- *Frost Nip or Incipient Frostbite*—Characterized by sudden blanching or whitening of skin.
- *Superficial Frostbite*—Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- *Deep Frostbite*—Tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. It can be fatal. Its symptoms are usually exhibited in five stages:

1) Shivering;

2) Apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F;

3) Unconsciousness, glassy stare, slow pulse, and slow respiratory rate;

4) Freezing of the extremities; and

5) Death.

Trauma sustained in freezing or sub-zero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first-aid treatment. To avoid cold stress, site personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training, and warming regimens may be used to prevent cold stress.

4.5.1 Cold Stress Safety Precautions

The following safety precautions should be followed to prevent cold stress:

- For air temperature of 0°F or less, mittens should be used to protect the hands. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of -25°F.
- At air temperatures of 36°F or less, field personnel who become immersed in water or whose clothing becomes wet must be immediately provided with a change of clothing and be treated for hypothermia.
- If work is done at normal temperature or in a hot environment before entering the cold, the field personnel must confirm that their clothing is not wet as a consequence of sweating. If wet, field personnel must change into dry clothes prior to entering the cold area.
- If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified or suspended until adequate clothing is made available or until weather conditions improve.

- Field personnel handling evaporative liquid (e.g., gasoline, alcohol, or cleaning fluids) at air temperatures below 40°F must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

4.5.2 Safe Work Practices

The following safe work practices must be employed to prevent cold stress:

- Direct contact between bare skin and cold surfaces (< 20°F) should be avoided. Metal tool handles and/or equipment controls should be covered by thermal insulating material.

- For work performed in a wind chill temperature at or below 10°F, workers should be under constant protective observation (buddy system). The work rate should be established to prevent heavy sweating that will result in wet clothing. For heavy work, rest periods must be taken in heated shelters and workers should be provided with an opportunity to change into dry clothing if needed.

- Field personnel should be provided the opportunity to become accustomed to cold-weather working conditions and required protective clothing.

- Work should be arranged in such a way that sitting or standing still for long periods is minimized.

- During the warming regimen (rest period), field personnel should be encouraged to remove outer clothing to permit sweat evaporation or to change into dry work clothing. Dehydration, or loss of body fluids, occurs insidiously in the cold environment and may increase susceptibility to cold injury due to a significant change in blood flow to the extremities. Fluid replacement with warm, sweet drinks and soups is recommended. The intake of coffee should be limited because of diuretic and circulatory effects.

4.6 Carbon Monoxide

When working indoors with any type of gasoline, diesel or liquid propane (LP) gas powered equipment; CO is a significant hazard. Recognize that a single generator, propane heater or propane fork truck can quickly generate CO above the permissible exposure level regardless of the size of the room. The following guidelines will mitigate any carbon monoxide issues.

- Utilize remotely powered equipment whenever possible. Validate that the exhaust from the generating unit is not being sucked or blown back into the building.

- Use an approved exhaust extension for stationary work. Run the extension to the outside of the building.

- Do not use unvented gas or kerosene space heaters in enclosed spaces

- When operating any fossil-fueled equipment indoors ensure that all pre-operation equipment checks are completed and that the equipment is running to specifications. Smokey exhaust, sputtering, backfires, etc. all indicate an equipment problem requiring immediate service.

- Provide ventilation within the building regardless of the weather outdoors. Open vents and intakes as well as entry and overhead doors.

- Utilize fans large enough to move air into or out of the building. Sometimes you get better results blowing air out than bringing it in. For stationary work be sure to move fresh air through the breathing zone of employees.

- Operate a properly calibrated CO meter (such as the Multi-Rae) within the worker breathing zone before, during and after equipment operation. Recognize that a CO alarm requires immediate action. Stop work, shut down engines and move to the outdoors until the alarm subsides and it is safe to reenter. Exposure guidelines for CO are listed in the Table 4-4 below.

TABLE 4-4
CARBON MONOXIDE ACTION LEVELS

Parameter	Reading in Work Area/ Worker Breathing Zone	Action
Carbon Monoxide	0 ppm to 20 ppm	Normal operations; continue monitoring
	> 20 ppm	Stop work; evacuate work area, ventilate work area; investigate cause of reading, reduce through engineering controls.

4.6.1 Symptoms of Carbon Monoxide Exposure

CO is called the silent killer because it has no odor and it slowly overcomes those who are overexposed. Symptoms include: Headache, fatigue, shortness of breath, nausea and dizziness. Employees in the same room may or may not have all symptoms simultaneously. As with all BBLES work, use the buddy system to keep each other safe.

4.6.2 Treatment of Carbon Monoxide Exposure

If you think you are experiencing any of the symptoms of CO poisoning, get fresh air immediately. Open windows and doors for more ventilation, turn off any combustion equipment, and leave the building. See medical treatment. You could lose consciousness and die if you do nothing. It is also important to contact a doctor immediately for a proper diagnosis. Tell your doctor that you suspect CO poisoning is causing your problems. Prompt medical attention is important if you are experiencing any symptoms of CO poisoning when you are operating fuel-burning devices.

4.7 Biological Hazards

Biological hazards may include poison ivy, snakes, thorny bushes and trees, ticks, mosquitoes, and other pests.

4.7.1 Tick-Borne Diseases

Lyme disease and erlichiosis are transmitted primarily by the bite of an infected deer tick, which is smaller and redder than the common wood tick. The diseases may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis. Symptoms of erlichiosis include muscle and joint aches and flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF) is transmitted via the bite of an infected tick. The tick must be attached for 4 to 6 hours before the disease-causing organism (Rickettsia rickettsii) becomes reactivated and can infect humans.

The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for 2 to 3 weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

Use tick repellant containing diethyltoluamide (DEET) when working in tick-infested areas. Tuck pant legs into boots. In addition, workers should search the entire body every 3 or 4 hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

4.7.2 Mosquitoes

Personnel may be exposed to mosquitoes during work activities. Typical exposure to mosquitoes does not present a significant hazard. However, if West Nile virus is prevalent in the area, the potential for exposure to this virus is increased. West Nile virus results in flu-like symptoms and can be serious if not treated or in immune compromised individuals.

Control: To minimize the threat of mosquito bites all personnel working outside must be aware of the potential for encountering mosquitoes and implement the basic precautions listed below:

- Avoid working at dawn or dusk when mosquitoes are most active
- Prevent accumulation of standing water at the work-site
- Apply an insect repellent that contains DEET to exposed skin
- Wear light colored clothes, preferably with long-sleeves and full-length pants
- Do not touch any dead birds or animals that you encounter

If dead birds are detected near the site, report them to the local County Health Department. If flu-like symptoms are present, contact your doctor or the HSO for more information.

4.7.3 Poisonous Plants

Poisonous plants may be present in the work area. Personnel should be alerted to their presence and instructed on methods to prevent exposure. Poison sumac grows as a shrub or small tree with large alternate, compound leaves having 7-13 leaflets without teeth. All plant parts are poisonous. The lack of 1) leaflet glands, 2) "wings" between the leaflets, and 3) teeth on the leaves, in addition to this species' red stems supporting the leaflets and leaves, help to distinguish this plant from similar-looking nonpoisonous species such as other sumacs and tree-of-heaven. Flowers are shades of green, white and yellow and appear in late spring. Fruits are small white berries that mature in late summer and may last through winter. Poison sumac is occasionally present in moist or wet soils.

Poison ivy is a woody shrub or vine with hairy looking aerial roots. It grows to 10 feet or more, climbing high on trees, walls and fences or trails along the ground. All parts of poison ivy, including the roots, are poisonous at all times of the year. Photographs of poison sumac and poison ivy are presented below to facilitate identification.

Poison Sumac

Poison Ivy

Control - The main control for both poison ivy and poison sumac is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin

contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance.

Poison ivy and sumac are very easy to treat *if* you identified your contact with the irritating plant within a few hours of the incident. The urushiol oil present in both plants chemically bonds with the proteins in your skin about 30 minutes after contact. 75% of the population is affected by contact with urushiol, although immunity to urushiol today does not assure immunity tomorrow, and vice versa. Rash symptoms can appear within a few hours but can take two to five days to appear. The rash starts as a red, annoyingly itchy area that starts to swell. The area then gets inflamed and will get covered in clusters of tiny pimples, the pimple eventually merge and turn into blisters. The fluid in the blisters turns yellow, dries up, and becomes crusty. Left completely untreated, this cycle can last as short as five days and in severe cases as long as five to six weeks.

If you come in contact with poison ivy, oak or sumac, or a animal exposed to any of these, or tools, gear, or clothing exposed to any of these, you should wash off with hot water (not so hot that it burns) and strong soap as soon as possible. If you can get washed up in the first six hours, before the first symptoms appear, you have a good chance of avoiding an out break, and an even better chance of minimizing the effects if you do have one.

4.7.4 Snakes

The possibility of encountering snakes exists, specifically for personnel working in wooded or vegetated areas. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include:

- Neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties;
- Cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs;
- Defects in coagulation; and
- Effects from local release of substances by enzymatic actions.

Other noticeable effects of venomous snakebites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

To minimize the threat of snakebites, all personnel walking through vegetated areas must be aware of the potential for encountering snakes and the need to avoid actions potentiating encounters, such as turning over logs. If a snake bite occurs, an attempt should be made to identify the snake via size and markings. The victim must be transported to the nearest hospital within 30 minutes. First aid consists of applying a constriction band and washing the area around the wound to remove any unabsorbed venom.

4.7.5 Spiders

Personnel may encounter spiders during work activities. Two spiders of concern are the black widow and the brown recluse. Both prefer dark sheltered areas such as basements, equipment sheds and enclosures, and around woodpiles or other scattered debris. The black widow is shiny black, approximately 1-inch long, and found throughout the United States. There is a distinctive red hourglass marking on the underside of the black widow's body. The bite of a black widow is seldom fatal to healthy adults, but effects include respiratory

distress, nausea, vomiting, and muscle spasms. The brown recluse is smaller than the black widow and gets its name from its brown coloring and behavior. The brown recluse is more prevalent in the Southern United States. The brown recluse has a distinctive violin shape on the top of its body. The bite of the brown recluse is painful, and the bite site ulcerates and takes many weeks to heal completely.

To minimize the threat of spider bites, all personnel walking through vegetated areas must be aware of the potential for encountering arachnids. Personnel should avoid actions that may result in encounters, such as turning over logs and placing hands in dark places such as behind equipment or in corners of equipment sheds or enclosures. If a spider bite occurs, the victim must be transported to the nearest hospital as soon as possible. First aid consists of applying ice packs and washing the area around the wound to remove any unabsorbed venom.

4.8 Noise

Exposure to noise louder than the appropriate action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site.

All personnel must wear hearing protection, with a noise reduction rating (NRR) of at least 20, when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA and hearing protection is necessary. All site personnel who may be exposed to noise must also receive baseline and annual audiograms, and training as to the causes and prevention of hearing loss. Noise monitoring is discussed in Section 6.2, Noise Monitoring.

Whenever possible, equipment that does not generate excessive noise levels will be selected. If using noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

4.9 Spill Control

All personnel must take every precaution to minimize the potential for spills during site operations. All on-site personnel must immediately report any discharge, no matter how small, to the SS.

Spill control equipment and materials will be located on site at locations that present the potential for discharge. All sorbent materials used to cleanup spills will be containerized and labeled appropriately. In the event of a spill, the SS will follow the provisions in Section 9, Emergency Procedures, to contain and control released materials and to prevent their spread to offsite areas.

4.10 Sanitation

Site sanitation will be maintained according to appropriate federal, state, and local requirements.

4.10.1 Break Area

Take breaks in the SZ, away from the active work area, after site personnel go through decontamination procedures. There will be no smoking, eating, drinking, or chewing gum or tobacco in any area other than the SZ.

4.10.2 Potable Water

The following rules regarding potable water apply to any field operations where no permanent facilities exist:

- An adequate supply of potable water will be provided at each project site. Potable water must be kept away from hazardous materials or media and contaminated clothing or equipment.
- Portable containers used to dispense drinking water must be capable of being tightly closed and must be equipped with a tap dispenser. Water must not be consumed directly from the container (drinking from the tap is prohibited) nor may it be removed from the container by dipping.
- Containers used for drinking water must be clearly marked and must not be used for any other purpose.
- Disposable drinking cups must be provided. A sanitary container for dispensing cups and a receptacle for disposing of used cups is required.

4.10.3 Sanitary Facilities

Access to facilities for washing before eating, drinking, or smoking, or alternate methods such as waterless hand cleaner and paper towels, will be provided.

4.10.4 Lavatory

If permanent toilet facilities are not available, an appropriate number of portable chemical toilets will be provided. This requirement does not apply to mobile crews or to normally unattended site locations so long as employees at these locations have transportation immediately available to nearby toilet facilities.

4.11 Emergency Equipment

Adequate emergency equipment for the activities being conducted on site and as required by applicable sections of 29 CFR 1910 and 29 CFR 1926 will be on site prior to commencing project activities. Personnel will be provided with access to emergency equipment including, but not limited to, the following:

- Fire extinguishers of adequate size, class, number, and location as required by applicable sections of 29 CFR 1910 and 1926;
- Industrial first-aid kits of adequate size for the number of personnel on site; and

- Emergency eyewash and/or shower if required by operations being conducted on site.

4.11.1 Electrical Safety

Electricity may pose a particular hazard to site workers due to the use of portable electrical equipment. If wiring or other electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements include:

- All electrical wiring and equipment must be a type listed by Underwriters Laboratories (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.
- All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or USCG regulations.
- Portable and semi-portable tools and equipment must be grounded by a multiconductor cord having an identified grounding conductor and a multicontact polarized plug-in receptacle.
- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double-insulated tools must be distinctly marked and listed by UL or FM.
- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.
- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.
- All circuits must be protected from overload.
- Temporary power lines, switchboxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.
- Plugs and receptacles must be kept out of water unless of an approved submersible construction.
- All extension cord outlets must be equipped with ground-fault-circuit interrupters (GFCIs).
- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.
- Extension cords or cables must be inspected prior to each use and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.
- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

4.12 Lifting Safety

Using proper lifting techniques may prevent back strain or injury. The fundamentals of proper lifting include:

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone.
- The hands and the object should be free of dirt or grease that could prevent a firm grip.
- Gloves should be used and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces.
- Fingers must be kept away from points that could crush or pinch them, especially when putting an object down.
- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.
- The load should be kept as low as possible, close to the body, with the knees bent.
- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.
- A worker should not carry a load that he or she cannot see around or over.
- When putting an object down, the stance and position are identical to that for lifting; the legs are bent at the knees and the back is straight as the object is lowered.

4.13 Traffic Safety

Traffic may be encountered as vehicles enter and exit the site. If work activities are required adjacent to roadways and parking areas, to minimize the likelihood of project personnel and activities being affected by traffic, the following procedures will be implemented.

Cones must be placed along the shoulder of the roadway starting 100 feet from the work area to alert passing motorists to the presence of personnel and equipment. A "Slow" or "Men Working" sign must be placed at the first cone. Barricades with flashing lights should be placed between the roadway and the work area.

During activities along a roadway, equipment will be aligned parallel to the roadway to the extent feasible, facing into the oncoming traffic so as to place a barrier between the work crew and the oncoming traffic. All crewmembers must remain behind the equipment and the traffic barrier.

All site personnel who are potentially exposed to vehicular traffic must wear an outer layer of orange warning garments, such as vests, jackets, or shirts. If work is performed in hours of dusk or darkness, workers will be outfitted with reflective garments either orange, white (including silver-coated reflective coatings or elements that reflect white light), yellow, fluorescent red-orange, or fluorescent yellow-orange.

The flow of traffic into and out of the work area must be assessed, and precautions taken to warn motorists of the presence of workers and equipment. Where possible, vehicles should be aligned to provide physical protection of people and equipment.

5. Personal Protective Equipment

5.1 Levels of Protection

PPE is required to safeguard site personnel from various hazards. Varying levels of protection may be required depending on COC levels and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level.

5.1.1 Level D Protection

The minimum level of protection that is required of BBLES personnel and subcontractors at the site is Level D, which is worn when activities do not involve potential dermal contact with contaminants and air monitoring indicates that no inhalation hazard exists. Level D protection includes the following equipment:

- Work clothing as prescribed by weather;
- Steel-toe work boots, meeting ANSI Z41;
- Safety glasses with side shields or goggles, meeting ANSI Z87 if required for the task being completed;
- Hard hat, meeting ANSI Z89, when falling object hazards are present; and
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used).

5.1.2 Modified Level D Protection

Modified Level D will be used when airborne contaminants are not present at levels of concern, but site activities present the potential for skin contact with contaminated materials. Modified Level D consists of the following equipment:

- Viton or neoprene outer gloves worn over nitrile surgical gloves;
- Latex or PVC overboots when contact with COC-impacted media is anticipated;
- Steel-toe work boots, meeting ANSI Z41;
- Safety glasses with side shields or goggles, meeting ANSI Z87;
- Face shield in addition to safety glasses or goggles when projectiles or splash hazards exist;
- Tyvek® or KleenGuard® coveralls when skin contact with COC-impacted media is anticipated;

- Hard hat, meeting ANSI Z89, when falling object hazards are present; and
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used).

5.1.3 Level C Protection

Level C protection will be required when the airborne concentration of COCs reaches one-half of the OSHA Permissible Exposure Limit (PEL) or ACGIH TLV. The following equipment will be used for Level C protection:

- Full-face, National Institute for Occupational Safety and Health (NIOSH) approved, air-purifying respirator with combination organic vapor cartridges;
- Polyethylene-coated Tyvek® suit with ankles and cuffs taped to boots and gloves;
- Viton or neoprene outer gloves worn over nitrile surgical gloves;
- Steel-toe work boots, meeting ANSI Z41;
- Chemical-resistant boots with steel toes, or latex or PVC overboots over steel-toe boots;
- Hard hat, meeting ANSI Z89; and
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used).

5.1.4 Level B Protection

Level B protection will be required when the airborne concentration of suspected chemicals is unknown or is known but exceeds the action levels for use of Level C PPE.

The following equipment will be used for Level B protection:

- Positive pressure-demand, full-face piece self-contained breathing apparatus (SCBA), or positive pressure-demand supplied air respirator with escape SCBA (NIOSH approved).
- Saranax-coated Tyvek ® coverall with attached boots or equivalent;
- Nitrile outer gloves over Silver Shield® inner gloves;
- Steel toe work boots, ANSI Z41 approved;
- Chemical resistant Neoprene boots with steel toes; or latex booties over safety toe shoes;
- Hard hat, ANSI Z89 approved; and

- Hearing protection (if necessary).

5.2 PPE Selection

PPE will be selected based on the potential for contact, site conditions, ambient air quality, and the judgment of supervising site personnel and health and safety professionals. The PPE used will be chosen to be effective against the COCs present on site.

Specifically, the level of PPE selected will be based on air monitoring of the work environment, and an assessment by the SS and HSS of the potential for skin contact with COCs. The PPE selection matrix is presented in Table 5-1, below. This matrix is based on information available at the time this plan was written. The Airborne Contaminant Action Levels in Table 6-1 (provided in Section 6) should be used to verify that the PPE prescribed in Table 5-1 is appropriate.

TABLE 5-1
PPE SELECTION MATRIX

Task	Anticipated Level of Protection
Mobilization/Drilling and Well Installation	Level D
Equipment Upgrades	Level D/Modified Level D (Viton or Neoprene Gloves)
Start-Up/Operation and Maintenance	Level D/Modified Level D (Viton or Neoprene Gloves)
Decontamination	Modified Level D (Viton or Neoprene Gloves, and Face Shield)
Demobilization	Level D

5.3 Site Respiratory Protection Program

Respiratory protection is an integral part of employee health and safety at the site due to potentially hazardous concentrations of airborne COCs. The site respiratory protection program will consist of the following elements (as a minimum):

- All on-site personnel who may use respiratory protection will have an assigned respirator.
- All on-site personnel who may use respiratory protection will have been fit-tested and trained in the use of a full-face, air-purifying respirator within the past 12 months.
- All on-site personnel who may use respiratory protection must, within the past year, have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the HSS prior to commencing site work.
- Only cleaned, maintained NIOSH-approved respirators will be used.

- If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs.
- Contact lenses are not to be worn when a respirator is worn.
- All on-site personnel who may use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not touch the sealing surface of the respirator.
- Respirators will be inspected and a negative-pressure test performed prior to each use.
- After each use, the respirator will be wiped with a disinfectant, cleansing wipe. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the face piece.

5.4 Using PPE

Depending on the level of protection selected, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory if Modified Level D or higher PPE is used. All personnel entering the EZ must put on the required PPE in accordance with the requirements of this HASP. When leaving the EZ, PPE will be removed in accordance with the procedures listed to minimize the spread of COCs.

5.4.1 Donning Procedures

These procedures are mandatory only if Modified Level D, Level C or Level B PPE is used on site:

- Remove bulky outerwear. Remove street clothes and store in clean location.
- Put on work clothes or coveralls.
- Put on the required chemical-protective coveralls.
- Put on the required chemical-protective boots or boot covers.
- Tape the legs of the coveralls to the boots with duct tape.
- Put on the required chemical-protective gloves.
- Tape the wrists of the protective coveralls to the gloves.
- Don the required respirator and perform appropriate fit check (Level C or higher PPE only).
- Put hood or head covering over head and respirator straps, and tape hood to face piece (Level C or higher PPE only).
- Don remaining PPE, such as safety glasses or goggles and hard hat.

- Positive pressure-demand, full-face piece self-contained breathing apparatus (SCBA), or positive pressure-demand supplied air respirator with escape SCBA (NIOSH approved).
- Saranax-coated Tyvek ® coverall with attached boots or equivalent;
- Nitrile outer gloves over Silver Shield® inner gloves;
- Steel toe work boots, ANSI Z41 approved;
- Chemical resistant Neoprene boots with steel toes; or latex booties over safety toe shoes;
- Hard hat, ANSI Z89 approved; and
- Hearing protection (if necessary).

When these procedures are instituted, one person must remain outside the work area to confirm that each person entering has the proper protective equipment.

5.4.2 Doffing Procedures

The following procedures are only mandatory if Modified Level D, Level C or Level B PPE is required for the site. Whenever a person leaves the work area, the following decontamination sequence will be followed:

- Upon entering the CRZ, rinse contaminated materials from the boots or remove contaminated boot covers.
- Clean reusable protective equipment.
- Remove protective garments, equipment, and respirator (Level C or higher PPE only). All disposable clothing should be placed in plastic bags with contaminated-waste labels.
- Wash hands, face, and neck (or shower, if necessary).
- Proceed to clean area and dress in clean clothing.
- Clean and disinfect respirator for next use.
- Positive pressure-demand, full-face piece self-contained breathing apparatus (SCBA), or positive pressure-demand supplied air respirator with escape SCBA (NIOSH approved).
- Saranax-coated Tyvek ® coverall with attached boots or equivalent;
- Nitrile outer gloves over Silver Shield® inner gloves;
- Steel toe work boots, ANSI Z41 approved;
- Chemical resistant Neoprene boots with steel toes; or latex booties over safety toe shoes;

- Hard hat, ANSI Z89 approved; and
- Hearing protection (if necessary).

All disposable equipment, garments, and PPE must be bagged in plastic bags labeled for disposal. See Section 7, Work Zones and Decontamination, for detailed information on decontamination stations.

6. Air Monitoring

6.1 Air Monitoring

If deemed necessary by the BBLES HSS, air monitoring will be conducted to determine employee exposure to airborne constituents. The monitoring results will dictate work procedures and the selection of PPE. The monitoring device to be used is a Rae Systems MultiRAE detector (PID with a 11.7 eV lamp/oxygen/LEL/Hydrogen Sulfide Sensors). (or equivalent). Colorimetric detector tubes for vinyl chloride and Chloroform may be required based upon monitoring results. The BBLES HSS will be responsible for utilizing the air monitoring results to determine appropriate health and safety precautions for BBLES personnel and subcontractors. Air monitoring results should be recorded in field notebooks or on an air monitoring log (see Attachment H for a copy of the log).

Air monitoring should be performed continuously with the MultiRAE during any activity where flammable vapors could be generated or accumulate. All work activity must stop where tests indicate the concentration of flammable vapors exceeds 10% of the LEL at a location with a potential ignition source. Such an area must be ventilated to reduce the concentration to an acceptable level. If established action levels for total organic vapors are exceeded, screening for vinyl chloride and chloroform will be conducted with colorimetric tubes (Drager, Sensidyne, etc.). Drager tube measuring ranges are as follows:

Vinyl Chloride	0.5 – 5 ppm
Chloroform	2 - 10 ppm

6.2 Noise Monitoring

Noise monitoring may be conducted as required. Hearing protection is mandatory for all employees in noise hazardous areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection.

6.3 Monitoring Equipment Maintenance and Calibration

All direct-reading instrumentation calibrations should be conducted under the approximate environmental conditions that the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments that are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be documented on a calibration log or in the field notebook. All completed health and safety forms must be reviewed by the HSS and maintained by the SS.

All air-monitoring equipment will be maintained and calibrated in accordance with the specific manufacturer's procedures. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturer's procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventive maintenance.

If an instrument is found to be inoperative or suspected of giving erroneous readings, the HSS must be responsible for immediately removing the instrument from service and obtaining a replacement unit. If the

instrument is essential for safe operation during a specific activity, that activity must cease until an appropriate replacement unit is obtained. The HSS will be responsible for confirming that a replacement unit is obtained and/or repairs are initiated on the defective equipment.

6.4 Personal Air Monitoring for Vinyl Chloride

To quantify the potential exposure of site personnel to vinyl chloride in air during this project (if any), a personal air sampling plan to determine airborne concentrations of vinyl chloride will be implemented by each employee on site if survey instrument readings (colorimetric tubes) exceed site action levels. The following paragraphs outline the frequency, sampling, analytical, and record-keeping requirements associated with personal air sampling during this project. The requirements of 29 CFR 1910.1017 must also be met for vinyl chloride.

If the action level of 0.5 ppm for vinyl chloride (as determined with colorimetric tube monitoring) is exceeded, personal air sampling will be conducted in the areas of the site during the next full shift of the activity in the area where the action level for vinyl chloride was exceeded. Personal air samples for vinyl chloride will be collected for at least 20% of representative employees working in or around the site activities. Additional personal sampling may be required during on-site activities based on the results of the initial personal air monitoring assessment. Monitoring frequency for vinyl chloride will be based on the requirements of 29 CFR 1910.1017.

Personal samples for vinyl chloride will be collected (if necessary) according to NIOSH Method #1007 (Attachment I) or equivalent. Samples will be collected utilizing a personal sample pump equipped with two charcoal tubes or an equivalent passive organic vapor dosimeter badge. The sample pump must be calibrated prior to and following sample collection to a flow rate of 0.05 L/min with a representative sampler in place. Organic vapor dosimeter badges do not require calibration prior to use.

All personal samples will be submitted to an independent, American Industrial Hygiene Association-accredited laboratory for analysis. Accompanying media blanks also will be submitted to the laboratory for analysis at a rate of one blank for every five samples. Holding time requirements and field preparation procedures as specified in the respective NIOSH method will be followed.

6.5 Action Levels

Table 6-1 presents airborne contaminant action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the site.

TABLE 6-1
AIRBORNE CONTAMINANT ACTION LEVELS

Parameter	Reading	Action
Total Hydrocarbons (PID)	0 ppm to < 1 ppm	Normal operations; continue hourly breathing zone monitoring
	> 1 ppm	Increase monitoring frequency to every 15 minutes and use chloroform and vinyl chloride Drager tubes to screen for the presence of chloroform and vinyl chloride
	> 5 ppm to < 25 ppm	Upgrade to Level C PPE; continue screening for chloroform and vinyl chloride
	> 25 ppm	Stop work; investigate cause of reading; contact HSO
Vinyl Chloride (measured with colorimetric tubes)	> 0.5 ppm	Initiate personal sampling for vinyl chloride.
	> 1 ppm	Stop work; evacuate work area; investigate cause of reading; contact HSO regarding upgrade to Level B PPE.
Chloroform (From Colorimetric Tube)	≥ 1 ppm to 10 ppm	Normal operations; continue screening at 15 minute intervals
	> 10 ppm	Stop work; evacuate area; investigate cause of reading, contact HSO
Flammable Vapors (LEL)	< 10% LEL	Normal operations
	≥ 10% LEL	Stop work, ventilate area, investigate source of vapors
Hydrogen Sulfide	< 5 ppm	Normal operations, acceptable entry condition
	≥ 5 ppm	Stop work; evacuate confined space; ventilate area; investigate source of vapors
Carbon Monoxide	< 25 ppm	Normal operations, acceptable entry condition
	≥ 25 ppm	Stop work; evacuate confined space; ventilate area; investigate source of vapors
Oxygen	> 19.5%, < 23.5%	Normal operations, acceptable entry condition
	< 19.5%, > 23.5%	Stop work; evacuate confined space; ventilate; re-sample

7. Work Zones and Decontamination

7.1 Work Zones

7.1.1 Authorization to Enter

Only personnel with the appropriate training and medical certifications (if respirators are required) will be allowed to work at the project site. The SS will maintain a list of authorized persons; only personnel on the authorized-persons list will be allowed to enter the site work areas.

7.1.2 Site Orientation and Hazard Briefing

No person will be allowed in the work area during site operations without first being given a site orientation and hazard briefing. This orientation will be presented by the SS or HSS and will consist of a review of this HASP. This review must cover the chemical, physical, and biological hazards; protective equipment; safe work procedures; and emergency procedures for the project. Following this initial meeting, daily safety meetings will be held each day before work begins.

All people entering the site work areas, including visitors, must document their attendance at this briefing, as well as the daily safety meetings, on the forms included with this plan. All reviewers of the HASP must sign the HASP acknowledgement form.

7.1.3 Certification Documents

A training and medical file may be established for the project and kept on site during all site operations. Specialty training, such as first aid and cardiopulmonary resuscitation (CPR), as well as current medical clearances for all project field personnel required to wear respirators, will be maintained within that file. All BBLES and subcontractor personnel must provide their training and medical documentation to the HSS prior to starting work.

7.1.4 Entry Log

A log-in/log-out sheet will be maintained on site by the SS. Personnel must sign in and out on a log sheet as they enter and leave the work area, and the SS may document entry and exit in the field notebook.

7.1.5 Entry Requirements

In addition to the authorization, hazard briefing, and certification requirements listed above, no person will be allowed in any BBLES work area unless they are wearing the minimum PPE as described in Section 5, Personal Protective Equipment.

7.1.6 Emergency Entry and Exit

People who must enter the work area on an emergency basis will be briefed of the hazards by the SS. All activities will cease in the event of an emergency. People exiting the work area because of an emergency will gather in a safe area for a head count. The SS is responsible for confirming that all people who entered the work area have exited in the event of an emergency.

7.1.7 Contamination-Control Zones

Contamination-control zones are maintained to prevent the spread of contamination, and to prevent unauthorized people from entering hazardous areas.

7.1.7.1 Exclusion Zone

An EZ may consist of a specific work area or may be the entire area of potential contamination. All employees entering an EZ must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. Cones, caution tape, or a site diagram will identify the location of each EZ, if needed.

7.1.7.2 Contamination-Reduction Zone

The CRZ or transition area will be established, if necessary, to perform decontamination of personnel and equipment. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated in a specific location. All personnel will be decontaminated on site adjacent to the EZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the SZ.

7.1.7.3 Support Zone

The SZ is a clean area outside the CRZ located to prevent employee exposure to hazardous substances. Eating and drinking will be permitted in the SZ only after proper decontamination. Smoking may be permitted in the SZ, subject to site requirements.

7.1.8 Posting

Work areas will be prominently marked and delineated using cones, caution tape, or a site diagram.

7.1.9 Site Inspections

The SS will conduct a daily inspection of site activities, equipment, and procedures to verify that the required elements are in place. The Safety Inspection Form in Attachment J may be used as a guide for daily inspections. LPOs will be completed per the project schedule and input into the BBLES LPS Database.

7.2 Decontamination

7.2.1 Personnel Decontamination

All personnel wearing Modified Level D, Level C or Level B protective equipment in the EZ must undergo personal decontamination prior to entering the SZ. The personnel decontamination area will consist of the following stations, at a minimum:

- *Station 1*: Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots.
- *Station 2*: Personnel will remove their outer garment and gloves and dispose of them in properly labeled containers. Personnel will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items are then hand carried to the next station.
- *Station 3*: Personnel will thoroughly wash their hands and face before leaving the CRZ. Respirators will be sanitized and then placed in a clean plastic bag.

7.2.2 Equipment Decontamination

All equipment must be decontaminated prior to leaving the work area. Any decon solution and rinsate water generated must be poured into a drum for disposal.

7.2.3 PPE Decontamination

Where and whenever possible, single-use, external protective clothing must be used for work within the EZ or CRZ. This protective clothing must be disposed of in properly labeled containers. Reusable protective clothing will be rinsed on site with detergent and water. The rinsate will be collected for disposal.

When removed from the CRZ, the respirator will be thoroughly cleaned with soap and water. The respirator face piece, straps, valves, and covers must be thoroughly cleaned at the end of each work shift and ready for use prior to the next shift. Respirator parts may be disinfected with a solution of bleach and water, or by using a spray disinfectant.

8. Training and Medical Surveillance

8.1 Training

8.1.1 General

All on-site project personnel who work in areas where they may be exposed to site contaminants must be trained as required by OSHA Regulation 29 CFR 1910.120 (HAZWOPER). Field employees also must receive a minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their initial training more than 12 months prior to the start of the project must have completed an 8-hour refresher course within the past 12 months. The SS must have completed an additional 8 hours of supervisory training, and must have current first-aid and CPR certificates.

8.1.2 Basic 40-Hour Course

The following is a list of the topics typically covered in a 40-hour HAZWOPER training course:

- General safety procedures;
- Physical hazards (fall protection, noise, heat stress, cold stress);
- Names and job descriptions of key personnel responsible for site health and safety;
- Safety, health, and other hazards typically present at hazardous waste sites;
- Use, application, and limitations of PPE;
- Work practices by which employees can minimize risks from hazards;
- Safe use of engineering controls and equipment on site;
- Medical surveillance requirements;
- Recognition of symptoms and signs that might indicate overexposure to hazards;
- Worker right-to-know (Hazard Communication OSHA 1910.1200);
- Routes of exposure to contaminants;
- Engineering controls and safe work practices;
- Components of a health and safety program and a site-specific HASP;

- Decontamination practices for personnel and equipment;
- Confined-space entry procedures; and
- General emergency response procedures.

8.1.3 Supervisor Course

Managers and supervisors must receive an additional 8 hours of training, which typically includes:

- General site safety and health procedures;
- PPE programs; and
- Air monitoring techniques.

8.1.4 Lockout/Tagout Training

Only employees and subcontractors who have received lockout/tagout training as authorized employees will be authorized to implement lockout/tagout procedures.

Training will be documented on a Lockout/Tagout Training Certificate Form provided and maintained by the HSS.

8.1.5 Confined Space Entry Training

All employees performing confined space entry work shall receive training in the hazards of confined spaces, work practices to control these hazards and duties to be performed.

Requirements for Entrants, Attendants: Basic training requirements for entrants and attendants include 40-Hour HAZWOPER training course (or equivalent) and if not part of the 40-hour training, Confined Space Entry Entrant/Attendant training. Personnel assigned to attendant duties shall be trained in non-entry rescue procedures.

Requirements for Entry Supervisors: Basic training for entry supervisors and personnel conducting atmospheric testing shall include Confined Space Entry Supervisor Training (or equivalent), 8 hour supervisor training, and 40 hour training.

8.1.6 Site-Specific Training

Site-specific training will be accomplished by on-site personnel reading this HASP or through a thorough site briefing by the PM, SS, or HSS on the contents of this HASP before work begins. The review must include a discussion of the chemical, physical, and biological hazards; protective equipment and safety procedures; and emergency procedures.

8.1.7 Daily Safety Meetings

During construction activities, twice daily safety meetings will be held to cover the equipment upgrade work to be accomplished, hazards anticipated, PPE and procedures required to minimize site hazards, and emergency procedures. The SS, HSS or their designee should present these meetings prior to beginning the day's fieldwork and again after lunch. During on-going operations, a safety meeting will be held at the beginning of each shift. No work will be performed in an EZ before a safety meeting has been held. A safety meeting must also be held prior to new tasks and repeated if new hazards are encountered. The Daily Safety Meeting Log is included as Attachment K.

8.1.8 First Aid and CPR

At least one employee current in first aid and CPR will be assigned to the work crew, and will be on site during operations. Refresher training in first aid (triennially) and CPR (annually) is required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens.

8.1.9 Medical Surveillance

8.1.10 Medical Examination

All personnel who are potentially exposed to site contaminants must participate in a medical surveillance program as defined by OSHA at 29 CFR 1910.120(f).

8.1.11 Pre-Placement Medical Examination

All potentially exposed personnel must have completed a comprehensive medical examination prior to assignment and periodically thereafter, as defined by applicable regulations. The pre-placement and periodic medical examinations typically include the following elements:

- Medical and occupational history questionnaire;
- Physical examination;
- Complete blood count, with differential;
- Liver enzyme profile;
- Chest x-ray, at a frequency determined by the physician;
- Pulmonary function test;

- Audiogram;
- Electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination;
- Drug and alcohol screening, as required by job assignment;
- Visual acuity; and
- Follow-up examinations, at the discretion of the examining physician or the corporate medical director.

The examining physician must provide the employee with a letter summarizing his or her findings and recommendations, confirming the worker's fitness for work and ability to wear a respirator. Documentation of medical clearance will be available for each employee during all project site work.

Subcontractors will certify that all their employees have successfully completed a physical examination by a qualified physician. The physical examinations must meet the requirements of 29 CFR 1910.120 and 29 CFR 1910.134. Subcontractors will supply copies of the medical examination certificate for each on-site employee.

8.1.12 Other Medical Examinations

In addition to pre-employment, annual, and exit physicals, personnel may be examined:

- At employee request after known or suspected exposure to toxic or hazardous materials; and
- At the discretion of the HSS, HSO, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials.

8.1.13 Periodic Exam

Following the placement examination, all employees must undergo a periodic examination similar in scope to the placement examination. For employees potentially exposed more than 30 days per year, the frequency of periodic examinations will be annual. For employees potentially exposed less than 30 days per year, the frequency for periodic examinations will be 24 months.

8.1.14 Medical Restriction

When the examining physician identifies a need to restrict work activity, the employee's supervisor must communicate the restriction to the employee and the HSS. The terms of the restriction will be discussed with the employee and the supervisor.

9. Emergency Procedures

9.1 General

Prior to the start of operations, the work area will be evaluated for the potential for fire, contaminant release, or other catastrophic event. Unusual conditions or events, activities, chemicals, and conditions will be reported to the SS/HSS immediately.

The SS/HSS will establish evacuation routes and assembly areas for the site. All personnel entering the site will be informed of this route and the assembly area.

9.2 Emergency Response

If an incident occurs, the SS or HS should take the following steps:

- Evaluate the incident and assess the need for assistance and/or evacuation;
- Call for outside assistance as needed;
- Confirm that the PM is notified promptly of the incident; and
- Take appropriate measures to stabilize the incident scene.

9.2.1 Fire

In the case of a fire on site, the SS/HSS will assess the situation and direct firefighting activities. The SS/HSS will confirm that the PM is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that site personnel are unable to safely extinguish with one fire extinguisher, the local fire department will be summoned.

9.2.2 Contaminant Release

In the event of a contaminant release, the following steps will be taken:

- Notify SS/HSS immediately;
- Evacuate immediate area of release;
- Conduct air monitoring to determine needed level of PPE; and
- Don required level of PPE and prepare to implement control procedures.

The SS/HSS has the authority to commit resources as needed to contain and control released material, and to prevent its spread to offsite areas.

9.3 Medical Emergency

All employee injuries must be promptly reported to the HSS/SS, who will:

- Confirm that the injured employee receives prompt first aid and medical attention.
- In emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room).

If the injured person is a BBLES employee, notify BBLES Human Resources at 315-446-9120, ext. 336 as soon as possible after the injured employee has been safely evacuated from the site.

9.3.1 Emergency Care Steps

Upon entering an accident area, site personnel must follow these emergency care steps:

- Survey the scene. Determine if it is safe to proceed. Try to determine if the conditions that caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim.
- Do a primary survey of the victim. Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.
- Phone emergency medical services (EMS). Give the location, telephone number used, caller's name, what happened, number of victims, victim's condition, and help being given.
- Maintain airway and perform rescue breathing as necessary.
- Perform CPR as necessary.
- Do a secondary survey of the victim. Check vital signs and do a head-to-toe exam.
- Treat other conditions as necessary. If the victim can be moved, take him or her to a location away from the work area where EMS can gain access.

9.4 First Aid—General

All persons must report any injury or illness to their immediate supervisor or the SS. Trained personnel will provide first aid. Injuries and illnesses requiring medical treatment must be documented. The SS and HSS must conduct an II as soon as emergency conditions no longer exist, and first aid and/or medical treatment has been confirmed. IIs must be completed and submitted to the PM within 24 hours after the incident.

If first-aid treatment is required, first-aid kits are kept at the facility. If treatment beyond first aid is required, the injured person(s) should be transported to the medical facility. If the injured person is not ambulatory or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance and/or paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

9.4.1 First Aid - Inhalation

Any employee complaining of symptoms of chemical overexposure as described in Section 4, General Safety Practices, will be removed from the work area and transported to the designated medical facility for examination and treatment.

9.4.2 First Aid - Ingestion

Call EMS and consult a poison control center for advice. If available, refer to the MSDS (Attachment E) for treatment information. If the victim is unconscious, keep them on their side and clear the airway if vomiting occurs.

9.4.3 First Aid - Skin Contact

Project personnel, who have had skin contact with contaminants will, unless the contact is severe, proceed through the CRZ to the wash area. Personnel will remove any contaminated clothing and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he or she shows any sign of skin reddening, irritation, or if he or she requests a medical examination.

9.4.4 First Aid - Eye Contact

Project personnel who have had contaminants splashed in their eyes, or who have experienced eye irritation while in the EZ, must immediately proceed to the eyewash station in the CRZ, if available. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

9.5 Reporting Injuries, Illnesses, and Near-Miss Incidents

Injuries and illnesses, however minor, will be reported to the SS immediately. The SS will complete an injury report and submit it to the HSM/HSO, Client, PO and the PM within 24 hours.

Near-miss incidents are situations in which no injury or property damage occurred, but under slightly different circumstances an injury or property damage could have occurred. Near misses are caused by the same factors as injuries; therefore, they must be reported and investigated in the same manner. An SPSA must be done immediately after an injury, illness, near miss, or other incident to determine if it is safe to proceed with the work.

9.6 Emergency Information

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting. These agencies are identified in Table 9-1 below.

Table 9-1
Emergency Contacts

EMERGENCY/CONTINGENCY CONTACT TELEPHONE LIST	
LOCAL EMERGENCY CONTACTS	**PHONE NUMBER**
FIRE DEPARTMENT: (Manhasset Lakeside)	911
LOCAL POLICE: (Nassau County – 3rd Precinct)	911
STATE POLICE:	(631) 756-3300
AMBULANCE:	911
i.Park Lake Success Site Security	(516) 592-4504
HOSPITAL:	(516) 470-7000
LOCAL HEALTH DEPARTMENT:	(516) 571-3344
STATE HEALTH DEPARTMENT:	(518) 437-8600
PROJECT EMERGENCY CONTACTS	
State Environmental Agency:	(518) 402-9814
U.S. EPA - Regional Office:	(212) 637-5000
Emergency Response Contractor:	NA
Emergency Client Contact:	(301) 214-9971
BBLES Project Manager:	(516) 328-0464
OTHER EMERGENCY CONTACTS	
USEPA Emergency Response Team	(800) 424-8802
NYSDEC Spill Hotline	(800) 342-9296

Anytime local public response agencies such as police, fire and or ambulance are called, i.Park Lake Success Site Security must be called also and provided pertinent information so that i.Park Lake Success Site Security can direct the local response agencies to where they are required.

9.6.1 Directions to Hospital

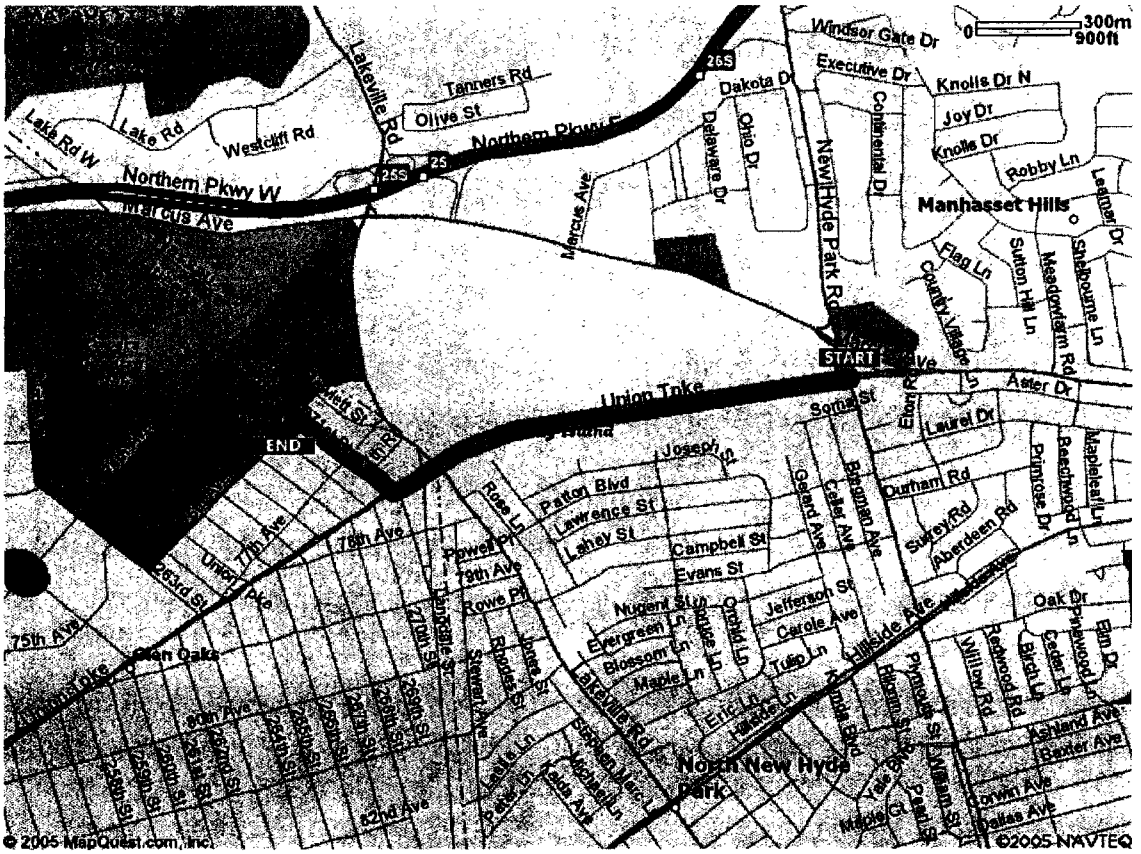
When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

9.6.2 Map to Hospital from OU-1

Long Island Jewish Medical Center
27005 76th Avenue
#1120
New Hyde Park, NY 11040
Phone: (516) 470-7000

Directions

- Start out going SOUTH on NEW HYDE PARK ROAD. (<0.1 miles)
- Turn RIGHT onto UNION TURNPIKE. (0.9 miles)
- Turn LEFT onto 269TH STREET. (0.1 miles)
- Turn RIGHT onto 76TH AVENUE. (<0.1 miles)

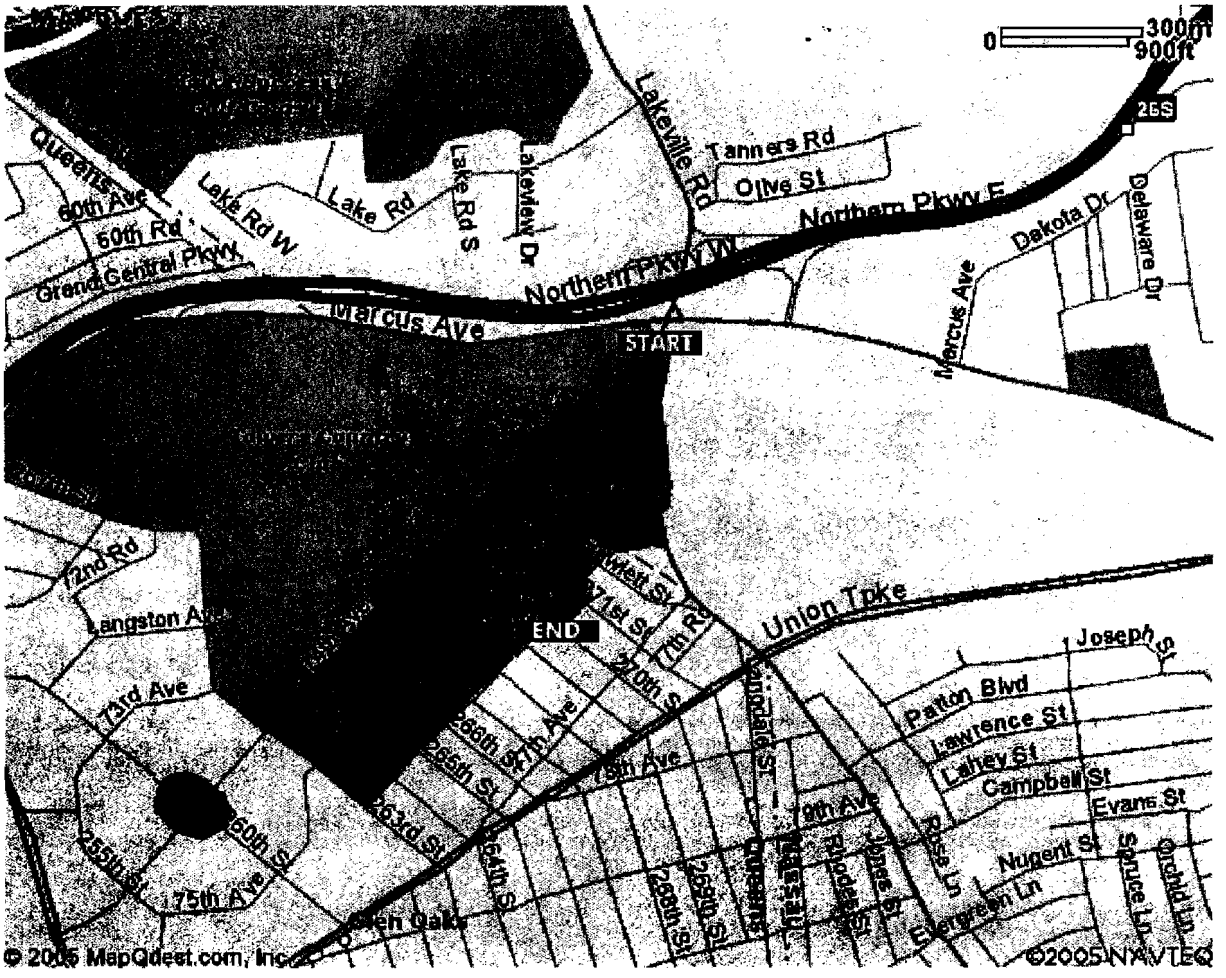


9.6.3 Map to Hospital from OU-2

Long Island Jewish Medical Center
27005 76th Avenue
#1120
New Hyde Park, NY 11040
Phone: (516) 470-7000

Directions

- Start out going SOUTH on LAKEVILLE ROAD.
- Turn RIGHT.
- Turn LEFT.
- Turn RIGHT onto 76th Avenue.



10. Acronyms and Abbreviations

The following acronyms and abbreviations (listed alphabetically) are applicable to this HASP:

ACGIH - American Conference of Governmental Industrial Hygienists
BBLES - BBL Environmental Services, Inc.
CFR - Code of Federal Regulations
CO - Carbon Monoxide
COC(s) - Constituent(s) of Concern
CPR - Cardiopulmonary Resuscitation
CRZ - Contamination Reduction Zone
DEET - diethyltoluamide
EMS - Emergency Medical Services
EZ - Exclusion Zone
GFCI - Ground-Fault-Circuit Interrupter
H2S – Hydrogen Sulfide
HASP - Health and Safety Plan
HSO - Health and Safety Officer
HSS - Health and Safety Supervisor
II - Incident Investigation
JSA - Job Safety Analysis
kV - Kilovolts
LEL - Lower Explosive Limit
LFL - Lower Flammable Limit
LPO - Loss Prevention Observation
mph - Miles Per Hour
MSDS - Material Safety Data Sheet
NEC - National Electrical Code
NESC - National Electrical Safety Code
NYSDOT - New York State Department of Transportation
NIOSH - National Institute for Occupational Safety and Health
NRR - Noise Reduction Rating
OSHA - Occupational Safety and Health Administration
PEL - Permissible Exposure Limit
PID - Photoionization Detector
PM - Project Manager
PO - Project Officer
PPE - Personal Protective Equipment
RMSF - Rocky Mountain Spotted Fever
SPSA - Safe Performance Self-Assessment
SS - Site Supervisor
SZ - Support Zone
Ta adj - Adjusted Air Temperature
TLV - Threshold Limit Value
UL - Underwriters Laboratory
USEPA - United States Environmental Protection Agency

Attachments

BBL
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Remedial Management & Construction

Attachment A

Lockout/Tagout Equipment Specific Energy Control Procedure

BBL
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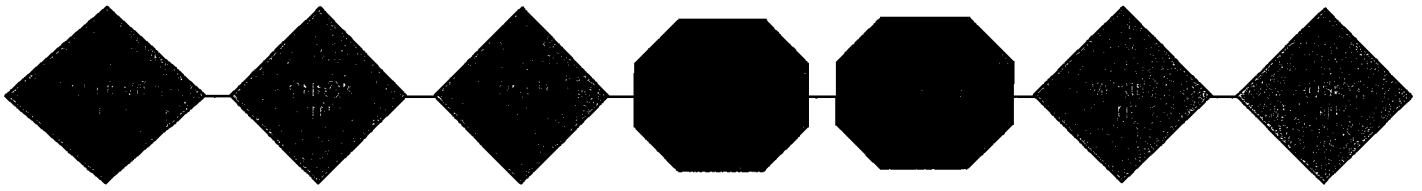
Lockout / Tagout Equipment-Specific Energy Control Procedure



Equipment Identification:

Hazardous Energy Source		Isolation Device			Verifying Lockout
Type and Magnitude	Function	Type	Location	ID No.	Means of Verification of Lockout
Electrical 120v					
Pneumatic					
Hydraulic					
Mechanical					
Potential					
Gravity					
Other					
Other					
Other					
Area		Date of Last Review		Authorized by	

Attachment B

Confined Space Entry Checklist

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Remedial Management & Construction

BBL
ENVIRONMENTAL SERVICES, INC.

Confined Space Entry Checklist

ALL COPIES OF PERMIT TO BE MAINTAINED ON JOB SITE UNTIL THE ENTRY IS COMPLETE

Project:

Location and Description of Confined Space:

Checklist	YES	NO	N/A	COMMENTS
Are all lines to and from confined space blanked, capped, or isolated?				
Electrical service locked out (entrant with key)?				
Are mechanical devices / systems restrained and locked out?				
Is explosion-proof electrical equipment in use?				
Are ladders secured at top?				
Is the ground fault circuit interrupter checked and functioning?				
Are all ignition sources identified and isolated?				
Are respirators and air supply equipment in proper condition?				
Are safety harnesses and lifelines in proper condition?				
Is required PPE being used?				
Is monitoring equipment calibrated and functioning properly?				
Is atmospheric testing completed?				
Is a trained attendant on standby?				
Is emergency equipment ready for use?				
Are rescue provisions in place?				
Are warning signs posted?				
Is ventilation equipment functioning properly?				
Is the retrieval system functioning properly?				
Communication device for entrance and attendants?				
Is the area secured to eliminate unauthorized entry?				
Are entry personnel trained for confined space entry?				
Is the confined space entry permit completed and posted?				
Are the permanent ladder rungs in safe condition?				

Monitoring Frequency: **Continuous** **5 min.** **10 min.** **30 min.**

Monitor's Name: _____

Confined Space Air Monitoring Parameters				
Time of Reading	% Oxygen (19.5%)	% LEL (10%)	CO (<400ppm)	Other
Pre-Entry				

Entry Supervisor _____
Print Name

Signature _____ Date _____ Time _____

Air Monitor _____
Print Name

Signature _____ Date _____ Time _____

Attachment C

Confined Space Entry Permit

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Remedial Management & Construction

BBL
ENVIRONMENTAL SERVICES LLC

Confined Space Entry Permit

Project Name:	Date:
Project Number:	Location:
Prepared By:	Project Manager:

Location and Description of Confined Space:	
Rescue Contact and Phone Number:	
Entry Objectives:	
Equipment / Materials Required for Entry:	
Time of Entry:	Expiration of Entry:
Required Respirator for Entry:	
Required Protective Clothing for Entry:	

Monitoring Interval: **Continuous** **5 minutes** **10 minutes** **15 minutes** **30 minutes**

Air Monitoring Requirements

Monitor For	Monitoring Equipment	Calibrated	
		Date / Time	By
% O_2			
% of LEL			
H_2S			
CO			
Other:			
Other:			

Entrants and Attendants

Number of Entrants:	Number of Attendants:

Names of Entrants	Names of Attendants

Entry Supervisor Authorizing Confined Space Entry

Print:	Date:	Time:
Signature:	Date:	Time:

Entry Supervisor Cancelling Confined Space Entry

Print:	Date:	Time:
Signature:	Date:	Time:

Attachment D

Hot Work Permit

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BBL
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Site Hot Work Permit

Location and Description of Hot Work: _____

Checklist	YES	NO	N/A	COMMENT
Is there any alternate procedure to use instead of hot work?				
Is it possible to move the hot work to a designated hot work area?				
Is it possible to move all fire hazards at least 35 feet away?				
If all fire hazards cannot be removed, can guards, barriers, or screens be used to confine any heat, sparks, or slag, and to protect the immovable fire hazards?				
Are there any flammable or combustible liquid storage areas within 50 feet?				
Is the area where the work is to be performed free of combustible material to heat, sparks, flying sparks, or slag?				
Are combustible materials adjacent to the opposite side of partitions, walls, or ceilings protected by guards or moved 35 feet away from the surface?				
Is everything moved or protected that could be damaged by sparks or water?				
Is suitable fire extinguishing equipment on hand and ready for immediate use?				
Is the sprinkler system in the area operational?				
Are the surrounding employees in an area where flying sparks and slag may injure them?				
When working with compressed gas cylinders and torches, has the worker verified that all connections are tight?				
Have precautions been implemented to prevent injury to employees?				
Has the area supervisor been notified?				
Is a fire watch in place? When using compressed gases, is the fire watch located in a position to cut off the flow of gas if needed?				
Is hot work to be conducted in a confined space?				
Is appropriate personal protective equipment and respiratory protection being used?				

The area where hot work is being conducted must remain attended for at least 30 minutes after completion of the work.

Monitoring Frequency: **Continuous** **Every 30 min.** **Other**

Monitor's Name: _____

Time of Reading	Hot Work Air Monitoring Parameters			
	% Oxygen 19.5%	% LEL 10%	PID	Other

Air Monitor _____
Print Name

_____
Signature Date Time

Attachment E

Material Safety Data Sheets

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Remedial Management & Construction

ATTACHMENT E

SITE CONSTITUENTS OF CONCERN

Bentonite
Chloroform
1,1-Dichloroethene
1,2-Dichloroethane
cis 1,2-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
Freon 113: Trichlorotrifluoroethane
Helium
Tetrachloroethane
Trichloroethane
Vinyl Chloride

CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

BENTONITE

Section 1 - Product and Company Identification
BENTONITE

Product Identification: BENTONITE
Date of MSDS: 11/06/1991 **Technical Review Date:** 06/02/1992
FSC: 6850 **NIIN:** 00-263-8640
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: FISHER SCIENTIFIC, CHEMICAL DIV.
Post Office Box: N/K
Manufacturer's Address1: 1 REAGENT LANE
Manufacturer's Address2: FAIR LAWN, NJ 07410
Manufacturer's Country: US
General Information Telephone: 201-796-7100
Emergency Telephone: 201-796-7100 OR 201-796-7523
Emergency Telephone: 201-796-7100 OR 201-796-7523
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 1B464
Special Project Code: N

Item Description

Item Name: DESICCANT,ACTIVATED
Item Manager: S9G
Specification Number: MIL-D-3464E
Type/Grade/Class: TYPE I
Unit of Issue: CN **Quantitative Expression:** 00000000005GL
Unit of Issue Quantity: 1
Type of Container: CAN/PAIL

Contractor Information

Contractor's Name: FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Contractor's Address1: 1 REAGENT LANE
Contractor's Address2: FAIR LAWN, NJ 07410-2802
Contractor's Telephone: 201-796-7100
Contractor's CAGE: 1B464

Section 2 - Compositon/Information on Ingredients
BENTONITE

Ingredient Name: BENTONITE (AS NUISANCE DUST OR PARTICULATES NOT OTHERWISE REGULATED)
Ingredient CAS Number: 1302-78-9 **Ingredient CAS Code:** M
RTECS Number: CT9450000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100
% Enviromental Weight:

Other REC Limits: N/K
OSHA PEL: 15 MG/M3 TOTAL DUST **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 10 MG/M3 TDUST;8990 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
BENTONITE

Health Hazards Acute & Chronic: ACUTE-INHALE:HIGH CONCENTRATIONS OF DUST MAY CAUSE IRRITATION.SKIN:NO ADVERSE EFFECTS.EYE:PARTICLES IN THE EYE MAY CAUSE IRRITATION.ORAL:INGESTION OF LARGE AMOUNTS MAY CAUSE INTESTINAL OBSTRUCTION.CHR ONIC-MAY CAUSE PNEUMOCONIOSIS,CHEST PAIN,COUGH,DYSPNEA,CYANOSIS,FATIGUE & BRONCHITIS.

Signs & Symptoms of Overexposure:
HIGH CONCENTRATIONS OF DUST MAY CAUSE IRRITATION BY INHALATION. PARTICLES IN THE EYE MAY CAUSE IRRITATION. INGESTION OF LARGE AMOUNTS MAY CAUSE INTESTINAL OBSTRUCTION.

Medical Conditions Aggravated by Exposure:
PERSONS WITH PRE-EXISTING RESPIRATORY DISORDERS BE MORE SUSCEPTIBLE TO THE EFFECTS OF THE SUBSTANCE.

LD50 LC50 Mixture: LD50 (INTRAVENOUS, AT) 35 MG/KG

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: NO

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
BENTONITE

First Aid:
GET MEDICAL ATTENTION IF SYMPTOMS PERSIST.SKIN:WASH WITH SOAP & WATER.EYE:FLUSH WITH WATER FOR 15 MINUTES,HOLDING EYELIDS OPEN.INHALED:REMOVE TO FRESH AIR & PROVIDE OXYGEN/CPR IF NEEDED.ORAL:DO NOT IN DUCE VOMITING.IF VOMITING OCCURS,KEEP HEAD BELOW HIPS DUE TO ASPIRATION HAZARD.TREAT SYMPTOMATICALLY AND SUPPORTIVELY.CALL PHYSICIAN.

Section 5 - Fire Fighting Measures
BENTONITE

Fire Fighting Procedures:
WEAR FULL PROTECTIVE CLOTHING AND NIOSH-APPROVED SELF-CONTAINED BREATHING APPARATUS. MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. AVOID BREATHING VAPOR OR DUST.
Unusual Fire or Explosion Hazard:
NEGLIGIBLE FIRE HAZARD
Extinguishing Media:
WATER SPRAY, CO2, FOAM/DRY CHEMICAL. WATER SPRAY MAY BE USED TO KEEP FIRE EXPOSED CONTAINERS COOL & FLUSH SPILLS AWAY.
Flash Point: Flash Point Text: NONE

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/R
Upper Limit(s): N/R

Section 6 - Accidental Release Measures
BENTONITE

Spill Release Procedures:
USE NIOSH APPROVED DUST MASK/RESPIRATOR & PROTECTIVE GLOVES. SWEEP UP OR VACUUM AND TRANSFER INTO A CONTAINER FOR LATER DISPOSAL OR RECOVERY.

Section 7 - Handling and Storage
BENTONITE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
BENTONITE

Repiratory Protection:
USE NIOSH APPROVED DUST MASK/RESPIRATOR OR SELF-CONTAINED BREATHING APPARATUS.
Ventilation:
GOOD GENERAL VENTILATION IS SUFFICIENT FOR MOST CONDITIONS (10 ROOM VOLUMES PER HOUR).
Protective Gloves:
AS REQUIRED
Eye Protection: DUST-RESISTANT SAFETY GOGGLES
Other Protective Equipment: EYE WASH STATION, QUICK DRENCH SHOWER AND IMPERVIOUS CLOTHING
Work Hygenic Practices: OBSERVE GOOD PERSONAL HYGIENE PRACTICES AND RECOMMENDED PROCEDURES. DO NOT WEAR CONTAMINATED CLOTHING OR FOOTWEAR.
Supplemental Health & Safety Information: N/P

Section 9 - Physical & Chemical Properties
BENTONITE

HCC: N1
NRC/State License Number: N/R
Net Property Weight for Ammo: N/R
Boiling Point: Boiling Point Text: N/R
Melting/Freezing Point: Melting/Freezing Text: UNKNOWN
Decomposition Point: Decomposition Text: UNKNOWN
Vapor Pressure: N/R **Vapor Density:** N/R
Percent Volatile Organic Content:
Specific Gravity: UNKNOWN
Volatile Organic Content Pounds per Gallon:
pH: N/R
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/R
Solubility in Water: INSOLUBLE
Appearance and Odor: VERY FINE, ODORLESS, HYGROSCOPIC, PALE BUFF OR CREAM-COLORED TO GRAYISH POWDER
Percent Volatiles by Volume: N/R
Corrosion Rate: UNKNOWN

Section 10 - Stability & Reactivity Data
BENTONITE

Stability Indicator: YES
Materials to Avoid:
LITHIUM: MOLTEN LITHIUM ATTACKS SILICATES.
Stability Condition to Avoid:
MOISTURE. SWELLS TO APPROXIMATELY TWELVE TIMES ITS VOLUME WHEN ADDED TO WATER.
Hazardous Decomposition Products:
THERMAL DECOMPOSITION MAY RELEASE ACRID SMOKE AND IRRITATING FUMES.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
N/R

Section 11 - Toxicological Information
BENTONITE

Toxicological Information:
N/P

Section 12 - Ecological Information
BENTONITE

Ecological Information:
N/P

Section 13 - Disposal Considerations
BENTONITE

Waste Disposal Methods:
KEEP IN COVERED DRUMS, PENDING DISPOSAL. HANDLE & DISPOSE IN FULL COMPLIANCE WITH ALL APPLICABLE FEDERAL, STATE & LOCAL REGULATIONS.

Section 14 - MSDS Transport Information
BENTONITE

Transport Information:
N/P

Section 15 - Regulatory Information
BENTONITE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
BENTONITE

Other Information:
N/P

HMIS Transportation Information

Product Identification: BENTONITE
Transporation ID Number: 62923
Responsible Party CAGE: 1B464
Date MSDS Prepared: 11/06/1991
Date MSDS Reviewed: 06/02/1992
MFN: 06/02/1992
Submitter: D DG
Status Code: C

Container Information
Unit of Issue: CN
Container Quantity: 1
Type of Container: CAN/PAIL
Net Unit Weight: N/K

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N

Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
DOT PSN Code: ZZZ
Symbols: N/R
DOT PSN Modifier:
Hazard Class: N/R
UN ID Number: N/R
DOT Packaging Group: N/R
Label: N/R
Special Provision(s): N/R
Packaging Exception: N/R
Non Bulk Packaging: N/R
Bulk Packaging: N/R
Maximimum Quanity in Passenger Area: N/R
Maximimum Quanity in Cargo Area: N/R
Stow in Vessel Requirements: N/R
Requirements Water/Sp/Other: N/R

IMO Detail Information

IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION
IMO PSN Code: ZZZ
IMO PSN Modifier:
IMDG Page Number: N/R
UN Number: N/R
UN Hazard Class: N/R
IMO Packaging Group: N/R
Subsidiary Risk Label: N/R
EMS Number: N/R
Medical First Aid Guide Number: N/R

IATA Detail Information

IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
IATA PSN Code: ZZZ
IATA PSN Modifier:
IATA UN Id Number: N/R
IATA UN Class: N/R
Subsidiary Risk Class: N/R
UN Packaging Group: N/R
IATA Label: N/R
Packaging Note for Passengers: N/R
Maximum Quantity for Passengers: N/R
Packaging Note for Cargo: N/R
Maximum Quantity for Cargo: N/R
Exceptions: N/R

AFI Detail Information

AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
AFI Symbols:
AFI PSN Code: ZZZ
AFI PSN Modifier:

AFI UN Id Number: N/R
AFI Hazard Class: N/R
AFI Packing Group: N/R
AFI Label: N/R
Special Provisions: N/A
Back Pack Reference: N/A

HAZCOM Label Information

Product Identification: BENTONITE
CAGE: 1B464
Assigned Individual: N
Company Name: FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Company PO Box:
Company Street Address1: 1 REAGENT LANE
Company Street Address2: FAIR LAWN, NJ 07410-2802 US
Health Emergency Telephone: 201-796-7100 OR 201-796-7523
Label Required Indicator: Y
Date Label Reviewed: 06/02/1992
Status Code: C
Manufacturer's Label Number: UNKNOWN
Date of Label: 06/02/1992
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: N/P
Eye Protection Indicator: YES
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: CAUTION
Health Hazard: Slight
Contact Hazard: Slight
Fire Hazard: None
Reactivity Hazard: None

8/7/2002 9:49:35 PM

CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

CHLOROFORM

Section 1 - Product and Company Identification
CHLOROFORM

Product Identification: CHLOROFORM
Date of MSDS: 01/01/1987 **Technical Review Date:** 01/07/1993
FSC: 6520 **NIIN:** **LIIN:** 00F025941
Submitter: F BT
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: SULTAN CHEMISTS INC
Post Office Box: N/K
Manufacturer's Address1: 85 WEST FOREST INC AVE
Manufacturer's Address2: ENGLEWOOD, NJ 07631
Manufacturer's Country: US
General Information Telephone: (201) 871-1232
Emergency Telephone: (201) 871-1232
Emergency Telephone: (201) 871-1232
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 63536
Special Project Code: N

Preparer Information

Preparer's Name: SULTAN CHEMISTS INC
Preparer's Address1: 85 W FOREST AVE
Preparer's Address2: ENGLEWOOD, NJ 07631-4001
Preparer's CAGE: 63536
Assigned Individual: N

Contractor Information

Contractor's Name: SULTAN CHEMISTS INC
Contractor's Address1: 85 W FOREST AVE
Contractor's Address2: ENGLEWOOD, NJ 07631-4001
Contractor's Telephone: 201-871-1232
Contractor's CAGE: 63536

Section 2 - Compositon/Information on Ingredients
CHLOROFORM

Ingredient Name: CHLOROFORM (TRICHLOROMETHANE) SUSPECTED CARCINOGEN BY NTP & IARC
Ingredient CAS Number: 67-66-3 **Ingredient CAS Code:** M
RTECS Number: FS9100000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: (C) 50 PPM **OSHA PEL Code:** M

OSHA STEL: OSHA STEL Code:
ACGIH TLV: 10 PPM; A2; 9293 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 10 LBS
DOT Reporting Quantity: 10 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
CHLOROFORM

Health Hazards Acute & Chronic: INHALATION: NERVOUS SYSTEM DEPRESSION, DIZZINESS, & VERTIGO. SKIN: IRRITATION, DEFATTING, DERMATITIS. EYES: LOSS OF CORNEA EPITHELIUM, PAIN & IRRITATION. INGESTION: BURNING OF MOUTH & THROAT, PAIN IN CHEST & ABDOMEN, VOMITING, & SYSTEMIC EFFECTS.

Signs & Symptoms of Overexposure:
INHALATION: UNCONSCIOUSNESS & DEATH CAN RESULT. SKIN: ABSORPTION MAY CAUSE SYSTEMIC POISONING. INGESTION: VOMITING MAY CAUSE ASPIRATION INTO LUNGS WHICH CAN CAUSE CHEMICAL PNEUMONIA & SYSTEMIC EFFECTS .

Medical Conditions Aggravated by Exposure:
N/K

LD50 LC50 Mixture: N/K

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NONE

Section 4 - First Aid Measures
CHLOROFORM

First Aid:
INHALATION: REMOVE TO FRESH AIR. IF BREATHING STOPS, ADMINISTER ARTIFICIAL RESPIRATION. EYES: FLUSH W/WATER FOR AT LEAST 15 MINS. SKIN: WASH W/PLENTY OF WATER FOR AT LEAST 15 MINS. INGESTION: DON'T IN DUCE VOMITING. NOTE TO PHYSICIAN: ADRENALIN SHOULD NEVER BE GIVEN TO PERSONS OVEREXPOSED TO CHLOROFORM. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Section 5 - Fire Fighting Measures
CHLOROFORM

Fire Fighting Procedures:
WEAR SELF-CONTAINED BREATHING APPARATUS IN POSTIVE PRESSURE MODE.

Unusual Fire or Explosion Hazard:
VAPORS ARE HEAVIER THAN AIR & WILL COLLECT IN LOW AREAS. UN 1888.
Extinguishing Media:
N/K
Flash Point: Flash Point Text: NONE

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/K
Upper Limit(s): N/K

Section 6 - Accidental Release Measures
CHLOROFORM

Spill Release Procedures:
EVACUATE AREA, VENTILATE. AVOID BREATHING VAPORS. WEAR PROTECTIVE EQUIPMENT. CLEAN UP BY MOPPING OR ABSORBENT MATERIAL, PLACE IN CLOSED CONTAINER FOR DISPOSAL. AVOID CONTAMINATION OF GROUND & SURFACE WATER. TURN OFF AIR CONDITIONING/HEAT SYSTEM.

Section 7 - Handling and Storage
CHLOROFORM

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
CHLOROFORM

Repiratory Protection:
IF VAPOR EXCEEDS OR IS LIKELY TO EXCEED 2 PPM USE NIOSH/MSHA APPROVED SELF-CONTAINED BREATHING APPARATUS OR AIR LINE RESPIRATOR W/FULL FACE PIECE.
Ventilation:
TO MAINTAIN EXPOSURE LEVELS <2 PPM. DON'T USE IN CLOSED OR CONFINED SPACE. OPEN DOORS OR WINDOWS.
Protective Gloves:
SOLVENT RESISTANT SUCH AS VITON
Eye Protection: FACE SHIELD
Other Protective Equipment: POLY VINYL ALCOHOL GLOVES OR EQUIVALENT, SOLVENT RESISTANT BOOTS, APRON, HEAD GEAR, SAFETY SHOWER & EYEWASH STATION.
Work Hygenic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. DON'T EAT, DRINK OR SMOKE IN WORK AREA.
Supplemental Health & Safety Information: N/K

Section 9 - Physical & Chemical Properties
CHLOROFORM

HCC:
NRC/State License Number:
Net Property Weight for Ammo:

Boiling Point: Boiling Point Text: 139F
Melting/Freezing Point: Melting/Freezing Text: N/K
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 167 **Vapor Density:** 4.1
Percent Volatile Organic Content:
Specific Gravity: 1.48
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: 1.8 GM/100 ML
Appearance and Odor: CLEAR, COLORLESS LIQUID W/MILDLY SWEET ODOR
Percent Volatiles by Volume: 100%
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
CHLOROFORM

Stability Indicator: YES
Materials to Avoid:
STRONG ALKALIES, OXIDIZERS, ALKALI METALS, METALIC FINES OR POWDERS, ACETONE, ALUMINUM, DISILANE, OR MAGNESIUM
Stability Condition to Avoid:
OPEN FLAME, ELECTRIC ARCS, OR OTHER HOT SURFACES
Hazardous Decomposition Products:
TOXIC GASES, HYDROGEN CHLORIDE, PHOSGENE, & CHLORINE
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
N/K

Section 11 - Toxicological Information
CHLOROFORM

Toxicological Information:
N/P

Section 12 - Ecological Information
CHLOROFORM

Ecological Information:
N/P

Section 13 - Disposal Considerations
CHLOROFORM

Waste Disposal Methods:
CONTACT LICENSED RECLAIMER OR INCINERATION FACILITY. DISPOSE OF IN ACCORDANCE W/FEDERAL, STATE, & LOCAL REGULATIONS. UN 1888.

Section 14 - MSDS Transport Information
CHLOROFORM

Transport Information:
N/P

Section 15 - Regulatory Information
CHLOROFORM

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
CHLOROFORM

Other Information:
N/P

HAZCOM Label Information

Product Identification: CHLOROFORM
CAGE: 63536
Assigned Individual: N
Company Name: SULTAN CHEMISTS INC
Company PO Box:
Company Street Address1: 85 W FOREST AVE
Company Street Address2: ENGLEWOOD, NJ 07631-4001 US
Health Emergency Telephone: (201) 871-1232
Label Required Indicator: Y
Date Label Reviewed: 01/07/1993
Status Code: C
Manufacturer's Label Number: N/R
Date of Label: 01/07/1993
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: WARNING
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: None
Reactivity Hazard: Slight

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

F29 1,1-DICHLOROETHENE

Section 1 - Product and Company Identification
F29 1,1-DICHLOROETHENE

Product Identification: F29 1,1-DICHLOROETHENE
Date of MSDS: 01/26/1995 **Technical Review Date:** 04/10/1996
FSC: 6550 **NIIN:** **LIIN:** 00F037520
Submitter: F BT
Status Code: C
MFN: 02
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: CHEM SERVICE INC
Post Office Box: 3108
Manufacturer's Address1: 660 TOWER LN
Manufacturer's Address2: WEST CHESTER, PA 19381-3108
Manufacturer's Country: US
General Information Telephone: 215-692-3026/800-452-9994
Emergency Telephone: 215-386-2100/215-692-3026
Emergency Telephone: 215-386-2100/215-692-3026
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 84898
Special Project Code: N

Preparer Information

Preparer's Name: CHEM SERVICE INC
Post Office Box: 3108
Preparer's Address1: N/K
Preparer's Address2: WEST CHESTER, PA 19381
Preparer's CAGE: 84898
Assigned Individual: N

Contractor Information

Contractor's Name: CHEM SERVICE INC
Post Office Box: 3108
Contractor's Address1: N/K
Contractor's Address2: WEST CHESTER, PA 19381
Contractor's Telephone: 215-692-3026
Contractor's CAGE: 84898

Contractor Information

Contractor's Name: CHEM SERVICE, INC
Post Office Box: 599
Contractor's Address1: 660 TOWER LN
Contractor's Address2: WEST CHESTER, PA 19301-9650
Contractor's Telephone: 610-692-3026
Contractor's CAGE: 8Y898

Section 2 - Compositon/Information on Ingredients
F29 1,1-DICHLOROETHENE

Ingredient Name: VINYLIDENE CHLORIDE, 1,1-DICHLOROETHENE, 1,1-DICHLOROETHYLENE, VDC
Ingredient CAS Number: 75-35-4 **Ingredient CAS Code:** M
RTECS Number: KV9275000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:

>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: 5 PPM
OSHA PEL: N/K **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 20 MG/CUM **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 100 LBS
DOT Reporting Quantity: 100 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
F29 1,1-DICHLOROETHENE

Health Hazards Acute & Chronic: SKIN: IRRITATION & SENSITIZATION, CAN CAUSE AN ALLERGIC SKIN REACTION. INHALATION: CAN BE IRRITATING TO MUCOUS MEMBRANES. NARCOTIC AT HIGH CONCENTRATIONS, EXPOSURE CAN CAUSE LIVER & KIDNEY DAMAGE, NER VOUS SYSTEM INJURY & CARDIOVASCULAR SYSTEM INJURY. CAN CAUSE DELAYED ADVERSE HEALTH EFFECTS.

Signs & Symptoms of Overexposure:
IRRITATION.

Medical Conditions Aggravated by Exposure:
N/K

LD50 LC50 Mixture: ORAL LD50(RAT/MOUSE): 200 MG/KG

Route of Entry Indicators:
Inhalation: YES
Skin: NO
Ingestion: NO

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NONE

Section 4 - First Aid Measures
F29 1,1-DICHLOROETHENE

First Aid:
EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20

MINS. IF NO BURNS HAVE OCCURED-USE SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE OXYGEN/MOUTH TO MOUTH I F NEEDED. CONTINUE LIFE SUPPORTING MEASURES UNTIL MEDICAL ASSISTANCE HAS ARRIVED. KEEP WARM & QUIET. INGESTION: DON'T GIVE LIQUIDS/INDUCE VOMITING TO AN UNCONSCIOUS/CONVULSING PERSON. (SEE SUPP)

Section 5 - Fire Fighting Measures
F29 1,1-DICHLOROETHENE

Fire Fighting Procedures:
N/K
Unusual Fire or Explosion Hazard:
FLAMMABLE CHEMICAL.
Extinguishing Media:
CO2, DRY CHEMICAL POWDER. DON'T USE WATER!
Flash Point: Flash Point Text: 5F

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 6.5
Upper Limit(s): 15.5

Section 6 - Accidental Release Measures
F29 1,1-DICHLOROETHENE

Spill Release Procedures:
EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN AN APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATED SUR FACES TO REMOVE ANY RESIDUES.

Section 7 - Handling and Storage
F29 1,1-DICHLOROETHENE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
F29 1,1-DICHLOROETHENE

Repiratory Protection:
USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Ventilation:
CHEMICAL HOOD.
Protective Gloves:
N/K
Eye Protection: GLASS SHIELDS
Other Protective Equipment: N/K
Work Hygenic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.
Supplemental Health & Safety Information: IF PATIENT IS VOMITING-WATCH CLOSELY TO

MAKE SURE AIRWAY DOESN'T BECOME OBSTRUCTED BY VOMIT. OBTAIN MEDICAL ATTENTION IN ALL CASES. AN ANTIDOTE IS A SUBSTANCE INTENDED TO COUNTERACT THE EFFECT OF A PO ISON. IT SHOULD BE GIVEN ONLY BY A PHYSICIAN/TRAINED EMERGENCY PERSONNEL. GET MEDICAL ADVICE FROM POISON CONTROL CENTER.

Section 9 - Physical & Chemical Properties
F29 1,1-DICHLOROETHENE

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 89.06F
Melting/Freezing Point: Melting/Freezing Text: -188.5F
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 500 **Vapor Density:** N/K
Percent Volatile Organic Content:
Specific Gravity: N/K
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: SLIGHT
Appearance and Odor: COLORLESS LIQUID W/FRUITY/PLEASANT ODOR
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
F29 1,1-DICHLOROETHENE

Stability Indicator: YES
Materials to Avoid:
INCOMPATIBLE MATERIALS
Stability Condition to Avoid:
HEAT, AIR, PRESSURE.
Hazardous Decomposition Products:
N/K
Hazardous Polymerization Indicator: YES
Conditions to Avoid Polymerization:
MAY POLYMERIZE UPON STANDING.

Section 11 - Toxicological Information
F29 1,1-DICHLOROETHENE

Toxicological Information:
N/P

Section 12 - Ecological Information
F29 1,1-DICHLOROETHENE

Ecological Information:
N/P

Section 13 - Disposal Considerations
F29 1,1-DICHLOROETHENE

Waste Disposal Methods:
BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.

Section 14 - MSDS Transport Information
F29 1,1-DICHLOROETHENE

Transport Information:
N/P

Section 15 - Regulatory Information
F29 1,1-DICHLOROETHENE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
F29 1,1-DICHLOROETHENE

Other Information:
N/P

HAZCOM Label Information

Product Identification: F29 1,1-DICHLOROETHENE
CAGE: 84898
Assigned Individual: N
Company Name: CHEM SERVICE INC
Company PO Box: 3108
Company Street Address1: N/K
Company Street Address2: WEST CHESTER, PA 19381 US
Health Emergency Telephone: 215-386-2100/215-692-3026
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

1,2-DICHLOROETHANE

Section 1 - Product and Company Identification
1,2-DICHLOROETHANE

Product Identification: 1,2-DICHLOROETHANE
Date of MSDS: 04/22/1989 **Technical Review Date:** 06/06/1999
FSC: 6810 **NIIN:** 00-838-5932
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: FISHER SCIENTIFIC CHEMICAL DIVISION
Manufacturer's Address1: 1 REAGENT LANE
Manufacturer's Address2: FAIR LAWN, NJ 07410
Manufacturer's Country: NK
General Information Telephone: 201-796-7100
Emergency Telephone: 201-796-7523
Emergency Telephone: 201-796-7523
MSDS Preparer's Name: GASTON L. PILLORI
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 1B464
Special Project Code: N

Item Description

Item Name: DICHLOROETHANE,REAGENT
Item Manager: S9G
Specification Number: O-C-265C
Type/Grade/Class: NONE
Unit of Issue: GL
Unit of Issue Quantity: 4
Type of Container: BOTTLE

Contractor Information

Contractor's Name: FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Contractor's Address1: 1 REAGENT LANE
Contractor's Address2: FAIR LAWN, NJ 07410-2802
Contractor's Telephone: 201-796-7100
Contractor's CAGE: 1B464

Section 2 - Compositon/Information on Ingredients
1,2-DICHLOROETHANE

Ingredient Name: ETHYLENE DICHLORIDE (SARA III)
Ingredient CAS Number: 107-06-2 **Ingredient CAS Code:** M
RTECS Number: KI0525000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100
% Enviromental Weight:
Other REC Limits: NOT ESTABLISHED
OSHA PEL: 50 PPM/C,100PPM **OSHA PEL Code:** M

OSHA STEL: OSHA STEL Code:
ACGIH TLV: 10 PPM; 9293 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 100 LBS
DOT Reporting Quantity: 100 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
1,2-DICHLOROETHANE

Health Hazards Acute & Chronic: ACUTE: INHALE- IRRITATION OF UPPER RESPIRATORY TRACT, HEADACE, NAUSEA, VOMITING. SKIN- IRRITATION, CYANOSIS, HYPOTENSION, DIZZINESS. EYE- DISCOMFORT, CORNEAL INJURY. INGEST- HYPOTENSION, CYANOSIS, NAU SEA. CHRONIC: INHALE- NEUROLOGICAL CHANGES, LIVER AND KIDNEY DAMAGE. SKIN- SEVERE IRRITATION. EYE- CONJUNCTIVITIS.

Signs & Symptoms of Overexposure:
SEE HEALTH HAZARDS AND MSDS. ETHYLENE DICHLORIDE IS AN EYE, SKIN, AND MUCOUS MEMBRANE IRRITANT AND A CENTRAL NERVOUS SYSTEM DEPRESSANT. POISONING MAY AFFECT THE LIVER, KIDNEYS, HEART ,AND ADRENAL GLAN DS. THE USE OF ALCOHOLIC BEVERAGES MAY ENHANCE THE TOXIC EFFECTS.

Medical Conditions Aggravated by Exposure:
PERSONS WITH A HISTORY OF SKIN AND RESPIRATORY DISORDERS MAY BE AT INCREASED RISK FROM EXPOSURE.

LD50 LC50 Mixture: LD50 (ORAL RAT) IS 670 MG/KG

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: YES
IARC: YES
OSHA: NO

Carcinogenicity Explanation: NONE OF THE CHEMICALS IN THIS PRODUCT IS LISTED BY OSHA AS A CARCINOGEN.

Section 4 - First Aid Measures
1,2-DICHLOROETHANE

First Aid:
INHALATION: REMOVE SUBJECT TO FRESH AIR. IF BREATHING STOPPED, GIVE ARTIFICIAL RESPIRATION. EYE: FLUSH WITH PLENTY OF WATER FOR 15 MINUTES. GET IMMEDIATE MEDICAL ATTENTION. SKIN: WASH WITH SOAP AND WA TER. REMOVE CONTAMINATED CLOTHING. INGESTION: GET IMMEDIATE MEDICAL ATTENTION. IF MEDICAL ATTENTION IS NOT AVAILABLE, INDUCE VOMITING BY TOUCHING FINGER TO BACK OF THROAT.

Section 5 - Fire Fighting Measures

1,2-DICHLOROETHANE

Fire Fighting Procedures:
FIRE FIGHTERS SHOULD USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT WHEN FIGHTING CHEMICAL FIRE. USE WATER SPRAY TO COOL NEARBY CONTAINERS EXPOSED TO FIRE.
Unusual Fire or Explosion Hazard:
CONTAINERS MAY BURST WHEN EXPOSED TO HEAT OF FIRE.
Extinguishing Media:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR STANDARD FOAM
Flash Point: Flash Point Text: 56.0F,13.3C

Autoignition Temperature:
Autoignition Temperature Text: 775F
Lower Limit(s): 6.2
Upper Limit(s): 16.0

Section 6 - Accidental Release Measures
1,2-DICHLOROETHANE

Spill Release Procedures:
SOAK UP SMALL SPILLS WITH SAND OR INERT ABSORBANT AND PLACE IN CONTAINERS FOR LATER DISPOSAL. DIKE TO RETAIN LARGE SPILLS. VACUUM UP FREE LIQUID. REMOVE RESIDUE WITH INERT ABSORBANT. PLACE IN DISPOSAL CONTAINER. FLUSH AREA WITH WATER.

Section 7 - Handling and Storage
1,2-DICHLOROETHANE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
1,2-DICHLOROETHANE

Repiratory Protection:
IF VENTILATION DOES NOT MAINTAIN INHALATION EXPOSURES BELOW PEL (TLV), USE NIOSH/MSHA APPROVED RESPIRATOR AS PER CURRENT 29 CFR 1910.134, INSTRUCTIONS/WARNINGS AND NIOSH-RESPIRATOR SELECTION.
Ventilation:
MECHANICAL (GENERAL) VENTILATION IS REQUIRED. LOCAL EXHAUST MAY BE REQUIRED IF WORK AREA IS NOT VENTED.
Protective Gloves:
RUBBER
Eye Protection: CHEMICAL SAFETY GOGGLES
Other Protective Equipment: SAFETY SHOWER AND EYE BATH. OTHER EQUIPMENT AS REQUIRED TO MINIMIZE EXPOSURE FROM PROLONGED OR REPEATED CONTACT.
Work Hygenic Practices: WASH THROUGHLY AFTER HANDLING AND BEFORE EATING. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.
Supplemental Health & Safety Information: CONTACT LENSES SHOULD NOT BE WORN WHEN

HANDLING THIS SUBSTANCE.

Section 9 - Physical & Chemical Properties
1,2-DICHLOROETHANE

HCC: F2
NRC/State License Number: N/R
Net Property Weight for Ammo: N/R
Boiling Point: =83.9C, 183.F **Boiling Point Text:**
Melting/Freezing Point: =-35.6C, -32.F **Melting/Freezing Text:**
Decomposition Point: Decomposition Text: N/A
Vapor Pressure: 87 **Vapor Density:** 3.35
Percent Volatile Organic Content:
Specific Gravity: 1.256
Volatile Organic Content Pounds per Gallon:
pH: N/P
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: 1.3 (CARBON TETRACHLO=1)
Solubility in Water: 0.8%
Appearance and Odor: CLEAR, COLORLESS, OILY LIQUID W/ PLEASANT CLOROFORM-LIKE ODOR AND SWEET TASTE.
Percent Volatiles by Volume: N/P
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data
1,2-DICHLOROETHANE

Stability Indicator: YES
Materials to Avoid:
ALUMINUM, AMMONIA, CAUSTICS, DIMETHYLAMINOPROPYAMINE, DINITROGEN TETROXIDE, NITRIC ACID, OXIDIZERS, POTASSIUM.
Stability Condition to Avoid:
ABNORMAL TEMPERATURES AND PRESSURES.
Hazardous Decomposition Products:
HIGHLY TOXIC FUMES OF PHOSGENE, TOXIC AND CORROSIVE FUMES OF CHLORIDES, AND OXIDES OF CARBON.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT APPLICABLE

Section 11 - Toxicological Information
1,2-DICHLOROETHANE

Toxicological Information:
N/P

Section 12 - Ecological Information
1,2-DICHLOROETHANE

Ecological Information:
N/P

Section 13 - Disposal Considerations
1,2-DICHLOROETHANE

Waste Disposal Methods:
DISPOSE OF IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS AND REGULATIONS.

Section 14 - MSDS Transport Information
1,2-DICHLOROETHANE

Transport Information:
N/P

Section 15 - Regulatory Information
1,2-DICHLOROETHANE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
1,2-DICHLOROETHANE

Other Information:
N/P

HMIS Transportation Information

Product Identification: 1,2-DICHLOROETHANE
Transporation ID Number: 88093
Responsible Party CAGE: 1B464
Date MSDS Prepared: 04/22/1989
Date MSDS Reviewed: 12/04/1989
MFN: 12/04/1989
Submitter: D DG
Status Code: C

Container Information
- **Unit of Issue:** GL
- **Container Quantity:** 4
- **Type of Container:** BOTTLE
- **Net Unit Weight:** 10.48 LBS

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:

Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: ETHYLENE DICHLORIDE
DOT PSN Code: GAP
Symbols:
DOT PSN Modifier:
Hazard Class: 3
UN ID Number: UN1184
DOT Packaging Group: II
Label: FLAMMABLE LIQUID, POISON
Special Provision(s): T14
Packaging Exception: NONE
Non Bulk Packaging: 202
Bulk Packaging: 243
Maximimum Quanity in Passenger Area: 1 L
Maximimum Quanity in Cargo Area: 60 L
Stow in Vessel Requirements: B
Requirements Water/Sp/Other: 40

IMO Detail Information

IMO Proper Shipping Name: ETHYLENE DICHLORIDE
IMO PSN Code: GVF
IMO PSN Modifier:
IMDG Page Number: 3224
UN Number: 1184
UN Hazard Class: 3.2
IMO Packaging Group: II
Subsidiary Risk Label: TOXIC
EMS Number: 3-03
Medical First Aid Guide Number: 340

IATA Detail Information

IATA Proper Shipping Name: ETHYLENE DICHLORIDE
IATA PSN Code: LIA
IATA PSN Modifier:
IATA UN Id Number: 1184
IATA UN Class: 3
Subsidiary Risk Class: 6.1
UN Packaging Group: II
IATA Label: FLAMMABLE LIQUID & TOXIC
Packaging Note for Passengers: 306
Maximum Quantity for Passengers: 1L
Packaging Note for Cargo: 308
Maximum Quantity for Cargo: 60L
Exceptions:

AFI Detail Information

AFI Proper Shipping Name: ETHYLENE DICHLORIDE

AFI Symbols:
AFI PSN Code: LIA
AFI PSN Modifier:
AFI UN Id Number: UN1184
AFI Hazard Class: 3
AFI Packing Group: II
AFI Label: 6.1
Special Provisions: P4
Back Pack Reference: A7.3

HAZCOM Label Information

Product Identification: 1,2-DICHLOROETHANE
CAGE: 1B464
Assigned Individual: N
Company Name: FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Company PO Box:
Company Street Address1: 1 REAGENT LANE
Company Street Address2: FAIR LAWN, NJ 07410-2802 US
Health Emergency Telephone: 201-796-7100 OR 201-796-7523
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

0-659 CIS 1,2-DICHLOROETHENE

Section 1 - Product and Company Identification
0-659 CIS 1,2-DICHLOROETHENE

Product Identification: 0-659 CIS 1,2-DICHLOROETHENE
Date of MSDS: 06/02/1992 **Technical Review Date:** 12/06/1994
FSC: 6550 **NIIN: LIIN:** 00F037480
Submitter: F BT
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: CHEM SERVICE INC
Post Office Box: 3108
Manufacturer's Address1: 660 TOWER LN
Manufacturer's Address2: WEST CHESTER, PA 19381-3108
Manufacturer's Country: US
General Information Telephone: 215-692-3026/800-452-9994
Emergency Telephone: 215-692-3026/800-452-9994
Emergency Telephone: 215-692-3026/800-452-9994
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 84898
Special Project Code: N

Preparer Information

Preparer's Name: CHEM SERVICE INC
Post Office Box: 3108
Preparer's Address1: N/K
Preparer's Address2: WEST CHESTER, PA 19381
Preparer's CAGE: 84898
Assigned Individual: N

Contractor Information

Contractor's Name: CHEM SERVICE INC
Post Office Box: 3108
Contractor's Address1: N/K
Contractor's Address2: WEST CHESTER, PA 19381
Contractor's Telephone: 215-692-3026
Contractor's CAGE: 84898

Contractor Information

Contractor's Name: CHEM SERVICE, INC
Post Office Box: 599
Contractor's Address1: 660 TOWER LN
Contractor's Address2: WEST CHESTER, PA 19301-9650
Contractor's Telephone: 610-692-3026
Contractor's CAGE: 8Y898

Section 2 - Compositon/Information on Ingredients
0-659 CIS 1,2-DICHLOROETHENE

Ingredient Name: DICHLOROETHENE
Ingredient CAS Number: 156-59-2 **Ingredient CAS Code:** M
RTECS Number: KV9420000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:

<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
0-659 CIS 1,2-DICHLOROETHENE

Health Hazards Acute & Chronic: SKIN: MAY BE HARMFUL IF ABSORBED. CAN CAUSE IRRITATION. INHALATION: MAY BE HARMFUL. DUST &/VAPORS CAN CAUSE RESPIRATORY TRACT IRRITATION. CAN BE IRRITATING TO MUCOUS MEMBRANCES. INGESTION: MAY BE HARM FUL. EYES: IRRITATION. EXPOSURE CAN CAUSE LIVER DAMAGE. NARCOTIC AT HIGH CONCENTRATIONS.

Signs & Symptoms of Overexposure:
IRRITATION, NARCOTIC.

Medical Conditions Aggravated by Exposure:
N/K

LD50 LC50 Mixture: N/P

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NONE

Section 4 - First Aid Measures
0-659 CIS 1,2-DICHLOROETHENE

First Aid:
EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO

FRESH AIR. GIVE CPR/OXYGEN IF NEEDED & CONTINU E LIFE SUPPORT UNTIL MEDICAL ASSISTANCEARRIVES. INGESTION: RINSE MOUTH OUT W/WATER, IF CONSCIOUS. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Section 5 - Fire Fighting Measures
0-659 CIS 1,2-DICHLOROETHENE

Fire Fighting Procedures:
N/K
Unusual Fire or Explosion Hazard:
FLAMMABLE CHEMICAL. VAPORS MAY TRAVEL CONSIDERABLE DISTANCE TO IGNITION SOURCE & FLASH BACK. DECOMPOSITION PRODUCTS ARE CORROSIVE.
Extinguishing Media:
CO2, DRY CHEMICAL POWDER/SPRAY.
Flash Point: Flash Point Text: 42.8F

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/K
Upper Limit(s): N/K

Section 6 - Accidental Release Measures
0-659 CIS 1,2-DICHLOROETHENE

Spill Release Procedures:
EVACUATE AREA. WEAR APPRORPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFAC ES TO REMOVE ANY RESIDUES.

Section 7 - Handling and Storage
0-659 CIS 1,2-DICHLOROETHENE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
0-659 CIS 1,2-DICHLOROETHENE

Repiratory Protection:
WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Ventilation:
CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Protective Gloves:
N/K
Eye Protection: EYE SHIELDS
Other Protective Equipment: N/K
Work Hygenic Practices: N/K
Supplemental Health & Safety Information: N/K

Section 9 - Physical & Chemical Properties
0-659 CIS 1,2-DICHLOROETHENE

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 140F
Melting/Freezing Point: Melting/Freezing Text: -112F
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: N/K **Vapor Density:** N/K
Percent Volatile Organic Content:
Specific Gravity: N/K
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: INSOLUBLE
Appearance and Odor: COLORLESS LIQUID
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
0-659 CIS 1,2-DICHLOROETHENE

Stability Indicator: YES
Materials to Avoid:
STRONG OXIDIZING AGENTS, MAGNESIUM, ALUMINUM.
Stability Condition to Avoid:
MOISTURE, AIR, LIGHT, HEAT & OTHER IGNITION SOURCES.
Hazardous Decomposition Products:
TOXIC FUMES
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
N/K

Section 11 - Toxicological Information
0-659 CIS 1,2-DICHLOROETHENE

Toxicological Information:
N/P

Section 12 - Ecological Information
0-659 CIS 1,2-DICHLOROETHENE

Ecological Information:
N/P

Section 13 - Disposal Considerations
0-659 CIS 1,2-DICHLOROETHENE

Waste Disposal Methods:
BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER

IAW/FEDERAL, STATE & LOCAL REGULATIONS.

Section 14 - MSDS Transport Information
0-659 CIS 1,2-DICHLOROETHENE

Transport Information:
N/P

Section 15 - Regulatory Information
0-659 CIS 1,2-DICHLOROETHENE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
0-659 CIS 1,2-DICHLOROETHENE

Other Information:
N/P

HAZCOM Label Information

Product Identification: 0-659 CIS 1,2-DICHLOROETHENE
CAGE: 84898
Assigned Individual: N
Company Name: CHEM SERVICE INC
Company PO Box: 3108
Company Street Address1: N/K
Company Street Address2: WEST CHESTER, PA 19381 US
Health Emergency Telephone: 215-692-3026/800-452-9994
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

TRANS-1,2-DICHLOROETHENE, O-660

Section 1 - Product and Company Identification
TRANS-1,2-DICHLOROETHENE, O-660

Product Identification: TRANS-1,2-DICHLOROETHENE, O-660
Date of MSDS: 09/01/1988 **Technical Review Date:** 12/27/1995
FSC: 6810 **NIIN:** **LIIN:** 00N067797
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: CHEM SERVICE INC
Post Office Box: 3108
Manufacturer's Address1:
Manufacturer's Address2: WEST CHESTER, PA 19381
Manufacturer's Country: US
General Information Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 84898
Special Project Code: N

Contractor Information

Contractor's Name: CHEM SERVICE INC
Post Office Box: 3108
Contractor's Address1: N/K
Contractor's Address2: WEST CHESTER, PA 19381
Contractor's Telephone: 215-692-3026
Contractor's CAGE: 84898

Contractor Information

Contractor's Name: CHEM SERVICE, INC
Post Office Box: 599
Contractor's Address1: 660 TOWER LN
Contractor's Address2: WEST CHESTER, PA 19301-9650
Contractor's Telephone: 610-692-3026
Contractor's CAGE: 8Y898

Section 2 - Compositon/Information on Ingredients
TRANS-1,2-DICHLOROETHENE, O-660

Ingredient Name: ETHYLENE, 1,2-DICHLORO-, (E)-; (TRANS-1,2-DICHLOROETHYLENE) (SARA 313) (CERCLA)
Ingredient CAS Number: 156-60-5 **Ingredient CAS Code:** M
RTECS Number: KV9400000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:

Other REC Limits: N/K
OSHA PEL: 200 PPM (MFR) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 200 PPM (MFR) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1000 LBS
DOT Reporting Quantity: 1000 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
TRANS-1,2-DICHLOROETHENE, O-660

Health Hazards Acute & Chronic: ACUTE: CAN BE HARMFUL IF ABSORBED THRU SKIN, INHALED/SWALLOWED. CAN CAUSE SKIN AND EYE IRRITATION. CAN BE IRRITATING TO MUCOUS MEMBRANES. VAPORS AND/OR DIRECT EYE CONTACT CAN CAUSE SEVERE EYE BURNS. C HRONIC: PROLONGED EXPOSURE MAY CAUSE NAUSEA, HEADACHE, DIZZINESS AND/OR EYE DAMAGE. CAN CAUSE LIVER & KIDNEY INJURY.

Signs & Symptoms of Overexposure:
SEE HEALTH HAZARDS.

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: LD50 (ORAL RAT): 7536 MG/KG.

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT.

Section 4 - First Aid Measures
TRANS-1,2-DICHLOROETHENE, O-660

First Aid:
AN ANTIDOTE IS A SUBSTANCE INTENDED TO COUNTERACT EFT OF POIS. IT SHOULD BE ADMIN ONLY BY MD/TRAINED EMER PERS. MED ADVICE CAN BE OBTAINED FROM POIS CTL CTR. EYES: FLUSH CONTINUOUSLY W/WATER FOR AT LE AST 15 MIN. SKIN: FLUSH W/WATER FOR 15-20 MIN. IF NO BURNS HAVE OCCURRED, USE SOAP & WATER TO CLEANSE SKIN. INHAL: REMOVE TO FRESH AIR. ADMIN OXYGEN IF DFCLT BRTHG. IF BRTHG HAS STOPPED, (SUP DAT)

Section 5 - Fire Fighting Measures
TRANS-1,2-DICHLOROETHENE, O-660

Fire Fighting Procedures:
WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
NONE SPECIFIED BY MANUFACTURER.
Extinguishing Media:
USE CARBON DIOXIDE, DRY CHEMICAL POWDER OR WATER SPRAY.
Flash Point: Flash Point Text: 42.8F,6.0C

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/K
Upper Limit(s): N/K

Section 6 - Accidental Release Measures
TRANS-1,2-DICHLOROETHENE, O-660

Spill Release Procedures:
EVACUATE AREA. WEAR APPROPRIATE OSHA-REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE OR SIMILAR MATERIAL. SWEEP UP AND PLACE IN AN APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATE D SURFACES TO REMOVE ANY RESIDUES.

Section 7 - Handling and Storage
TRANS-1,2-DICHLOROETHENE, O-660

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
TRANS-1,2-DICHLOROETHENE, O-660

Repiratory Protection:
USE NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation:
THIS CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Protective Gloves:
IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: EMERGENCY EYEWASH & DELUGE SHOWER MEETING ANSI DESIGN CRITERIA (FP N).
Work Hygenic Practices: CONTACT LENSES SHOULD NOT BE WORN IN THE LABORATORY.
Supplemental Health & Safety Information: FIRST AID PROC: ADMIN ARTF RESP. IF PATIENT IN CARD ARREST, ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL MED ASSIST HAS ARRIVED. INGEST: CALL MD IMMED (FP N). OTHER PREC: THIS PROD MAY NOT BE US ED AS DRUGS, COSMETICS, AGRICULTURAL/PESTICIDAL PRODS, FOOD ADDITIVES/AS HOUSEHOLD CHEMICALS.

Section 9 - Physical & Chemical Properties
TRANS-1,2-DICHLOROETHENE, O-660

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 118F,48C
Melting/Freezing Point: Melting/Freezing Text: -58F,-50C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: N/K **Vapor Density:** N/K
Percent Volatile Organic Content:
Specific Gravity: 1.257
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: INSOLUBLE
Appearance and Odor: COLORLESS LIQUID
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
TRANS-1,2-DICHLOROETHENE, O-660

Stability Indicator: YES
Materials to Avoid:
INCOMPATIBLE WITH STRONG OXIDIZING AGENTS, STRONG BASES. REACTS WITH WATER AND MOST REACTIVE HYDROGEN COMPOUNDS.
Stability Condition to Avoid:
FLAMMABLE.
Hazardous Decomposition Products:
DECOMPOSITION LIBERATES TOXIC FUMES. DECOMPOSITION PRODUCTS ARE CORROSIVE.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT.

Section 11 - Toxicological Information
TRANS-1,2-DICHLOROETHENE, O-660

Toxicological Information:
N/P

Section 12 - Ecological Information
TRANS-1,2-DICHLOROETHENE, O-660

Ecological Information:
N/P

Section 13 - Disposal Considerations
TRANS-1,2-DICHLOROETHENE, O-660

Waste Disposal Methods:
BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. DISPOSE OF IN ACCORDANCE W/LOCAL, STATE & FEDERAL REGULATIONS (FP N).

Section 14 - MSDS Transport Information
TRANS-1,2-DICHLOROETHENE, O-660

Transport Information:
N/P

Section 15 - Regulatory Information
TRANS-1,2-DICHLOROETHENE, O-660

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
TRANS-1,2-DICHLOROETHENE, O-660

Other Information:
N/P

HAZCOM Label Information

Product Identification: TRANS-1,2-DICHLOROETHENE, O-660
CAGE: 84898
Assigned Individual: N
Company Name: CHEM SERVICE INC
Company PO Box: 3108
Company Street Address1: N/K
Company Street Address2: WEST CHESTER, PA 19381 US
Health Emergency Telephone: 215-692-3026
Label Required Indicator: Y
Date Label Reviewed: 12/27/1995
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/27/1995
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Moderate
Contact Hazard: Slight
Fire Hazard: Severe
Reactivity Hazard: Slight

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
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1,2-DICHLOROPROPANE, O-638

Section 1 - Product and Company Identification
1,2-DICHLOROPROPANE, O-638

Product Identification: 1,2-DICHLOROPROPANE, O-638
Date of MSDS: 09/01/1988 **Technical Review Date:** 02/08/1996
FSC: 6810 **NIIN: LIIN:** 00N067785
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: CHEM SERVICE INC
Post Office Box: 3108
Manufacturer's Address1:
Manufacturer's Address2: WEST CHESTER, PA 19381
Manufacturer's Country: US
General Information Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 84898
Special Project Code: N

Contractor Information

Contractor's Name: CHEM SERVICE INC
Post Office Box: 3108
Contractor's Address1: N/K
Contractor's Address2: WEST CHESTER, PA 19381
Contractor's Telephone: 215-692-3026
Contractor's CAGE: 84898

Contractor Information

Contractor's Name: CHEM SERVICE, INC
Post Office Box: 599
Contractor's Address1: 660 TOWER LN
Contractor's Address2: WEST CHESTER, PA 19301-9650
Contractor's Telephone: 610-692-3026
Contractor's CAGE: 8Y898

Section 2 - Compositon/Information on Ingredients
1,2-DICHLOROPROPANE, O-638

Ingredient Name: PROPANE, 1,2-DICHLORO-; (1,2-DICHLOROPROPANE) (SARA 313) (CERCLA)
Ingredient CAS Number: 78-87-5 **Ingredient CAS Code:** M
RTECS Number: TX9625000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K

OSHA PEL: 75 PPM **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 75 PPM; 110 STEL **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1000 LBS
DOT Reporting Quantity: 1000 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
1,2-DICHLOROPROPANE, O-638

Health Hazards Acute & Chronic: ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS - AVOID DIRECT PHYSICAL CONTACT! CAN BE HARMFUL IF ABSORBED THROUGH THE SKIN. CAN BE HARMFUL IF INHALED. CAN CAUSE SKIN IRRITATION. CAN BE IRRITATING TO MU COUS MEMBRANES. SUSPECTED CARCINOGEN-MAY PRODUCE CANCER. CAN CAUSE EYE IRRITATION. CAN BE HARMFUL IF (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ: SWALLOWED. PROLONGED EXPOSURE MAY CAUSE NAUSEA/HEADACHE/DIZZINESS AND/OR EYE DAMAGE. CAN CAUSE NERVOUS SYSTEM INJURY. CAN CAUSE LIVER INJURY. CAN CAUSE KIDNEY INJURY. CAN CAUSE AN ALLERGIC S KIN REACTION. CAN BE IRRITATING TO MUCOUS MEMBRANES.

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: LD50: (RAT) 2196 MG/KG

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT

Section 4 - First Aid Measures
1,2-DICHLOROPROPANE, O-638

First Aid:
ANTIDOTE IS SUBSTANCE INTENDED TO COUNTERACT EFT OF POISON. IT SHOULD BE ADMIN ONLY BY MD/TRAINED EMER PERS. MED ADVICE CAN BE OBTAINED FROM POIS CTL CTR. EYES:FLUSH CONTINUOUSLY W/WATER FOR AT LEAST 15-20 MIN. SKIN: FLUSH W/WATER FOR 15-20 MIN. IF NO BURNS HAVE OCCURRED-USE SOAP & WATER TO CLEANSE SKIN. INHAL: REMOVE TO FRESH AIR. ADMIN OXYGEN IF HAVING DFCLTY BRTHG. IF BRTHG HAS STOPPED (SUPDAT)

Section 5 - Fire Fighting Measures

1,2-DICHLOROPROPANE, O-638

Fire Fighting Procedures:
USE NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
THIS IS A FLAMMABLE CHEMICAL.
Extinguishing Media:
CARBON DIOXIDE, DRY CHEMICAL POWDER OR WATER SPRAY.
Flash Point: Flash Point Text: 39.2F,4.0C

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 3.4%
Upper Limit(s): 14.5%

Section 6 - Accidental Release Measures
1,2-DICHLOROPROPANE, O-638

Spill Release Procedures:
EVACUATE AREA. WEAR APPROPRIATE OSHA-REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE OR SIMILAR MATERIAL. SWEEP UP AND PLACE IN AN APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATE D SURFACES TO REMOVE ANY RESIDUES.

Section 7 - Handling and Storage
1,2-DICHLOROPROPANE, O-638

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
1,2-DICHLOROPROPANE, O-638

Repiratory Protection:
USE NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation:
THIS CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Protective Gloves:
IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGLES (FP N).
Other Protective Equipment: ANSI APPROVED EYE WASH & DELUGE SHOWER (FP N). USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Work Hygenic Practices: CONTACT LENSES SHOULD NOT BE WORN IN THE LABORATORY.
Supplemental Health & Safety Information: FIRST AID PROC: ADMIN ARTF RESP. IF IN CARD ARREST ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL MED ASSISTANCE HAS ARRIVED.

Section 9 - Physical & Chemical Properties
1,2-DICHLOROPROPANE, O-638

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 205F,96C
Melting/Freezing Point: Melting/Freezing Text: -148F,-100C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 40 @ 20C **Vapor Density:** N/K
Percent Volatile Organic Content:
Specific Gravity: 1.156
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: INSOL (IMMISCIBLE)
Appearance and Odor: COLORLESS LIQUID; ETHER LIKE ODOR.
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
1,2-DICHLOROPROPANE, O-638

Stability Indicator: YES
Materials to Avoid:
INCOMPATIBLE WITH STRONG BASES. INCOMPATIBLE WITH STRONG OXIDIZING AGENTS. INCOMPATIBLE WITH STRONG ACIDS.
Stability Condition to Avoid:
FLAMMABLE. DO NOT USE MAGNESIUM/ALUMINUM OR THEIR ALLOYS AS CONTAINERS.
Hazardous Decomposition Products:
DECOMPOSITION LIBERATES TOXIC FUMES. DECOMPOSITION PRODUCTS ARE CORROSIVE.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT

Section 11 - Toxicological Information
1,2-DICHLOROPROPANE, O-638

Toxicological Information:
N/P

Section 12 - Ecological Information
1,2-DICHLOROPROPANE, O-638

Ecological Information:
N/P

Section 13 - Disposal Considerations
1,2-DICHLOROPROPANE, O-638

Waste Disposal Methods:
DISPOSAL MUST BE IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS (FP N). BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND

SCRUBBER.

Section 14 - MSDS Transport Information
1,2-DICHLOROPROPANE, O-638

Transport Information:
N/P

Section 15 - Regulatory Information
1,2-DICHLOROPROPANE, O-638

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
1,2-DICHLOROPROPANE, O-638

Other Information:
N/P

HAZCOM Label Information

Product Identification: 1,2-DICHLOROPROPANE, O-638
CAGE: 84898
Assigned Individual: N
Company Name: CHEM SERVICE INC
Company PO Box: 3108
Company Street Address1: N/K
Company Street Address2: WEST CHESTER, PA 19381 US
Health Emergency Telephone: 215-692-3026
Label Required Indicator: Y
Date Label Reviewed: 02/08/1996
Status Code: C
Manufacturer's Label Number:
Date of Label: 02/08/1996
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Moderate
Contact Hazard: Slight
Fire Hazard: Severe
Reactivity Hazard: None

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

FREON 113;TRICHLOROTRIFLUOROETHANE

Section 1 - Product and Company Identification
FREON 113;TRICHLOROTRIFLUOROETHANE

Product Identification: FREON 113;TRICHLOROTRIFLUOROETHANE
Date of MSDS: 10/01/1985 **Technical Review Date:** 12/28/1987
FSC: 6830 **NIIN:** 00-551-0854
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: E I DUPONT DE NEMOURS & CO
Post Office Box: N/K
Manufacturer's Address1: FREON PRODUCTS DIV,1007-MARKET STREET
Manufacturer's Address2: WILMINGTON, DE 19898
Manufacturer's Country: US
General Information Telephone: 302-999-3847/4338
Emergency Telephone: 800-441-3637
Emergency Telephone: 800-441-3637
MSDS Preparer's Name: T.D.ARMSTRONG
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 0ERJ7
Special Project Code: N

Item Description

Item Name: TRICHLOROTRIFLUOROETHANE, TECHNICAL
Item Manager: S9G
Specification Number: BB-F-1421
Type/Grade/Class: TYPE 113
Unit of Issue: DR **Quantitative Expression:** NK
Unit of Issue Quantity: 200 LB DR
Type of Container: NK

Contractor Information

Contractor's Name: DU PONT E I DE NEMOURS AND CO INC PETROCHEMICALS DEPT
Contractor's Address1: 1251 BRANDYWINE BLDG
Contractor's Address2: WILMINGTON, DE 19898
Contractor's Telephone: 302-773-5676
Contractor's CAGE: 73925

Contractor Information

Contractor's Name: E I DUPONT DE NEMOURS & CO, INC.
Post Office Box: N/K
Contractor's Address1: 1007 MARKET STREET
Contractor's Address2: WILMINGTON, DE 19898
Contractor's Telephone: 800-441-7515
Contractor's CAGE: 0ERJ7

Section 2 - Compositon/Information on Ingredients
FREON 113;TRICHLOROTRIFLUOROETHANE

Ingredient Name: 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113) (SARA III)
Ingredient CAS Number: 76-13-1 **Ingredient CAS Code:** M
RTECS Number: KJ4000000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:

<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100.0
% Enviromental Weight:
Other REC Limits: N/R
OSHA PEL: 1000PPM/1250STEL **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 1000PPM/1250STEL9192 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: 1

Section 3 - Hazards Identification, Including Emergency Overview
FREON 113;TRICHLOROTRIFLUOROETHANE

Health Hazards Acute & Chronic: ACUTE:INHALATION:LIGHT-HEADEDNESS,GIDDINESS,SHORTNESS OF BREATH,NARCOSIS;SKIN:DEFATTING OF TISSUES,IRRITATION.EYES:DISCOMFORT OR IRRITATION. CHRONIC:NOT KNOWN;POSSIBLE DERMATITIS.

Signs & Symptoms of Overexposure:
N/P

Medical Conditions Aggravated by Exposure:
MAY CAUSE DERMATITIS

LD50 LC50 Mixture: LD 50 RAT=43000MG/KG

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: N/P
IARC: N/P
OSHA: N/P

Carcinogenicity Explanation: N/K

Section 4 - First Aid Measures
FREON 113;TRICHLOROTRIFLUOROETHANE

First Aid:
INH: REMOVE TO FRESH AIR, CALL MD, DO NOT GIVE EPINEPHRINE OR SIMILAR DRUGS.
SKIN/EYE: FLUSH W/WATER.

Section 5 - Fire Fighting Measures
FREON 113;TRICHLOROTRIFLUOROETHANE

Fire Fighting Procedures:
USE NIOSH/MSHA APPROVED SCBA IN AN ENCLOSED AREA.
Unusual Fire or Explosion Hazard:
DRUMS MAY RUPTURE UNDER FIRE CONDITIONS.DECOMPOSITION MAY OCCUR.
Extinguishing Media:
USE SUITABLE MEDIA FOR SURROUNDING FIRES.
Flash Point: Flash Point Text: NONE

Autoignition Temperature:
Autoignition Temperature Text: N/K
Lower Limit(s):
Upper Limit(s):

Section 6 - Accidental Release Measures
FREON 113;TRICHLOROTRIFLUOROETHANE

Spill Release Procedures:
VENT AREA, ESPECIALLY LOW PLACES WHERE HEAVY VAPORS MIGHT COLLECT. REMOVE OPEN FLAMES.

Section 7 - Handling and Storage
FREON 113;TRICHLOROTRIFLUOROETHANE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
FREON 113;TRICHLOROTRIFLUOROETHANE

Repiratory Protection:
USE AIR MASK IN HIGH CONC
Ventilation:
LOCAL EXHST WHEN LG AMTS ARE RELEASED, MECH - IN LOW PLACES
Protective Gloves:
RUBBER
Eye Protection: SAFETY GOGGLES
Other Protective Equipment: N/P
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: N/P

Section 9 - Physical & Chemical Properties
FREON 113;TRICHLOROTRIFLUOROETHANE

HCC: N1
NRC/State License Number: N/R
Net Property Weight for Ammo: N/R
Boiling Point: Boiling Point Text: 117.6F

Melting/Freezing Point: Melting/Freezing Text: N/K
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 334 **Vapor Density:** 6.5
Percent Volatile Organic Content:
Specific Gravity: 1.57
Volatile Organic Content Pounds per Gallon:
pH: N/P
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: 0.1 (CCL*4 =1)
Solubility in Water: NEGLIGIBLE
Appearance and Odor: COLORLESS LIQ, SLIGHT ETHEREAL ODOR
Percent Volatiles by Volume: 100
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
FREON 113;TRICHLOROTRIFLUOROETHANE

Stability Indicator: YES
Materials to Avoid:
ALKALI OR ALKALINE EARTH METALS, POWDERED AL, ZN, BE, ETC
Stability Condition to Avoid:
OPEN FLAMES OR HIGH TEMPS
Hazardous Decomposition Products:
HCL & HF ACIDS, POSS PHOSGENE
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
N/P

Section 11 - Toxicological Information
FREON 113;TRICHLOROTRIFLUOROETHANE

Toxicological Information:
N/P

Section 12 - Ecological Information
FREON 113;TRICHLOROTRIFLUOROETHANE

Ecological Information:
N/P

Section 13 - Disposal Considerations
FREON 113;TRICHLOROTRIFLUOROETHANE

Waste Disposal Methods:
EVAPORATE OUTDOORS

Section 14 - MSDS Transport Information
FREON 113;TRICHLOROTRIFLUOROETHANE

Transport Information:
N/P

Section 15 - Regulatory Information
FREON 113;TRICHLOROTRIFLUOROETHANE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
FREON 113;TRICHLOROTRIFLUOROETHANE

Other Information:
N/P

HMIS Transportation Information

Product Identification: FREON 113;TRICHLOROTRIFLUOROETHANE
Transporation ID Number: 76420
Responsible Party CAGE: 0ERJ7
Date MSDS Prepared: 10/01/1985
Date MSDS Reviewed: 12/28/1987
MFN: 12/28/1987
Submitter: D DG
Status Code: C

Container Information
- **Unit of Issue:** DR
- **Container Quantity:** 200 LB DR
- **Type of Container:** NK
- **Net Unit Weight:** 200.0 LBS

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
DOT PSN Code: ZZZ
Symbols: N/R
DOT PSN Modifier:

Hazard Class: N/R
UN ID Number: N/R
DOT Packaging Group: N/R
Label: N/R
Special Provision(s): N/R
Packaging Exception: N/R
Non Bulk Packaging: N/R
Bulk Packaging: N/R
Maximimum Quanity in Passenger Area: N/R
Maximimum Quanity in Cargo Area: N/R
Stow in Vessel Requirements: N/R
Requirements Water/Sp/Other: N/R

IMO Detail Information

IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION
IMO PSN Code: ZZZ
IMO PSN Modifier:
IMDG Page Number: N/R
UN Number: N/R
UN Hazard Class: N/R
IMO Packaging Group: N/R
Subsidiary Risk Label: N/R
EMS Number: N/R
Medical First Aid Guide Number: N/R

IATA Detail Information

IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
IATA PSN Code: ZZZ
IATA PSN Modifier:
IATA UN Id Number: N/R
IATA UN Class: N/R
Subsidiary Risk Class: N/R
UN Packaging Group: N/R
IATA Label: N/R
Packaging Note for Passengers: N/R
Maximum Quantity for Passengers: N/R
Packaging Note for Cargo: N/R
Maximum Quantity for Cargo: N/R
Exceptions: N/R

AFI Detail Information

AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
AFI Symbols:
AFI PSN Code: ZZZ
AFI PSN Modifier:
AFI UN Id Number: N/R
AFI Hazard Class: N/R
AFI Packing Group: N/R
AFI Label: N/R
Special Provisions: N/A
Back Pack Reference: N/A

HAZCOM Label Information

Product Identification: FREON 113;TRICHLOROTRIFLUOROETHANE
CAGE: 0ERJ7
Assigned Individual: N

Company Name: E I DUPONT DE NEMOURS & CO, INC.
Company PO Box: N/K
Company Street Address1: 1007 MARKET STREET
Company Street Address2: WILMINGTON, DE 19898 US
Health Emergency Telephone: 800-441-3637
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

HELIUM

Section 1 - Product and Company Identification
HELIUM

Product Identification: HELIUM
Date of MSDS: 01/01/1985 **Technical Review Date:** 11/01/1979
FSC: 6830 **NIIN:** 00-973-3184
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: DEPT. OF THE AIR FORCE
Manufacturer's Address1:
Manufacturer's Address2: N/P, NK 00000
Manufacturer's Country: NK
General Information Telephone:
Emergency Telephone: N/P
Emergency Telephone: N/P
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: MO412
Special Project Code: N

Item Description

Item Name:
Item Manager:
Specification Number: NK
Type/Grade/Class: NK
Unit of Issue:
Unit of Issue Quantity:
Type of Container:

Contractor Information

Contractor's Name: DEPARTMENT OF THE AIR FORCE
Contractor's Address1: UNKNOWN
Contractor's Address2: UNKNOWN, NK 00000
Contractor's Telephone: UNKNOWN
Contractor's CAGE: 80049

Contractor Information

Contractor's Name: DEPT. OF THE AIR FORCE
Contractor's Address1: UNKNOWN
Contractor's Address2: UNKNOWN, NK 00000
Contractor's Telephone: UNKNOWN
Contractor's CAGE: MO412

Section 2 - Compositon/Information on Ingredients
HELIUM

Ingredient Name: HELIUM
Ingredient CAS Number: 7440-59-7 **Ingredient CAS Code:** M
RTECS Number: MH6520000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:

% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 99.9
% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: N/P **OSHA PEL Code:**
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/P **ACGIH TLV Code:**
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
HELIUM

Health Hazards Acute & Chronic: N/P

Signs & Symptoms of Overexposure:
N/P

Medical Conditions Aggravated by Exposure:
N/P

LD50 LC50 Mixture: N/P

Route of Entry Indicators:
Inhalation: N/P
Skin: N/P
Ingestion: N/P

Carcenogenicity Indicators
NTP: N/P
IARC: N/P
OSHA: N/P

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
HELIUM

First Aid:
N/P

Section 5 - Fire Fighting Measures
HELIUM

Fire Fighting Procedures:
N/P
Unusual Fire or Explosion Hazard:

N/P
Extinguishing Media:
N/P
Flash Point: Flash Point Text: N/A

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s):
Upper Limit(s):

Section 6 - Accidental Release Measures
HELIUM

Spill Release Procedures:
N/P

Section 7 - Handling and Storage
HELIUM

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
HELIUM

Repiratory Protection:
N/P
Ventilation:
N/P
Protective Gloves:
N/P
Eye Protection: N/P
Other Protective Equipment: N/P
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: N/P

Section 9 - Physical & Chemical Properties
HELIUM

HCC: G3
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: N/A
Melting/Freezing Point: Melting/Freezing Text: N/A
Decomposition Point: Decomposition Text: N/A
Vapor Pressure: N/P **Vapor Density:** N/P
Percent Volatile Organic Content:
Specific Gravity: N/P
Volatile Organic Content Pounds per Gallon:
pH: N/P

Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/P
Solubility in Water: N/P
Appearance and Odor:
Percent Volatiles by Volume: N/P
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data
HELIUM

Stability Indicator: N/P
Materials to Avoid:
N/P
Stability Condition to Avoid:
N/P
Hazardous Decomposition Products:
N/P
Hazardous Polymerization Indicator: N/P
Conditions to Avoid Polymerization:
N/P

Section 11 - Toxicological Information
HELIUM

Toxicological Information:
N/P

Section 12 - Ecological Information
HELIUM

Ecological Information:
N/P

Section 13 - Disposal Considerations
HELIUM

Waste Disposal Methods:
N/P

Section 14 - MSDS Transport Information
HELIUM

Transport Information:
N/P

Section 15 - Regulatory Information
HELIUM

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P

State Regulatory Information:
N/P

Section 16 - Other Information
HELIUM

Other Information:
N/P

HMIS Transportation Information

Product Identification: HELIUM
Transporation ID Number: 95924
Responsible Party CAGE: MO412
Date MSDS Prepared: 01/01/1985
Date MSDS Reviewed: 09/05/1986
MFN: 09/05/1986
Submitter: D DG
Status Code: C

Container Information
Unit of Issue:
Container Quantity:
Type of Container:
Net Unit Weight:

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: HELIUM, COMPRESSED
DOT PSN Code: GZR
Symbols:
DOT PSN Modifier:
Hazard Class: 2.2
UN ID Number: UN1046
DOT Packaging Group:
Label: NONFLAMMABLE GAS
Special Provision(s):
Packaging Exception: 306

Non Bulk Packaging: 302
Bulk Packaging: 302,314
Maximimum Quanity in Passenger Area: 75 KG
Maximimum Quanity in Cargo Area: 150 KG
Stow in Vessel Requirements: A
Requirements Water/Sp/Other: 85

IMO Detail Information

IMO Proper Shipping Name: HELIUM, COMPRESSED
IMO PSN Code: HWT
IMO PSN Modifier:
IMDG Page Number: 2144
UN Number: 1046
UN Hazard Class: 2(2.2)
IMO Packaging Group: -
Subsidiary Risk Label: -
EMS Number: 2-04
Medical First Aid Guide Number: NON

IATA Detail Information

IATA Proper Shipping Name: HELIUM, COMPRESSED
IATA PSN Code: NCJ
IATA PSN Modifier:
IATA UN Id Number: 1046
IATA UN Class: 2.2
Subsidiary Risk Class:
UN Packaging Group:
IATA Label: NON-FLAMMABLE GAS
Packaging Note for Passengers: 200
Maximum Quantity for Passengers: 75KG
Packaging Note for Cargo: 200
Maximum Quantity for Cargo: 150KG
Exceptions:

AFI Detail Information

AFI Proper Shipping Name: HELIUM, COMPRESSED
AFI Symbols:
AFI PSN Code: NCJ
AFI PSN Modifier:
AFI UN Id Number: UN1046
AFI Hazard Class: 2.2
AFI Packing Group: N/A
AFI Label:
Special Provisions: P5
Back Pack Reference: A6.3, A6.6

HAZCOM Label Information

Product Identification: HELIUM
CAGE: MO412
Assigned Individual: Y
Company Name: DEPT. OF THE AIR FORCE
Company PO Box:
Company Street Address1: UNKNOWN
Company Street Address2: UNKNOWN, NK 00000 NK
Health Emergency Telephone:
Label Required Indicator: Y

Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
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TETRACHLOROETHENE, 0-663

Section 1 - Product and Company Identification
TETRACHLOROETHENE, 0-663

Product Identification: TETRACHLOROETHENE, 0-663
Date of MSDS: 07/01/1988 **Technical Review Date:** 11/03/1994
FSC: 6810 **NIIN:** **LIIN:** 00N054677
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: CHEM SERVICE INC
Post Office Box: 3108
Manufacturer's Address1:
Manufacturer's Address2: WEST CHESTER, PA 19381
Manufacturer's Country: US
General Information Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 84898
Special Project Code: N

Contractor Information

Contractor's Name: CHEM SERVICE INC
Post Office Box: 3108
Contractor's Address1: N/K
Contractor's Address2: WEST CHESTER, PA 19381
Contractor's Telephone: 215-692-3026
Contractor's CAGE: 84898

Contractor Information

Contractor's Name: CHEM SERVICE, INC
Post Office Box: 599
Contractor's Address1: 660 TOWER LN
Contractor's Address2: WEST CHESTER, PA 19301-9650
Contractor's Telephone: 610-692-3026
Contractor's CAGE: 8Y898

Section 2 - Compositon/Information on Ingredients
TETRACHLOROETHENE, 0-663

Ingredient Name: ETHYLENE, TETRACHLORO-; (TETRACHLOROETHYLENE) (SARA III)
Ingredient CAS Number: 127-18-4 **Ingredient CAS Code:** M
RTECS Number: KX3850000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K

OSHA PEL: 25 PPM **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 25 PPM;100 PPM STEL **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 100 LBS
DOT Reporting Quantity: 100 LBS
Ozone Depleting Chemical: N

Ingredient Name: EYE PROTECTION: FULL LENGTH FACESHIELD (FP N).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 2: ARRIVED. INGESTION: CALL MD IMMEDIATELY (FP N).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**

EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: SUPP DATA: RESPS. IF PATIENT IS IN CARD ARREST ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL MED ASSIST HAS (ING 3)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Section 3 - Hazards Identification, Including Emergency Overview
TETRACHLOROETHENE, 0-663

Health Hazards Acute & Chronic: CONT LENSES SHOULD NOT BE WORN IN LAB. ALL CHEMS SHOULD BE CONSIDERED HAZ-AVOID DIRECT PHYS CONT! CAN BE HARMFUL IF ABSORB THRU SKIN. CAN BE HARMFUL IF INHALED. CAN BE FATAL IF ABSORB THRU SKIN! CAN B E FATAL IF INHALED! MAY BE FATAL IF SWALLOWED! SUSPECTED CARCIN-MAY PRDCE CANCER. LACHRYMATOR-CAUSES (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ: SEV EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN CAUSE SEV EYE BURNS. CAN CAUSE EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN CAUSE SEV EYE BURNS. CAN CAUSE EYE IRRIT. CAN CAUSE SKIN IRRIT. CAN CAUSE SKIN BURNS. CAN CAUSE SEV SKIN BURNS. CAN BE HARMFUL IF SWALLOWED. CAN CAUSE LIVER INJ. CAN CAUSE KIDNEY INJ. (SUPDAT)

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: LD50 (ORAL,RAT): 8850 MG/KG.

Route of Entry Indicators:

Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: YES
IARC: YES
OSHA: NO

Carcinogenicity Explanation: TETRACHLOROETHYLENE: IARC MONOGRAPHS SUPP, VOL 7, PG 355, 1987: GRP 2B. NTP 7TH ANNUAL REPORT ON CARCINS, 1994: (SUPDAT)

Section 4 - First Aid Measures
TETRACHLOROETHENE, 0-663

First Aid:
AN ANTIDOTE IS SUBSTANCE INTENDED TO COUNTERACT EFT OF POIS. IT SHOULD BE ADMIN ONLY BY PHYS/TRAINED EMER PERS. MED ADVICE CAN BE OBTAINED FROM POIS CNTRL CNTR. EYE: FLUSH CONTINUOUSLY W/WATER FOR AT LST 15-20 MINS. SKIN: FLUSH W/WATER FOR15-20 MINS. IF NO BURNS HAVE OCCURRED-USE SOAP & WATER TO CLEANSE SKIN. INHAL: REMOVE PATIENT TO FRESH AIR. ADMIN OXYGEN IF PATIENT IS HAVING DFCLTY (SUPDAT)

Section 5 - Fire Fighting Measures
TETRACHLOROETHENE, 0-663

Fire Fighting Procedures:
WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
NONE SPECIFIED BY MANUFACTURER.
Extinguishing Media:
CARBON DIOXIDE, DRY CHEMICAL POWDER OR SPRAY.
Flash Point: Flash Point Text: NON-FLAMMABLE

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/A
Upper Limit(s): N/A

Section 6 - Accidental Release Measures
TETRACHLOROETHENE, 0-663

Spill Release Procedures:
EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE OR SIMILAR MATERIAL. SWEEP UP AND PLACE IN AN APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATE D SURFACES TO REMOVE ANY RESIDUES.

Section 7 - Handling and Storage
TETRACHLOROETHENE, 0-663

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
TETRACHLOROETHENE, 0-663

Repiratory Protection:
WEAR NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation:
CHEMICAL SHOULD BE HANDLED ONLY IN HOOD.
Protective Gloves:
IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPRVD CHEM WORKERS GOGG & (ING 4)
Other Protective Equipment: USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.EMER EYEWASH & DELUGE SHOWER WHICH MEET ANSI DESIGN CRITERIA (FP N).
Work Hygenic Practices: NONE SPECIFIED BY MANUFACTURER.
Supplemental Health & Safety Information: EXPLAN OF CARCIN: ANTIC TO BE CARCIN. ANIMAL: LIVER TUMORS. EFTS OF OVEREXP: CAN BE IRRIT TO MUC MEMB. PRLNGD EXPOS MAY CAUSE NAUS/HDCH, DIZZ &/OR EYE DMG. AVOID CONSUMPTION OF ALCOHOL BEFORE & AFTER HNDLG OF CMPD BECAUSE IT WILL INCR TOX OF CMPD. FIRST AID PROC: BRTHG. IF PATIENT HAS STOPPED BRTHG ADMIN ARTF (ING 2)

Section 9 - Physical & Chemical Properties
TETRACHLOROETHENE, 0-663

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 250F,121C
Melting/Freezing Point: Melting/Freezing Text: 71.6F,22C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 14 @ 20C **Vapor Density:** N/A
Percent Volatile Organic Content:
Specific Gravity: 1.623
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: NOT APPLICABLE
Solubility in Water: INSOLUBLE
Appearance and Odor: COLORLESS LIQUID.
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
TETRACHLOROETHENE, 0-663

Stability Indicator: YES
Materials to Avoid:
STRONG BASES, OXIDIZING AGENTS.

Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
DECOMPOSITION LIBERATES TOXIC FUMES. DECOMPOSITION PRODUCTS ARE CORROSIVE.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT.

Section 11 - Toxicological Information
TETRACHLOROETHENE, 0-663

Toxicological Information:
N/P

Section 12 - Ecological Information
TETRACHLOROETHENE, 0-663

Ecological Information:
N/P

Section 13 - Disposal Considerations
TETRACHLOROETHENE, 0-663

Waste Disposal Methods:
BURN IN CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS (FP N).

Section 14 - MSDS Transport Information
TETRACHLOROETHENE, 0-663

Transport Information:
N/P

Section 15 - Regulatory Information
TETRACHLOROETHENE, 0-663

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
TETRACHLOROETHENE, 0-663

Other Information:
N/P

HAZCOM Label Information

Product Identification: TETRACHLOROETHENE, 0-663
CAGE: 84898
Assigned Individual: N
Company Name: CHEM SERVICE INC
Company PO Box: 3108

Company Street Address1: N/K
Company Street Address2: WEST CHESTER, PA 19381 US
Health Emergency Telephone: 215-692-3026
Label Required Indicator: Y
Date Label Reviewed: 11/03/1994
Status Code: C
Manufacturer's Label Number:
Date of Label: 11/03/1994
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: WARNING
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: None
Reactivity Hazard: None

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

TRICHLOROETHENE, 0-664

Section 1 - Product and Company Identification
TRICHLOROETHENE, 0-664

Product Identification: TRICHLOROETHENE, 0-664
Date of MSDS: 01/07/1993 **Technical Review Date:** 10/26/1994
FSC: 6810 **NIIN:** **LIIN:** 00N054683
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: CHEM SERVICE INC
Post Office Box: 3108
Manufacturer's Address1:
Manufacturer's Address2: WEST CHESTER, PA 19381
Manufacturer's Country: US
General Information Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 84898
Special Project Code: N

Contractor Information

Contractor's Name: CHEM SERVICE INC
Post Office Box: 3108
Contractor's Address1: N/K
Contractor's Address2: WEST CHESTER, PA 19381
Contractor's Telephone: 215-692-3026
Contractor's CAGE: 84898

Contractor Information

Contractor's Name: CHEM SERVICE, INC
Post Office Box: 599
Contractor's Address1: 660 TOWER LN
Contractor's Address2: WEST CHESTER, PA 19301-9650
Contractor's Telephone: 610-692-3026
Contractor's CAGE: 8Y898

Section 2 - Compositon/Information on Ingredients
TRICHLOROETHENE, 0-664

Ingredient Name: ETHYLENE, TRICHLORO-; (TRICHLOROETHYLENE) (SARA III). LD50: (ORAL,RAT) 4920 MG/KG.
Ingredient CAS Number: 79-01-6 **Ingredient CAS Code:** M
RTECS Number: KX4550000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:

Other REC Limits: N/K
OSHA PEL: 100 PPM **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 50 PPM;100 STEL **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 100 LBS
DOT Reporting Quantity: 100 LBS
Ozone Depleting Chemical: N

Ingredient Name: OTHER PREC:CAUSE THE FORMATION OF HCL &/OR PHOSGENE (FP N).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: SUPDAT:BY MD/TRAINED EMERGENCY PERSONNEL. MEDICAL ADVICE CAN BE OBTAINED FROM A POISON CONTROL CENTER.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:

ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Section 3 - Hazards Identification, Including Emergency Overview
TRICHLOROETHENE, 0-664

Health Hazards Acute & Chronic: ALL CHEMS SHOULD BE CONSIDERED HAZ - AVOID DIRECT PHYSICAL CONT! SUSPECTED CARCIN - MAY PRDCE CANCER. MAY BE HARMFUL IF ABSORBED THRU SKIN, INHALED/SWALLOWED. LACHRYMATOR - CAUSES SEV EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN CAUSE SEV EYE BURNS. CAN CAUSE SKIN/EYE IRRIT. CAUSE CAUSE SKIN BURNS. CAN (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ:CAUSE SEV SKIN BURNS. EXPOS CAN CAUSE LIVER/KIDNEY DMG. CAN CAUSE GI DISTURBS. CAN BE IRRIT TO MUC MEMBS. PRLNG EXPOS MAY CAUSE NAUS, HDCH, DIZZ &/OR EYE DMG. CAN CAUSE SENSIT BY SKIN CONT. C HLOROCARBON MATLS HAVE PRDCD SENSIT OF MYOCARDIUM TO EPINEPHRINE IN LAB ANIMALS & COULD HAVE SIMILAR EFT IN (SUPP DATA)

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: SEE INGREDIENT.

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT

Section 4 - First Aid Measures
TRICHLOROETHENE, 0-664

First Aid:
INGEST:CALL MD IMMED (FP N). EYES:FLUSH CONTINUOUSLY W/WATER FOR AT LST 15-20 MINS. SKIN:FLUSH W/WATER FOR 15-20 MINS. IF NO BURNS HAVE OCCURRED - USE SOAP & WATER TO CLEANSE SKIN. INHAL:REMOVE PATIEN T TO FRESH AIR. ADMIN OXYGEN IF PATIENTIS HAVING DFCLTY BRTHG. IF PATIENT HAS STOPPED BRTHG ADMIN ARTF RESP. IF PATIENT IS IN CARDIAC ARREST ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL(SUPDAT)

Section 5 - Fire Fighting Measures
TRICHLOROETHENE, 0-664

Fire Fighting Procedures:
USE NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE HCL & PHOSGENE (FP N).
Extinguishing Media:
CARBON DIOXIDE, DRY CHEMICAL POWDER OR SPRAY.
Flash Point: Flash Point Text: NON-FLAMMABLE

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 11%
Upper Limit(s): 41%

Section 6 - Accidental Release Measures
TRICHLOROETHENE, 0-664

Spill Release Procedures:
EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE OR SIMILAR MATERIAL. SWEEP UP & PLACE IN AN APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.

Section 7 - Handling and Storage
TRICHLOROETHENE, 0-664

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
TRICHLOROETHENE, 0-664

Repiratory Protection:
NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation:
THIS CHEMICAL SHOULD ONLY BE HANDLED IN A HOOD.
Protective Gloves:
IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: USE APPROPRIATE NIOSH/MSHA APPROVED SAFETY EQUIPMENT.
Work Hygenic Practices: CONTACT LENSES SHOULD NOT BE WORN IN THE LABORATORY. ANSI APPRVD EYE WASH & DELUGE SHOWER (FP N).
Supplemental Health & Safety Information: EFTS OF OVEREXP:HUMANS. ADRENOMIMETICS (E.G., EPINEPRHINE) MAY BE CONTRAINDICATED EXCEPT FOR LIFE-SUSTAINING USES IN HUMANS ACUTELY/CHRONICALLY EXPOS TO CHLOROCARBONS (FP N). FIRST AID PROC:MED ASSIST ANCE HAS ARRIVED. NOTE:AN ANTIDOTE IS ASUBSTANCE INTENDED TO COUNTERACT EFT OF A POIS. IT SHOULD BE ADMIN ONLY (ING 2)

Section 9 - Physical & Chemical Properties

TRICHLOROETHENE, 0-664

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 189F,87C
Melting/Freezing Point: Melting/Freezing Text: -125F,-87C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 58 @ 20C **Vapor Density:** N/K
Percent Volatile Organic Content:
Specific Gravity: 1.462
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: INSOL (IMMISCIBLE)
Appearance and Odor: COLORLESS LIQUID.
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
TRICHLOROETHENE, 0-664

Stability Indicator: YES
Materials to Avoid:
INCOMPATIBLE W/STRONG BASES, STRONG OXIDIZING AGENTS.
Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
DECOMPOSITION LIBERATES TOXIC FUMES. DECOMPOSTION PRODUCTS ARE CORROSIVE. VOLATILE. HCL, PHOSGENE (FP N).
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT

Section 11 - Toxicological Information
TRICHLOROETHENE, 0-664

Toxicological Information:
N/P

Section 12 - Ecological Information
TRICHLOROETHENE, 0-664

Ecological Information:
N/P

Section 13 - Disposal Considerations
TRICHLOROETHENE, 0-664

Waste Disposal Methods:
DISPOSAL MUST BE I/A/W FEDERAL, STATE & LOCAL REGULATIONS (FP N). BURN IN A

CHEMICAL INCINERATOR EQUIPPED W/AFTERBURNER & SCRUBBER.

Section 14 - MSDS Transport Information
TRICHLOROETHENE, 0-664

Transport Information:
N/P

Section 15 - Regulatory Information
TRICHLOROETHENE, 0-664

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
TRICHLOROETHENE, 0-664

Other Information:
N/P

HAZCOM Label Information

Product Identification: TRICHLOROETHENE, 0-664
CAGE: 84898
Assigned Individual: N
Company Name: CHEM SERVICE INC
Company PO Box: 3108
Company Street Address1: N/K
Company Street Address2: WEST CHESTER, PA 19381 US
Health Emergency Telephone: 215-692-3026
Label Required Indicator: Y
Date Label Reviewed: 10/26/1994
Status Code: C
Manufacturer's Label Number:
Date of Label: 10/26/1994
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Moderate
Contact Hazard: Severe
Fire Hazard: None
Reactivity Hazard: None

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
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VINYL CHLORIDE

Section 1 - Product and Company Identification
VINYL CHLORIDE

Product Identification: VINYL CHLORIDE
Date of MSDS: 10/01/1985 **Technical Review Date:** 10/09/1992
FSC: 6810 **NIIN: LIIN:** 00N034925
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: MATHESON GAS PRODUCTS
Manufacturer's Address1: 932 PATTERSON PLANK RD
Manufacturer's Address2: EAST RUTHERFORD, NJ 07073
Manufacturer's Country: US
General Information Telephone: 201-933-2400
Emergency Telephone: 201-933-2400
Emergency Telephone: 201-933-2400
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 0FB11
Special Project Code: N

Contractor Information

Contractor's Name: MATHESON GAS PRODUCTS
Contractor's Address1: 30 SEAFIEW DRIVE
Contractor's Address2: SEACAUCUS, NJ 07096
Contractor's Telephone: 201-867-4100, CHEMTREC 800-424-9300
Contractor's CAGE: 0FB11

Section 2 - Compositon/Information on Ingredients
VINYL CHLORIDE

Ingredient Name: ETHYLENEM, CHLORO-; (VINYL CHLORIDE) (SARA III)
Ingredient CAS Number: 75-01-4 **Ingredient CAS Code:** M
RTECS Number: KU9625000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: SEE 1910.1017 **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 5 PPM, A1; 9293 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1 LB
DOT Reporting Quantity: 1 LB
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
VINYL CHLORIDE

Health Hazards Acute & Chronic: ACUTE:INHAL MAY CAUSE DROWS, BLURRED VISION, STAG GAIT, & TINGLING & NUMBNESS IN THE FEET & HANDS. IN HIGH CONC VINYL CHLORIDE ACTS AS AN ANESTHETIC. CONTACT WITH LIQ VINYL CHLORIDE MAY CAUSE SEVERE I RRITATION & BURNS. CHRONIC: VINYL CHLORIDE IS A RECOGNIZED CARCINOGEN & HAS CAUSED CANCER IN MAN.(EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
SEE HEALTH HAZARDS.

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route of Entry Indicators:
Inhalation: YES
Skin: NO
Ingestion: YES

Carcenogenicity Indicators
NTP: YES
IARC: YES
OSHA: YES

Carcinogenicity Explanation: VINYL CHLORIDE: KNOWN CARCINOGEN (NTP), GROUP 1 (IARC); OSHA REGULATED

Section 4 - First Aid Measures
VINYL CHLORIDE

First Aid:
INHAL: MOVE VICTIM TO FRESH AIR. IF NOT BRTHG, GIVE ARTF RESP. IF BRTHG IS DIFFICULT, GIVE OXYGEN. CALL A PHYSICIAN. EYE/SKIN: IMMED FLUSH EYE/SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MIN. REMOVE CON TAMINATED CLOTHING AND SHOES. CALL A PHYSICIAN. INGEST: GET MD IMMEDIATELY (FP N). NOTE: SKIN BURNS CAN BE TREATED BY THE APPLICATION OF MAGNESIUM PASTE (MAGNESIUM OXIDE AND GLYCERINE).

Section 5 - Fire Fighting Measures
VINYL CHLORIDE

Fire Fighting Procedures:
FIRE FIGHTERS MUST WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N). FIREIGHTERS TURNOUT GEAR IS INADEQUATE.
Unusual Fire or Explosion Hazard:
CYLINDERS THAT ARE EXPOSED TO FIRE MAY RUPTURE WITH VIOLENT FORCE. EXTING SURROUNDING FIRE & KEEP CYLINDERS COOL USING A WATER SPRAY APPLIED FROM THE (SUPP DATA)
Extinguishing Media:
TO EXTING A VINYL CHLORIDE FIRE STOP THE FLOW OF GAS. IF THE FLOW CANNOT BE STOPPED, LET THE FIRE BURN ITSELF(SUPP DATA)
Flash Point: Flash Point Text: N/K

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 4%
Upper Limit(s): 22%

Section 6 - Accidental Release Measures
VINYL CHLORIDE

Spill Release Procedures:
EVACUATE AREA. PERSONNEL EQUIPPED W/SPECIAL PERSONAL PROTECTIVE SUITS FOR FIRE/CHEMICALS AND POSITIVE PRESSURE NIOSH/MSHA APPROVED SCBA CAN RE-ENTER THE AREA AND ATTEMPT TO STOP LEAK.

Section 7 - Handling and Storage
VINYL CHLORIDE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
VINYL CHLORIDE

Repiratory Protection:
NIOSH/MSHA APPROVED POSITIVE PRESSURE SCBA SHOULD BE WORN IF IT IS SUSPECTED THAT VINYL CHLORIDE IS IN THE AIR.
Ventilation:
NONE SPECIFIED BY MANUFACTURER.
Protective Gloves:
IMPERVIOUS GLOVES.
Eye Protection: CHEM WORK GOGG/FULL LENGTH FSHLD (FP N).
Other Protective Equipment: EYE WASH STATIONS & SAFETY SHOWERS READILY AVAILABE.
Work Hygenic Practices: NONE SPECIFIED BY MANUFACTURER.
Supplemental Health & Safety Information: EXTING MEDIA:OUT WHILE COOLING CYLINDER & SURROUNDINGS USING A H*2O SPRAY. EXPLO HAZ:MAX POSS DISTANCE. FLAMM & TOX GASES MAY SPREAD FROM A SPILL AFTER FIRE IS EXTING & BE SUBJECT TO REIGNIT. THERMAL DECOMP PRODS MAY INCL HCL & PHOSGENE (FP N). OTHER PREC: PLAN COVERING STEPS TO BE TAKEN IN CASE OF ACCIDENTAL RELEASE.

Section 9 - Physical & Chemical Properties
VINYL CHLORIDE

HCC: G2
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 7.2F,-13.8C
Melting/Freezing Point: Melting/Freezing Text: -245F,-154C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 234KPA@21C **Vapor Density:** N/K
Percent Volatile Organic Content:
Specific Gravity: 2.21

Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: 1.07 CM3/1 ML H*2O
Appearance and Odor: COLORLESS, HIGHLY FLAMM GAS WITH A PLEASANT, SWEET ODOR AT HIGH CONC.
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
VINYL CHLORIDE

Stability Indicator: YES
Materials to Avoid:
OXIDIZING MATLS, ACTIVE METALS, ALUMINUM ALLOYS AND ORGANOMETALLICS.
Stability Condition to Avoid:
AVOID EXPOSURE TO SUNLIGHT, HEAT, AIR, OXYGEN PEROXIDES AND OTHER STRONG OXIDIZING AGENTS.
Hazardous Decomposition Products:
HYDROGEN CHLORIDE, PHOSGENE, CARBON MONOXIDE.
Hazardous Polymerization Indicator: YES
Conditions to Avoid Polymerization:
OXYGEN (AIR), HEAT, SUNLIGHT, MOISTURE AND FREE RADICAL INITIATORS OR OTHER CATALYTIC MATERIALS.

Section 11 - Toxicological Information
VINYL CHLORIDE

Toxicological Information:
N/P

Section 12 - Ecological Information
VINYL CHLORIDE

Ecological Information:
N/P

Section 13 - Disposal Considerations
VINYL CHLORIDE

Waste Disposal Methods:
DISPOSAL MUST BE IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS (FP N).

Section 14 - MSDS Transport Information
VINYL CHLORIDE

Transport Information:
N/P

Section 15 - Regulatory Information

VINYL CHLORIDE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
VINYL CHLORIDE

Other Information:
N/P

HMIS Transportation Information

Product Identification: VINYL CHLORIDE
Transporation ID Number: 39375
Responsible Party CAGE: 0FB11
Date MSDS Prepared: 10/01/1985
Date MSDS Reviewed: 03/24/1993
MFN: 03/24/1993
Submitter: N TN
Status Code: C

Container Information
Unit of Issue: NK
Container Quantity: NK
Type of Container:
Net Unit Weight:

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: VINYL CHLORIDE, INHIBITED OR VINYL CHLORIDE, STABILIZED
DOT PSN Code: PRS
Symbols:
DOT PSN Modifier:
Hazard Class: 2.1

UN ID Number: UN1086
DOT Packaging Group:
Label: FLAMMABLE GAS
Special Provision(s): 21,B44
Packaging Exception: 306
Non Bulk Packaging: 304
Bulk Packaging: 314,315
Maximimum Quanity in Passenger Area: FORBIDDEN
Maximimum Quanity in Cargo Area: 150 KG
Stow in Vessel Requirements: B
Requirements Water/Sp/Other: 40

IMO Detail Information

IMO Proper Shipping Name: VINYL CHLORIDE, INHIBITED
IMO PSN Code: PJJ
IMO PSN Modifier:
IMDG Page Number: 2186
UN Number: 1086
UN Hazard Class: 2(2.1)
IMO Packaging Group: -
Subsidiary Risk Label: -
EMS Number: 2-07
Medical First Aid Guide Number: 340

IATA Detail Information

IATA Proper Shipping Name: VINYL CHLORIDE, INHIBITED
IATA PSN Code: ZHW
IATA PSN Modifier:
IATA UN Id Number: 1086
IATA UN Class: 2.1
Subsidiary Risk Class:
UN Packaging Group:
IATA Label: FLAMMABLE GAS
Packaging Note for Passengers: FORB
Maximum Quantity for Passengers: FORB
Packaging Note for Cargo: 200
Maximum Quantity for Cargo: 150KG
Exceptions: A1

AFI Detail Information

AFI Proper Shipping Name: VINYL CHLORIDE, INHIBITED
AFI Symbols:
AFI PSN Code: ZHW
AFI PSN Modifier:
AFI UN Id Number: UN1086
AFI Hazard Class: 2.1
AFI Packing Group: N/A
AFI Label:
Special Provisions: P4
Back Pack Reference: A6.3, A6.5

HAZCOM Label Information

Product Identification: VINYL CHLORIDE
CAGE: 0FB11
Assigned Individual: N
Company Name: MATHESON GAS PRODUCTS

Company PO Box:
Company Street Address1: 30 SEAFIEW DRIVE
Company Street Address2: SEACAUCUS, NJ 07096 US
Health Emergency Telephone: 201-933-2400
Label Required Indicator: Y
Date Label Reviewed: 10/08/1992
Status Code: C
Manufacturer's Label Number:
Date of Label: 10/08/1992
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: Severe
Reactivity Hazard: Slight

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Attachment F

Incident/Near Miss Investigation Form

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Remedial Management & Construction

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Incident / Near-Miss Investigation Report

Every employee injury, accident, and near miss must be reported within 24 hours of the injury. If the incident results in hospitalization, an immediate report must be made by telephone to the Project Manager and the Health and Safety Officer.

Project Information

Project Name:	Project #
Location of Incident:	

Employee

Name:	Employee Number:
Employment Status: ☐ Regular ☐ Part Time	How long in present job?

Injury or Illness Information

Where did the incident / near miss occur? (number, street, city, state, zip):

Employee's specific activity at the time of the incident / near miss:

Equipment, materials, or chemicals the employee was using when the incident / near miss occurred (e.g., the equipment employee struck against or that struck the employee; the vapor inhaled or material swallowed; what the employee was lifting, pulling, etc.):

Describe the specific injury or illness (e.g., cut, strain, fracture, etc.):

Body part(s) affected (e.g., back, left wrist, right eye, etc.):

Name and address of treatment provider (e.g., physician or clinic):	Phone No.:
If hospitalized, name and address of hospital:	Phone No.:

Date of injury or onset of illness: / /	Time of event or exposure: ☐ AM ☐ PM

Did employee miss at least one full shift's work? ☐ No ☐ Yes, 1st date absent (MM/DD/YYYY) / /

Has employee returned to work? ☐ Regular work ☐ Restricted work ☐ No
☐ Yes, date returned (MM/DD/YYYY) / /

To whom reported:	Other workers injured / made ill in this event? ☐ Yes ☐ No

Description of Incident / Near Miss: (Describe what happened and how it happened.)

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Incident / Near-Miss Investigation Report

Motor Vehicle Accident (MVA)

Company Vehicle?	☐ Yes ☐ No

Accident Location (street, city, state)									
Vehicle Towed?	☐ Yes ☐ No	Other Vehicle?	☐ Yes ☐ No	# Vehicles Towed:		# of Injuries:			

Spill

Material Spilled:	Quantity:	Source:
Agency Notifications:		
Cost of Incident $		

Third Party Incidents

Name of Owner:		Address:	Telephone:
Description of Damage:			
Witness Name:		Address:	Telephone:
Witness Name:		Address:	Telephone:

Root Cause and Contributing Factors: Conclusion (Describe in Detail Why Incident / Near Miss Occurred)

1	
2	
3	
4	
5	

Root Cause(s) Analysis (RCA):

1. Lack of skill or knowledge.
2. Lack of or inadequate operational procedures or work standards.
3. Inadequate communication of expectations regarding procedures or work standards.
4. Inadequate tools or equipment.
5. Correct way takes more time and / or requires more effort.
6. Short-cutting standard procedures is positively reinforced or tolerated.
7. Person thinks there is no personal benefit to always doing the job according to standards.
8. Uncontrollable.

#	RCA #	Solution(s): How to Prevent Incident / Near Miss From Reoccurring	Person Responsible	Due Date	Closure Date

Investigation Team Members

Name	Job Title	Date

Results of Solution Verification and Validation

Reviewed By

Name	Job Title	Date
	Project Manager	
	Health and Safety Reviewer	

Attachment G

Loss Prevention Observation

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Loss Prevention Observation

Observer Name	Observer Title	Project/Project Number
Date _____ Time ____ ☐ AM ☐ PM	Project Type / Task Observed	

Background Information

List Critical Work Procedures

List Issue/Items Requiring Corrective Action

Root Cause Analysis

1. Employee lacks the skill or knowledge to carry out duties
2. Procedures, work standards, or expectations were not communicated
3. Procedures or work standards were not developed or were inadequate
4. Equipment, systems, or tools were inadequate
5. Employee chose not to take the time or put forth the effort to do the job properly
6. Supervisor did not require the employee to follow the standard procedure
7. Employee doesn't see any advantage to doing the job to standard
8. Uncontrollable

Criterion #	RCA #	Corrective Action Identified	Responsible Individual	Due Date	Closure Date

Results of Corrective Action

Reviewed by	Date	Reviewed by	Date

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Loss Prevention Observation (LPO) Form

Environmental Operations

	PRE-TASK PREPARATION	Correct	Questionable	Comments
1.	Are Health and Safety Plan / MSDSs on site?			
2.	Is the employee familiar / trained on task?			
3.	OSHA-required training / medical surveillance?			
4.	Was utility mark out / check performed?			
5.	Was traffic hazard addressed / work area marked?			
6.	Are walking / working surfaces free of hazards?			
7.	Was the tailgate safety meeting performed?			
8.	Was SPSA performed prior to beginning work?			
9.	Communicates intentions to other personnel?			
10.	Knowledge of emergency procedures?			
11.	Distance between equipment and power lines?			
12.	Personal protective equipment?			
13.	Air monitoring equipment on site, calibrated?			
14.	Is a first aid kit / fire extinguisher on site?			
15.	Is one person trained in first aid / CPR?			
16.	Are work zones established and marked?			
	PERFORMING TASK			
17.	RSA before beginning new task?			
18.	Correct body positioning?			
19.	Proper lifting / pushing / pulling techniques?			
20.	Keep hands / body away from pinch points?			
21.	Are walking / working surfaces kept clear of debris?			
22.	Faces traffic as appropriate?			
23.	Do vehicles / barricades exist to protect against traffic?			
24.	Is the drill rig located properly, blocked / chocked?			
25.	Is the drill rig moved only with derrick lowered?			
26.	Is the excavator located on stable			

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Environmental Operations

Loss Prevention Observation (LPO) Form

	ground?			
27.	Is eye contact made with equipment operator?			
28.	Is spoil at least 2 feet back from edge of excavation?			
29.	Is the excavation shored / sloped / benched?			
30.	Is the excavation entry controlled?			
31.	Are equipment / tools used properly?			
32.	Is electrical equipment connected through GFCI?			
33.	Are power tools handled properly?			
34.	Are electrical cords inspected / in good condition?			
35.	Follows lockout / tagout procedures?			
36.	Air monitoring conducted / action levels understood?			
37.	Was equipment decontaminated properly?			
38.	Were personnel decontaminated prior to eating / drinking / smoking?			
39.	Was the decontamination effective?			
	POST – TASK			
40.	Procedures / JSA adequate?			
41.	Are equipment / tools stored properly?			
42.	Proper storage of soil / water / waste material?			
43.	Is the work area secured?			
44.	Other?			
	Total #			**% Safe:** (Total Correct/[Total Correct + Total Questionable]) * 100]

Attachment H

Air Monitoring Log

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Air Monitoring Log

Monitoring Instruments:

Air Monitor:

Activity:

Level of Protection:

Time	Location	Instrument Reading	Comments

Attachment I

NIOSH Method # 1007

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VINYL CHLORIDE

CH_2=CHCl MW: 62.50 CAS: 75-01-4 RTECS: KU9625000

METHOD: 1007, Issue 2 **EVALUATION: FULL** **Issue 1: 15 February 1984**
Issue 2: 15 August 1994

OSHA : 1 ppm; C 5 ppm
NIOSH: lowest feasible; carcinogen
ACGIH: 5 ppm; carcinogen
(1 ppm = 2.56 mg/m^3 @ NTP)

PROPERTIES: BP -14 °C; vapor density 2.2 (air = 1); lower explosive limit = 4% v/v in air

SYNONYMS: chloroethylene; chloroethethene.

SAMPLING

SAMPLER: SOLID SORBENT TUBE (2 tandem tubes, each with 150 mg activated coconut charcoal)

FLOW RATE: 0.05 L/min

VOL-MIN: 0.7 L
-MAX: 5 L

SHIPMENT: separate primary and backup tubes and cap each

SAMPLE STABILITY: 10 days @ 25 °C

BLANKS: 2 to 10 field blanks per set

ACCURACY

RANGE STUDIED: 1 to 64 mg/m^3 [1]

BIAS: - 6%

OVERALL PRECISION ($\hat{S}_{rT}$): 0.06 [1]

ACCURACY: ± 17.8%

MEASUREMENT

TECHNIQUE: GAS CHROMATOGRAPHY, FID

ANALYTE: vinyl chloride

DESORPTION: 1 mL carbon disulfide; 30 min

INJECTION ALIQUOT: 5 µL

COLUMN: stainless steel, 6.1 m x 3.2 mm, 10% SE-30 on 80/100 mesh Chromosorb W (AW-DMCS)

CARRIER GAS: He, 40 mL/min

TEMPERATURE-INJECTOR: 230 °C
-DETECTOR: 230 °C
-COLUMN: 60 °C

CALIBRATION: solutions of vinyl chloride in CS_2

RANGE: 2 to 200 µg per sample [1]

ESTIMATED LOD: 0.04 µg per sample [1]

PRECISION ($\bar{S}_r$): not determined

APPLICABILITY: The working range is 0.4 to 40 mg/m^3 (0.16 to 16 ppm) for a 5-L air sample. The method is applicable to 15-min samples at concentrations of 1 ppm or higher.

INTERFERENCES: Other than the possibility of loss of sample upon storage of two weeks or more at room temperature, none have been noted.

OTHER METHODS: This is a revision of P&CAM 178 [2].

REAGENTS:

1. Carbon disulfide,* chromatographic quality.
2. Vinyl chloride,*, 99.9%, in lecture bottle fitted with valve and septum.
3. Calibration stock solutions 0.26 mg/mL.
   a. Insert the tip of a gas syringe containing 1 mL vinyl chloride gas under the surface of 5 mL CS_2 in a 10-mL volumetric flask.
   b. Open the valve of the syringe and withdraw the plunger to pull CS_2 into the barrel. (As vinyl chloride dissolves, a vacuum will be created, pulling CS_2 into the syringe.)
   c. Push the solution from the syringe into the flask. Rinse the syringe twice with 1-mL portions of CS_2 and add the washings to the flask.
   d. Dilute to the mark with CS_2.
4. Helium, purified.
5. Hydrogen, purified.
6. Air, filtered.

* See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: two tandem glass tubes, 7 cm long, 6-mm OD, 4-mm ID, flame-sealed ends, each containing 150 mg of 20/40 mesh activated (600 °C) coconut shell charcoal. A silylated glass wool plug precedes the charcoal beds and a 3-mm urethane foam plug follows the charcoal beds. Plastic caps are included for sealing after use. Pressure drop across each tube at 1 L/min airflow must be less than 3.4 kPa.
   NOTE: A pair of two-section (100 mg/50 mg) tubes may be used. (SKC ST226-01, or equivalent).
2. Personal sampling pump, 0.05 L/min, with flexible connecting tubing.
3. Gas chromatograph, flame ionization detector, integrator and column (page 1007-1).
4. File.
5. Bent wire for removing plugs from sampling tube.
6. Vials, 2-mL, glass with PTFE-lined septa and crimp-on seals.
7. Volumetric flasks, 10-mL, with polyethylene stoppers.
8. Pipettes, delivery, 1.0-mL, graduated in 0.1-mL increments, 2- and 5-mL, with pipet bulb.
9. Air sampling bags, Tedlar, 10-L.
10. Gas syringe, with gas-tight valve, 0.1- and 1-mL.
11. Syringe, 10-µL, with 0.1-µL graduations.

SPECIAL PRECAUTIONS: Carbon disulfide is toxic and an acute fire and explosion hazard (flash point = -30 °C); work with it only in a hood.

Vinyl chloride is a human carcinogen [3].

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break the ends of the tubes immediately before sampling. Attach two tubes, with ends touching, with a short piece of tubing. Label one tube as the back tube and insert the back tube into the flexible tubing attached to the personal sampling pump.
3. Sample at 0.05 L/min for 15 to 100 min. Do not sample more than 5 L of air.
4. Separate the primary and backup tubes and cap each tube for shipment.

SAMPLE PREPARATION:

5. Add 1.0 mL CS_2 to an empty vial. Loosely cap the vial.
6. Score each sampler tube with a file in front of the glass wool plug. Break the tube at the score line.
7. Transfer the charcoal from the front and back tubes to separate vials. Discard the glass wool and foam plugs. Seal the vials with septum caps immediately.
8. Allow to stand for 30 min, with occasional agitation. Analyze the sample within the next 30-min period.

CALIBRATION AND QUALITY CONTROL:

9. Calibrate with at least six working standards covering the range 0.2 to 200 µg per sample.
   a. Add known amounts of calibration stock solution to CS_2 in 10-mL volumetric flasks and dilute to the marks, using serial dilution as appropriate.
      NOTE: Working standards can be stored at -20 °C for at least three days.
   b. Analyze together with samples and blanks (steps 12 and 13).
   c. Prepare calibration graphs of peak area vs. quantity (µg) of vinyl chloride per tube and peak area vs. quantity (ng) per injection.
10. Determine desorption efficiency (DE) at least once for each lot of charcoal used in the calibration range (step 9). Prepare three tubes at each of five levels plus three media blanks.
    a. Prepare three atmospheres of vinyl chloride in air by injecting 0.01, 0.08, and 0.2 mL vinyl chloride gas into 10 L air in Tedlar bags. The resulting concentrations are approximately 2.6, 21 and 52 mg/m^3.
    b. Following steps 1 through 4, sample these atmospheres according to the following scheme:

Concentration in Bag (mg/m^3)	Volume Sampled (L)	Quantity of Vinyl Chloride (µg)
2.6	0.8	2
	2.2	6
21	0.8	17
	2.2	46
52	2.5	130

    Obtain three samples at each level.
    c. Desorb (steps 6 through 8) and analyze together with working standards (steps 12 and 13). No vinyl chloride should be found on the back tubes.
    d. Analyze the atmospheres in the bags (steps 12 and 13) using 1-mL gas samples to verify concentration.
    e. Prepare a graph of DE vs. µg of vinyl chloride recovered.
11. Analyze three quality control blind spikes and three analyst spikes to ensure that the calibration graph and DE graph are in control.

MEASUREMENT:

12. Set the gas chromatograph according to manufacturer's instructions and to conditions given on page 1007-1. Inject sample aliquot manually using solvent flush technique or with autosampler. The retention time of vinyl chloride is about 1.7 min.
    NOTE: If peak area is above the linear range of the working standards, dilute with CS_2, reanalyze and apply the appropriate dilution factor in calculations.
13. Measure peak area.

CALCULATIONS:

14. Determine the mass, µg (corrected for DE) of vinyl chloride found in the sample front (W_f) and back (W_b) tubes, and in the average media blank (B).
    NOTE: If $W_b > W_f/10$, report breakthrough and possible sample loss.
15. Calculate concentration, C, of vinyl chloride in the air volume sampled, V (L):

$$C = \frac{(W_f + W_b - 2B)}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

The method was evaluated with single 150-mg coconut shell charcoal tubes (100-mg front beds and 50-mg back) [1]. Atmospheres were generated at four concentrations between 1 and 64 mg/m ^{3}. Recoveries, based on atmosphere concentrations calculated from the volumes of vinyl chloride and dilution air, averaged 94% with a pooled relative standard deviation ($\hat{S}_{rT}$) of 0.06. Samples at the 3-µg level showed no loss of vinyl chloride when stored for 12 days at room temperature or 19 days at -20 °C. There may be significant loss of vinyl chloride from samples stored for 14 days at room temperature [4]. The 1% breakthrough capacity for a 150-mg bed of coconut charcoal, challenged at 100 mL/min with vinyl chloride in air at 16 mg/m ^{3} and a relative humidity of 70%, was 4.6 L [5].

REFERENCES:

[1] Hill, R. H., Jr., C. S. McCammon, A. T. Saalwaechter, A. W. Teass, and W. J. Woodfin. Anal. Chem., 48, 1395-1398 (1976).
[2] NIOSH Manual of Analytical Methods, 2nd. ed., V. 1, P&CAM 178, U.S. Department of Health and Human Services, Publ. (NIOSH) 77-157-A (1977).
[3] TLVs - Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment 1993-94, ACGIH, Cincinnati, OH (1993).
[4] Cuddeback, J. E., W. R. Burg, and S. R. Birch, Environ. Sci. Technol., 9, 1168-1171 (1975).
[5] Matsumura, Y. Ind. Health, 18, 61-67 (1980).

METHOD WRITTEN BY:

A. W. Teass, Ph.D., NIOSH/DBBS.

Attachment J

Health and Safety Inspection Form

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Health and Safety Inspection Form

Project Name:		Date:		
Project Number:		Location:		
Prepared By:		Project Manager:		
Author:		HSS on Site:		
	YES	NO	N/A	COMMENTS
GENERAL				
Is the HASP on site?				
Is the HASP finalized and approved?				
Is the OSHA poster displayed?				
Are emergency telephone numbers posted?				
Is emergency eyewash immediately available?				
Is an emergency shower immediately available?				
Are emergency notification means available (radio, telephone)?				
Is a first-aid kit immediately available?				
Is the first-aid kit adequately stocked?				
Is there a proper sanitation facility on site?				
DOCUMENTATION AND RECORDKEEPING				
Are only personnel listed and approved in the HASP on site?				
Are all personnel properly trained? (Check company-issued wallet cards.)				
Is the daily field log kept by the Site Manager?				
Are levels of PPE recorded?				
Are contaminant levels recorded?				
Are site surveillance records kept by HSS?				
Is a copy of current fit test records on site?				
Are calibration records maintained for air monitoring equipment?				
Are accident / incident forms on site?				
Are field team review sheets signed?				
Are additional hospital route directions available?				
Is the visitors' logbook being accurately maintained?				
Are MSDSs available for all chemicals on site?				
Are HASP revisions recorded?				
Is the first-aid kit inspected weekly?				
Are daily safety meetings held?				
Are emergency procedures discussed during safety meetings?				

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Health and Safety Inspection Form

EMERGENCY RESPONSE				
Is a vehicle available on site for transportation to the hospital?				
Are fire extinguishers on site and immediately available at designated work areas?				
Is at least one person trained in CPR and first aid on site at all times during work activities?				
Do all personnel know who is trained in CPR / first aid?				
PERSONAL PROTECTIVE EQUIPMENT (PPE)				
Is proper PPE being worn as specified in HASP?				
Level of PPE being worn.				
Is PPE adequate for work conditions?				
If not, give reason.				
Upgrade/downgrade to PPE level.				
Does any employee have facial hair that would interfere with respirator fit?				
If yes, willing to shave, as necessary?				
Fit-tested within the last year? (Documentation present)				
If Level B, is a back-up / emergency person suited up (except for air)?				
Does the HSS periodically inspect PPE and equipment?				
Is the PPE not in use properly stored?				
Is all equipment required in the HASP on site?				
Properly calibrated?				
In good condition?				
Used properly?				
Other equipment needed?				
List.				
Is monitoring equipment covered with plastic to minimize contamination?				
PERSONNEL AND EQUIPMENT DECONTAMINATION				
Is the decontamination area properly designated?				
Is appropriate cleaning fluid used for known or suspected contaminants?				
Are appropriate decontamination procedures used?				
Are decontamination personnel wearing proper PPE?				
Is the equipment decontaminated?				

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Health and Safety Inspection Form

PERSONNEL AND EQUIPMENT DECONTAMINATION (continued)				
Are sample containers decontaminated?				
Are disposable items replaced as required?				
WORK PRACTICES				
Was proper collection and disposal of potentially contaminated PPE performed?				
Was proper collection and disposal of decontamination fluid performed?				
Is water available for decontamination?				
Is the buddy system used?				
Is equipment kept off drums and the ground?				
Is kneeling or sitting on drums or the ground prohibited?				
Do personnel avoid standing or walking through puddles or stained soil?				
Are work zones established?				
If night work is conducted, is there adequate illumination?				
Is smoking, eating, or drinking in the exclusion or CRZ prohibited?				
To the extent feasible, are contaminated materials handled remotely?				
Are contact lenses not allowed on site?				
Is entry into excavations not allowed unless properly shored or sloped?				
Is a competent person on site during excavation?				
Are all unusual situations on site listed in HASP?				
If not, when?				
Action taken?				
HASP revised?				
CONFINED SPACE ENTRY				
Are employees trained according to 1910.146 – Confined Space Entry?				
Are all confined spaces identified? If not, list:				
Is all appropriate equipment available and in good working order?				
Is equipment properly calibrated?				
Are confined space permits used?				
Are confined space permits completely and correctly filled out?				

*N/A = Not Applicable

Attachment K

Daily Safety Meeting Log

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Safety Meeting Log

Project: Location:

Date/Time: Activity:

1. Work Summary:

2. Physical / Chemical Hazards - Has JSA been reviewed/modified to address changing conditions?

3. Protective Equipment/Procedures

4. Emergency Procedures

Does anyone want to volunteer any medical issues that the rest of us should know about? (For example: allergic to bees or ants and requires an auto-injector, medic alert bracelet, nitro for heart problem)

Location of first-aid kits, fire extinguishers, auto-injectors, etc.

5. Signatures of Attendees

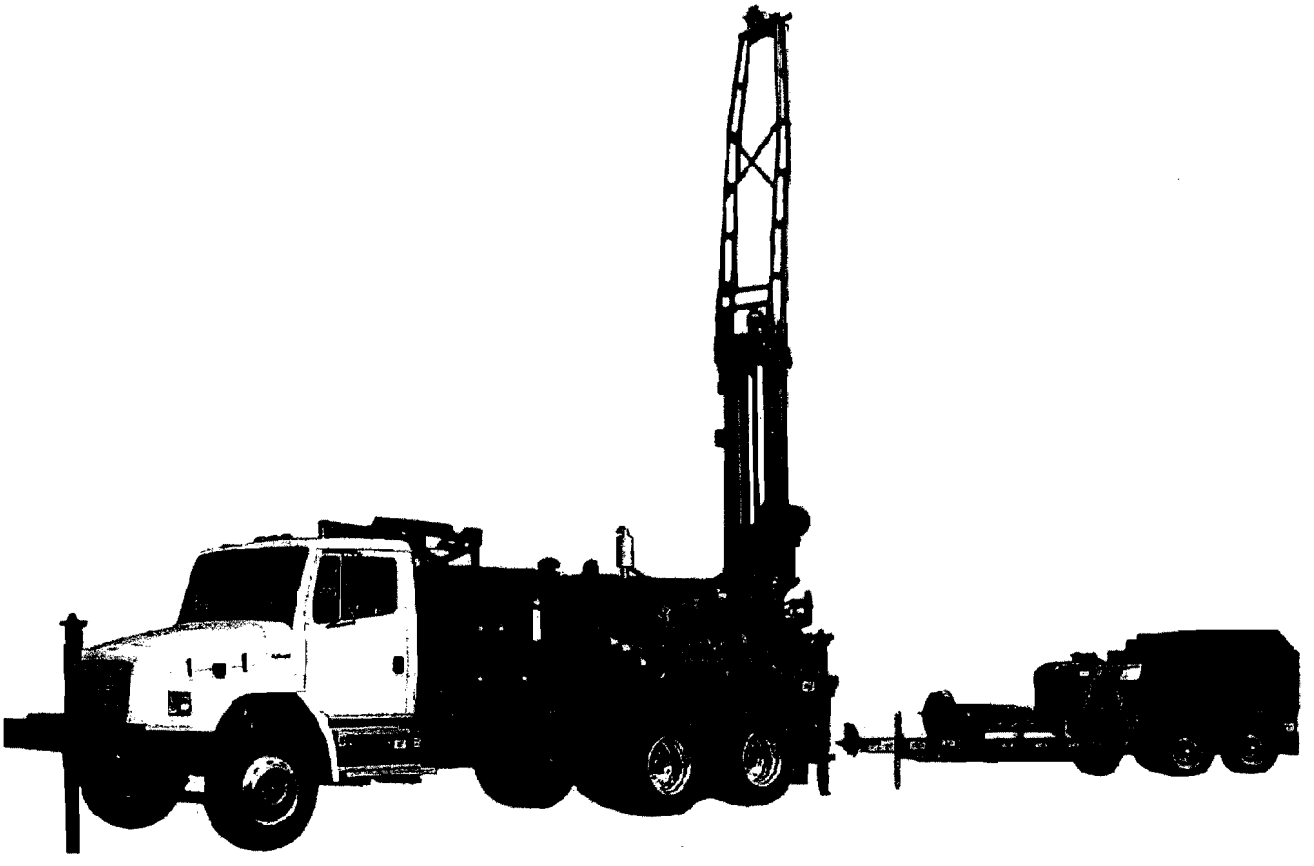
Attachment L

Environmental Remediation Drilling Safety Guideline

BBL
ENVIRONMENTAL SERVICES, INC.
Remedial Management & Construction

Environmental Remediation Drilling Safety Guideline

A summary of industry practices and techniques to help drillers enhance safety performance, environmental performance, and overall project quality



Revision 0 - 2005

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3. Information concerning safety and health risks of materials and operations should be obtained from the employer, the manufacturer, or supplier of that material, or the Material Safety Data Sheet (MSDS).

4. Nothing contained in this publication is to be construed as granting any right, by implication or otherwise, for the manufactured by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement or letters patent.

ACKNOWLEDGEMENTS

AntiEntropics, Inc. and the collective authors would like to thank the National Drilling Association (NDA) for the permission to use selected content from their *Drilling Safety Guide*. The *Drilling Safety Guide* is recognized throughout the U.S. as a guideline for the safe operation of drilling equipment. It is available through the NDA by contacting them at:

National Drilling Association
11001 Danka Way North, Suite 1
St. Petersburg, FL 33716

Telephone: 727-577-5006
Facsimile: 727-577-5012
Email: info@nda4u.com

We would also like to thank the many companies that shared information reflecting the practices they use to achieve safe and successful remediation well drilling projects. Their goal is to enhance safety and environmental performance across the industry.

Table of Contents

Attachments

INTRODUCTION

This publication gives guidance to address some of the most common safety concerns that should be considered while performing drilling activities. It is not intended to address every possible situation that may arise or every hazard which may come to exist during drilling activities.

The intended audience for this guideline includes:

- Customers and client companies the work is performed for
- Facility managers
- Engineers
- Geologists
- Project managers
- Environmental health and safety professionals and managers
- Site health, environmental, and safety (HES) officers
- Drillers and rig operators
- Driller helpers
- Field technicians
- Utility clearance companies and field crews

Your safety is an ongoing concern for you, the organization for which you work, and the companies that you perform work for...in other words, safety is everyone's concern.

This drilling safety guideline has been prepared to assist the environmental remediation industry in understanding drilling and direct push safety guidelines and common practices. When working on a project where more stringent safety practices are required, always defer to the more conservative practice. It contains suggested safety practices and is not intended to establish standard industry requirements. This guideline is to assist workers associated with the environmental remediation industry to work safely and with close adherence to environmental requirements. Many aspects of drilling and direct push safety can only be accomplished by using every worker's intelligence, careful attention to detail, and common sense.

The vision of this guideline is to provide a brief summary of some of the best available drilling safety knowledge in the remediation industry. By adopting these proven practices, you can reduce the potential for personal injury and safety related losses.

THE PURPOSE AND SCOPE OF THIS GUIDELINE

This guideline's purpose is to assist in preventing losses to the following four situations during environmental remediation drilling and direct push operations:

- Injury to workers
- Negative impact on the community
- Negative impact on the environment
- Damage to surface and subsurface structures

Our goal is to augment, not replace, site-specific safety plans. This guideline is a collection of safety practices and lessons learned and compiled by knowledgeable remediation drilling and safety, health, and environmental professionals. As our industries progress and learn new techniques, we hope to keep this guideline evergreen by revising it periodically to evolve with new practices and technology so that it reflects future remediation drilling practices.

The following sections include guidance for:

- Drilling pre-clearance,
- Borehole siting,
- Drilling and direct push operating equipment,
- Mobilizing and demobilizing equipment,
- Well construction,

DEFINITIONS

Term	Definition
Access and Egress	Entry and exit.
Air Drilling	A method of rotary drilling that uses compressed air as its circulation medium to remove cuttings from the borehole.
Air Knife	A device that directs compressed air to advance a hole. Usually used in conjunction with a vacuum truck. Generally used to safely advance a borehole through depths where underground utilities are generally present but may have not been otherwise identified.
Angle Drilling	Drilling that is deliberately made to depart significantly from the vertical. Usually performed with standard drilling rig with the mast deliberately set non-vertical. Allows for installation of wells adjacent to, or just beneath surface structures.
Annular Space	The space between two well casings or between the casing and the wall of the drilled hole.
Auger Fork	A U-shaped tool that is inserted around the auger flights to hold them in place on the surface of a borehole.
Auger Head	The part of the auger that is attached to the drilling drive (gimbal and kelly).
Auger/Auger Flight	Any of various tools or devices having a helical shaft or member that are used for boring holes.
Bit	The cutting or boring element used in drilling wells.
Boom Truck	A vehicle with a crane arm used for lifting augers, casing, or other heavy equipment.
Borehole	The hole drilled by the bit. A borehole may have casing in it or may be open (uncased), or a portion of it may be cased and a portion of it may be open.
Casing	A tubular retaining structure which is installed in the well bore to maintain the well opening.
Casing Advancer Drilling	A drill method that pushes casing forward as the drill bit is advanced (air hammer)
Cathead	A spool-shaped attachment on the end of the cat shaft, around which rope for hoisting and moving heavy equipment on or near the rig floor is wound.
Chemical	Any element, chemical compound, or mixture of elements or compounds.

Term	Definition
Clearance Techniques	Application of specialized equipment used to detect the presence of buried structures.
Combustible liquid	Any liquid having a flash point at or above 100 deg. F (37.8 deg. C), but below 200 deg. F (93.3 deg. C), except any mixture having components with flash points of 200 deg. F (93.3 deg. C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.
Compressed gas	Any compound that exhibits the following characteristics: • A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psig at 70 deg. F. • A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psig at 130 deg. F. regardless of the pressure at 70 deg. F. • A liquid having a vapor pressure exceeding 40 psig at 100 deg. F.
Concrete Coring	The cutting of surface concrete so drilling may be conducted in the soil beneath. This may be done with a circular drill bits or flat saws.
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, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.
Core Barrels	A tubular device run in place of a bit and used to cut (collect) a core sample.
Coupling and Decoupling Augers	The act of joining or separating two augers by adding or removing auger bolts or screwing/unscrewing the augers.
Critical Areas	The subsurface spaces within ten feet of a structure where items may exist that if compromised could result in injuries, damaged equipment, damaged property, or at a minimum, disruption of utility services.
Critical Zones	An area of the drilling site that poses special hazards or increased risk to personnel.
Cuttings	The fragments of rock and soil dislodged by the bit and brought to the surface in the drilling mud or by the rotation of the auger.
Decontamination	The act of cleaning equipment to remove unwanted materials or chemicals. Commonly done by pressure washing, steam cleaning, or hand scrubbing with soap and water.
Direct Push	A drilling technique that uses percussion hammer or hydraulic ram to *push* or *hammer* various sample tooling into the subsurface, Geotechnical sampling, continuous soil sampling, in situ groundwater sampling, or small diameter well installation can be performed with these units.

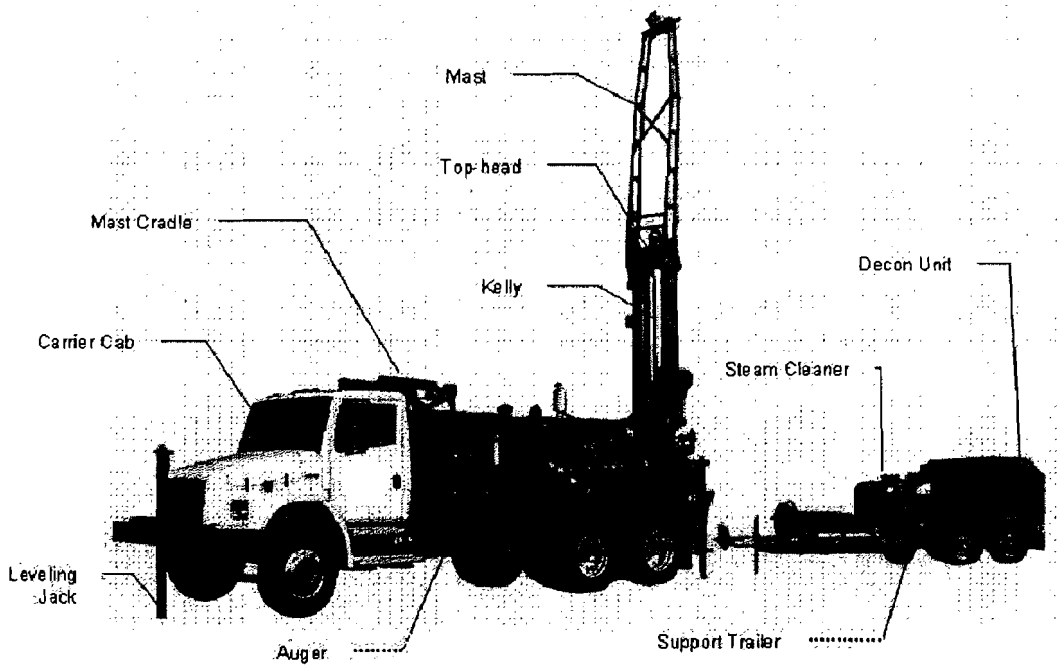
Term	Definition
Directional Drilling	Drilling that is deliberately made to depart significantly from the vertical.
Drill Rig Types	Hollow stem auger, flight auger, air rotary, casing hammer, mud rotary, rotosonic drilling, or direct push.
Drill Rod Chuck Jaws	Hydraulic driven equipment that holds the drill stem stable as the drill is rotated and advanced.
Drill Stem (Drill Rods)	All members in the assembly used for drilling by the rotary method from the swivel to the bit, including the kelly, drill pipe and tool joints, drill collars, stabilizers, and various subsequent items.
Driller (Rig Operator)	The employee of the drilling company directly in charge of a drilling rig and crew. Their main duty is operation of the drilling rig and hoisting equipment, but they are also responsible for the down-hole condition of the well, operation of down-hole tools, and pipe measurements.
Driller Helper	An assistant to the driller that moves the augers in and out, decouples and attaches the drive head, shovels cuttings, and otherwise assists the driller in all aspects of the operation except for the direct operation of the drill.
Drilling Fluid	Circulating fluid, one function of which is to force cuttings out of the borehole and to the surface. While a mixture of clay, water, and other chemical additives is the most common drilling fluid, boreholes can also be drilled using air, gas, or water as the drilling fluid.
Drive Hammer	A hydraulically driven hammer that advances casing as the drill bit advances.
Exclusion Zone	The exclusion zone is an area where inhalation, ingestion, or dermal contact with contaminants is plausible. The exclusion zone is sometimes called the hot zone. It is the area where the personnel have to be properly dressed in PPE and make sure any required respiratory protection is being worn.
Explosive	A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.
Exposure or exposed	When an employee is subjected in the course of employment to a chemical that is a physical or health hazard, and includes potential (incidental or possible) exposure. Subjected in terms of health hazards includes any route of entry (such as inhalation and ingestion)

Term	Definition
Flammable and Combustible Material	Flammable and combustible liquids are liquids that can burn. They are classified, or grouped as either flammable or combustible, by their flashpoints (the temperature at which they start to burn). Generally speaking, flammable liquids will ignite (catch on fire) and burn easily usually at normal working temperatures. Combustible liquids have the ability to burn at temperatures that are usually above working temperatures. Flammable material is designated by a flashpoint of under 100° F and combustible material is designated by a flashpoint between 100° F and 200° F.
Grouting	To fill the annulus between the casing and borehole with liquid slurry of grout (cement and/or bentonite) and water to support the casing and prevent fluid migration between permeable zones.
Hoisting Cables and Ropes	Ropes or metal cables that are used to lift or move augers, casing, and sampling tools. Usually attached to sheaves on the mast.
Hydraulic Ram	A fluid-pressurized device that pushes casing or sampling tools down.
Job Safety Analysis (JSA)	A step-by-step breakdown of a task. With each step, the hazard risks and precautions are identified. A JSA is frequently conducted using a three column document in which the first column is the step, the second the hazards which may be potentially encountered and the third column the precautions to take to avoid the hazard risk. Usually included in, attached to, or referenced by the Health and Safety Plan.
Kelly	The heavy square or hexagonal steel member suspended from the mast through the rotary table and connected to the topmost joint of drill pipe to turn the drill stem. Not for direct push or most hollow stem rigs.
Kill Switch	A safety device, normally a button or toggle stick that will turn off the drill rig engine when actuated. Usually located in the back of the rig near where the drilling is conducted.
Mast	A movable derrick capable of being raised as a unit, as distinguished from a standard derrick, which cannot be raised to a working position as a unit.
MSDS	A Material Safety Data Sheet (MSDS) is a report with descriptions of the physical properties, compatibilities, hazardous properties and other characteristic information of a material or chemical. MSDSs are usually attached to the Health and Safety Plan.
Mud	A liquid that may be used to circulate through the borehole during rotary drilling and work-over operations.
Non-Indigenous Material	Gravel or fill dirt that was used as backfill in a previous excavation or boring. Any material not naturally deposited.

Term	Definition
Non-Invasive GPR	Ground penetrating radar is a geophysical device that uses radar to search for underground structures without physically penetrating the ground.
Operations Foreman	Operations personnel managing/supervising a construction/installation project involving subsurface activities (another term for this position is *tool-pusher*).
Paving Scars	Scars left on pavement by the drill rig stabilizers.
Pinch Points	Any locations in a drilling operation where body parts may be pinched or crushed.
Post-Hole	A hole dug before drilling to search for underground structures or utilities.
Receptor Survey	Identification of utility vaults, monitoring wells, private and public supply wells, surface water bodies, basements, or any other subsurface exposure pathways.
Refusal	When the augers or drill cannot be advanced because of some subsurface blockage.
Rig	The mast, draw-works, and attendant surface equipment of a drilling unit.
Rotary Drilling	A drilling method in which a hole is made by a rotating bit to which a downward force is applied and cuttings are brought to the surface. The bit is fastened to and rotated by the drill stem, which also provides a passageway through which the drilling fluid is circulated. Additional "joints" of drill pipe are added as drilling progresses.
Safety Hammer	A hydraulically driven automatic hammer that advances a sampling tool. Used instead of a slide hammer.
Sampling Tools	Tools that capture and retrieve subsurface soil samples such as a shelby tube, sample extruder, or split barrel sampler.
Sheaves	A grooved pulley over which tape, wire, or cable rides.
Site-specific Health and Safety Plan (HASP)	That document which is designed to recognize potential risks, and identify precautions appropriate to the task. The document typically contains directions to the hospital, emergency contact information and health risk information. The plan will identify potential risks associated with field work, air monitoring requirements, environmental concerns (climate, insects, snakes, etc.), potential exposure to contaminants of concern, and provides requirements and thresholds for use of personal protective equipment to be employed during field operations. The plan may also address: worker training, waste characterization, contingency plans and other health and safety issues.

Term	Definition
Subsurface Activity	Activity carried out by mechanical equipment resulting in an intended disturbance of the earth.
Tenders	A rope attached to equipment hung on a boom that is used to guide the direction of movement.
Utility Mark-outs	The surface marking of underground utilities and structures. There are public services (one call centers) that will mark out underground utilities on public right-of-ways and private locaters that will mark out utilities on private property. A nation-wide one call center director maybe found at www.undergroundfocus.com/
Utility or Structure	Any underground object that could be damaged or cause harm if encountered during subsurface activities.
Water Swivels	A water-tight rotating connection located on top of the drill stem that connects to a hose delivering drilling mud, water or other drilling fluids.
Well Head	Equipment installed at the surface of the borehole when a casing is installed in the borehole. A well head may include such equipment as the casing head and tubing head.
Wire Rope Hoist or Draw Works	An arrangement of pulleys and wire rope used for lifting heavy objects, a winch or similar device.

A typical rig is presented below with major parts labeled



SECTION 1 - PRE-FIELDWORK

1.1 - Introduction

Environmental drilling can be performed safely with proper pre-fieldwork planning and proactive adjustment of planned safe work procedures to actual conditions in the field. As every experienced driller and environmental professional knows, it is very difficult to predict all hazards that may be encountered during drilling fieldwork. The pre-field work preparations suggested here are applicable to mechanical drilling and push probe where portable drill rigs are used for soil boring advancement, subsurface soil and water sample collection, or groundwater monitoring well installation. If these pre-fieldwork preparations are diligently completed, the job can proceed safely and smoothly with less down time. It is recommended that supporting documentation for the pre-fieldwork preparations is retained in the project files.

1.2 - Planning the Project

Project planning begins when the customer's drilling needs are made known to the environmental consultant or driller. Pre-fieldwork planning can be reflected in a proposal to the customer to secure the work assignment, or in a work plan used to communicate the technical approach and work procedures that will be used to safely complete the work. Following award of the project to a contractor, planning and scheduling should focus on preparations that will contribute to a safe and efficient operation at the job site. Much of the responsibility for planning, effective communication, and associated task work rests with the contractor's project manager, however, experience has demonstrated participation by the customer's project manager, (with other key personnel as needed) and the contractor's field team in the planning process significantly contributes to insuring a safe and efficient job site.

The following list of items should be considered during the project planning stage prior to mobilizing to begin fieldwork:

- Scope of work - overall project and drilling task objectives
- Customer, corporate, and job-site health and safety requirements
- Technical approach (the means and methods to accomplish customer scope of work)
- Procurement and vendor selection
    - Technical capabilities and equipment
        - Drillers
        - Public and private utility locators
        - Traffic control and security
        - Laboratory services (including data validation)
        - Waste transportation and disposal
    - Pre-qualification requirements to be considered
        - Safety performance
        - Training and experience of personnel
        - Age and condition of required equipment

        - Medical and substance abuse surveillance
        - Proof of adequate insurance
        - Licenses and registrations
        - References
    - Ability to meet schedule
- Roles and responsibilities (customer, owner, consultant, driller) for communications, work execution, and safety
- Schedule (work phasing and sequencing, prioritization, project kickoff, fieldwork, reporting, closeout)
- Permits and access agreements

1.3 - Preparing the Health and Safety Plan (HASP)

The site-specific hazards and potential risks associated with known conditions at the property or work area should be identified, reviewed, and addressed in the site-specific HASP. The site-specific HASP should be reviewed by project staff and readily available to them onsite during fieldwork. The typical topics addressed in a generic HASP are included as Attachment 1.A - *Typical Health and Safety Plan (HASP) Organization and Contents*.

Drilling activities are inherently dangerous and warrant detailed coverage in project specific health and safety planning. Drilling can be addressed in a HASP and Job Safety Analysis (JSA) developed by the contractor and the field team leader. The safe work procedures specified in the JSAs should be consistent with the overall project HASP, and the customer's site-specific health and safety requirements.

A JSA is a safety analysis tool that breaks down each work task into steps, assesses hazards and potential hazards associated with each step, and identifies corrective measures to mitigate or eliminate the hazard. JSAs should be prepared by workers experienced in the job to be performed and reviewed by the project team before going to the field, and then again onsite during the initial project kickoff and tailgate meetings. Examples of selected JSAs are included as Attachment 1.B and 1.C. The following are tasks that may be addressed by one or more JSA:

- Mobilization and Demobilization
- Traffic control
- Site security and site access
- Delineation and identification of critical zones
- Borehole siting and clearance - subsurface clearance protocol
- Rig maintenance
- Drilling operations
- Equipment decontamination procedures
- Well construction
- Well development
- Surface completions
- Well abandonment
- Well sampling
- Emergency situation notification and procedures

JSAs should be developed, reviewed, and approved prior to the start of field activities, and updated as necessary based on new information or changed conditions.

1.4 - Planning and Facilitating the Kick-off Meeting

Informed planning and communication allows drilling tasks to be consistently performed safely. Essential participants in the review and kickoff process are the customer/owner, consultant, driller, and field personnel that will execute the work. Following review, the participants should formally agree to or suggest revisions to the project plan. They should commit to rigorously implementing the HASP and stopping work when any unforeseen hazards are identified. Topics that may be addressed during the kickoff meeting include:

- Scope of work
    - Customer objectives
    - Technical approach - means and methods
- Roles and responsibilities
    - Site management – owner or operator
    - Project management or field team leader
    - Health and safety management
    - All site workers – stopping unsafe conditions
- Schedules
    - Mobilization
    - Drilling activities
    - Clean-up
    - De-mobilization
    - Sample management (e.g., deciding if rush turnaround services necessary for analytical results)
- Simultaneous operations - on or off site activities that could impact drilling activity logistics or safety
- Changed conditions
    - Access
    - Scope
    - Weather (include heat and cold management)
    - Work hour limitations
    - Construction
- Review, verify and validate hazards and mitigation measures
- Communication between field team, customer, and project mgmt.
    - Clearly communicate to project staff that stop work authority resides with every member of the project staff
    - Reporting incidents
    - Management of Change (MOC)
    - Schedule
- Documentation
    - Sign-off on review and acceptance of HASP
    - Workplace inspection and audits
    - Completed checklists (pre-drill protocol, borehole clearance review, and others)

1.4 - Planning and Facilitating the Kick-off Meeting cont.

Project planning and kickoff set the stage for safe work performance. However, incident free operation will be dependant on daily reviews of work to be performed and associated hazards and mitigation measures. Adjustments to JSAs to accommodate changed conditions should be made before work commences. Before beginning each field task, or when conditions change, employees should:

- Think through the task's work steps,
- Consider the potential for injury, and
- Identify what they must do to prevent injuries or accidents from occurring.

SECTION 2 - BOREHOLE LOCATION POSITIONING AND CLEARANCE

2.1 - Purpose

The purpose of this section is to provide guidance to protect underground facilities, owners of these facilities, the environment, and workers when conducting drilling activities. Risks can be minimized or eliminated when proper clearance procedures are followed. Typical underground facilities include, but are not limited to:

- pipelines of all types,
- utilities,
- electrical conduits,
- overhead structures such as signs or canopies,
- fiber optic lines, and
- tanks.

2.2 - Scheduling

Due to project budgets, resource allocation, and subcontractor agreements, scheduling is a key aspect to a successful result. After the client, the facility, and regulatory agency have approved the location(s), permits and any necessary access agreements have been obtained, the schedule should be developed. The following scheduling process should be followed:

1. Site visit (check for critical areas),
2. Schedule acquisition of permits and access agreements,
3. Schedule with the facility (utility locates, pavement cutting, drilling),
4. Schedule meeting with facility staff (underground structure locates),
5. Schedule *One Call* or other utility location representatives to mark public utilities,
6. Schedule private locators (if needed),
7. Schedule pavement removal crews,
8. Schedule drillers, and
9. Schedule traffic control companies.

2.3 - Obtaining Access Agreements

The next phase in the pre-fieldwork preparation is to determine if an access agreement is required to drill on the site property. If an access agreement is required, the proper legal agreements need to be drafted and executed prior to commencing the drilling operation. The project team should keep a copy of the applicable access agreement while on-site and during drilling activities. The following situations will most likely require an access agreement:

- Right of way agreements for access to railroad, county, city and state properties,
- Access to private property,
- Game and Fish permits for drilling within the high-water mark of any water way,
- Local jurisdiction permits as required, and
- Army Corp of Engineers for drilling on a levee.

2.4 - Positioning the Borehole

Some of the tasks involved in positioning the borehole can take place in the office. It is important to gather all the relevant information about each site to assist in identifying hazards, locations, and the necessary permits.

It is difficult to predict all problems that may occur during drilling fieldwork activities. Completing pre-fieldwork preparations will help to ensure that the project proceeds on schedule and in a safe manner. The project work plan should include (if applicable and available):

- Maps and figures showing underground and aboveground equipment, piping, utilities and/or any surface or subsurface hazards,
- Historic site information (maps, photos, files),
- Site as-built drawings,
- Easement maps,
    - Historic plot plans,
- Previous site investigations,
- Fire insurance plans,
- Tank dip charts, and
- Elevations and coordinates maps.

It is helpful to interview individuals who may have historical information. These individuals may be retired at the time the work is conducted, but may still have information needed to help avoid damaging underground facilities.

During pre-planning and site investigations, keep good notes, document preparation activities, question personnel who have historic site knowledge, identify below and above ground providers and services, and identify critical areas. Critical areas are those within ten feet of any structures or general high pressure pipeline corridor. If critical areas are encountered, there could be dramatic health, environmental, or operational impacts. Some examples of critical areas include: general high pressure pipeline corridors, underground storage tanks (USTs), utility lines, areas between an UST and a dispenser, areas between a dispenser rack and the building, areas within ten feet of the dispenser island canopy drip line, and overhead power or utility lines. Critical areas should be twice reviewed and hole clearance procedures completed prior to the drill team drilling.

2.5 - Selecting the Drilling Location

During the pre-fieldwork phase, determine the location and the type of drilling to avoid critical areas and structures. Regulatory requirements and investigation objectives need to be considered in determining the location and drilling types. For example, horizontal (directional) or angled drilling may be selected to drill in a desired location to avoid potentially hazardous or critical zones (including high traffic areas). The following is a list of questions the project team should ask when identifying a location, but note that this list is not all inclusive:

- Does the location allow for clear entry and exit (unobstructed)?
- Is there adequate work space (vertical and horizontal)?
- Will pavement, curbs, or other structures need to be removed?
- Are all locations located outside critical areas?
- Have access agreements been completed?
- Have all appropriate permits been obtained?
- Have selected areas been reviewed for structures, overhead power lines, and critical items?
- Have borehole clearance procedures been completed?

Review and investigate the location selection with the client during an on-site visit. The determined location should be identified on site maps and submitted to the facility, if required, in addition to the regulatory agency for approval.

2.6 - Methodologies for Locating Private Structures

Due to specific site conditions, no single method of locating subsurface utilities is universally fail proof. Surface and subsurface conditions may interfere with the effective use of a specific utility locating technology. Following is a discussion of some technologies available and the relative merits of each.

2.6.1 - Ground Penetrating Radar

Ground penetrating radar (GPR) is an advancing technology used for investigating shallow, geologic, and hydrologic features. The technique is also extremely useful in locating man-made features, such as buried drums, tanks, pipes, or other metallic objects. Locating rebar in concrete or detection of voids beneath concrete or asphalt is also a popular GPR application.

GPR operates on the principle that electromagnetic waves emitted from a transmitter antenna are reflected from buried objects having different electrical properties than the host material. The signals detected at the receiver antenna are recorded and provide a detailed cross section of the subsurface that is similar in appearance to a seismic reflection record. The depth of penetration of the radar pulse is controlled by site conditions and the frequency of the antenna chosen.

2.6.1 - Ground Penetrating Radar cont.

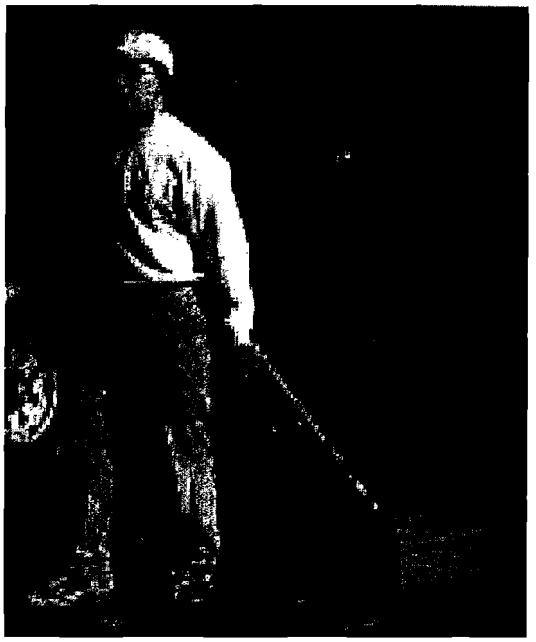


Figure 2.1 - Ground Penetrating Radar Being Demonstrated in a Non- Environmental Remediation Work Area. (Photo courtesy of Enviroscan, Inc.)

Limitations of GPR

Exploration depth can be limited by soil or water with high conductivity. Detection depends upon a dielectric contrast between the subsurface feature and the surrounding material.

GPR can be a very effective tool for location of subsurface structures, especially shallow obstructions. Although GPR has been applied at greater depths, it is generally considered to be more effective down to approximately 10 to 15 feet below the ground surface in most lithologies. Resolution is degraded with depths exceeding 20 to 30 feet. For utility locating, depth is usually limited to 10 feet or less to ensure safe drilling operation. Transducers exist that can penetrate to greater depths, but these use a lower frequency. Lower frequency means lower resolution, and narrow objects like utilities cannot be seen.

Some things to consider when evaluating GPR:

- Closely spaced survey lines are required to locate small objects,
- A relatively smooth surface is also necessary, and
- As with most utility locating technologies, GPR is not as effective where the ground surface is paved with highly reinforced concrete due to interference from the presence of the metal rebar. Interference is also prevalent if surface structures are immediately adjacent to the area.

Recent advances in radar antennae and computer software have made GPR more effective in difficult situations.

Limitations of GPR cont.

It is important to note the depth limitations of GPR when clearing horizontal or directional drilling boreholes. Horizontal drilling technology is usually used at depths greater than 20 feet below the surface which is beyond the detection limits for GPR. An option for clearing horizontally drilled boreholes is use of a template and water jet to clear the horizontal run to the required depth. This is a relatively extreme option and will only be justified in cases where utilities may be present.

2.6.2 - Pipe Tracing Transmitter and Receiver

A pipe and cable locator and tracer can be used to detect and trace metallic utilities, utility tracing wires, or warning tapes. In pipe and cable tracing mode, the transmitter can be coupled by direct contact (conductively) to exposed portions of a metallic pipe, cable, or wire; or by simple proximity (inductively) to a subsurface metallic utility with known location and orientation. The transmitter remains stationary and energizes or excites the metallic utility to be traced with a signal that can be traced at the ground surface using the mobile receiver wand or probe.

Figure 2.2 - A Pipe Tracing Transmitter/Receiver Being Demonstrated in a Non-environmental Remediation Work Area (Photo courtesy of Enviroscan, Inc.)

Limitations of Pipe Tracing Transmitter and Receiver

To use the transmitter in the most effective manner, all metallic pipes to be traced must be available for connection directly to the transmitter. The inductive mode is not as effective. Also, the detection is limited to metallic objects and is not useful for plastic, ceramic, or fiberglass utilities.

2.6.3 - Electromagnetic Utility Tracing Receiver

The electromagnetic technique locates buried materials having a high conductance. Alternating electromagnetic waves generated at the surface are induced into the ground during the survey. When the waves pass through a conducting body, they induce an alternating electrical current in the conductive materials. These currents become the source of secondary magnetic fields, which can be detected at the surface. The strength of the field is directly proportional to the average conductivity of the subsurface materials. Typical electromagnetic applications include:

- Location of:
    - buried pipes,
    - tanks,
    - drums and other metallic objects,
    - sludge wastes,
    - leachate plumes,
    - salt water intrusions,
    - acid mine drainage, and
    - other ground water contamination problems.

Other applications include quick and economical site assessment of areas with variable bedrock topography, such as those found in karst terrain, clay layer mapping, fault detection, or mine and quarry siting.

Figure 2.3 - An EM Tracer Being Demonstrated in a Non-environmental Remediation Work Area. (Photo courtesy of Enviroscan, Inc.)

Limitations of this technique that can adversely affect the electromagnetic measurements include:

- Power lines
- Metal fences
- Metal debris, and
- Utilities

2.6.4 - Deep Focused Sensing Metal Detector

A deep focused metal detector acts as a pipe and cable locator and tracer to detect and trace metallic utilities, utility tracing wires, or warning tapes. In pipe and cable search mode, the instrument is essentially a deep-sensing metal detector that detects any highly electrically conductive material (metals) by creating an electromagnetic field with a transmitting coil. A receiving coil at a fixed separation from the transmitter measures the field strength. As the instrument is swept along the ground surface, subsurface metallic bodies distort the transmitted field. The change in field strength or orientation is sensed by the receiver and triggers an audible alarm and deflection of an analog meter. The instrument can nominally detect a 2-inch metal pipe to a depth of 8 feet and a 10-inch metal pipe to a depth of 14 feet.

Figure 2.4 - A Deep Focused Metal Detector Being Demonstrated in a Non-environmental Remediation Work Area. (Photo courtesy of Enviroscan, Inc.)

This technique's effectiveness is limited to metallic objects. It is not useful for plastic, ceramic, or fiberglass utilities.

2.6.5 - Vibrocator

Vibrocators are used to detect and trace fluid-filled, non-metallic utilities (for example, PVC or concrete water lines). A vibrocator system involves a low-frequency pressure wave generator (called a *transonde*), which is attached to a faucet, hydrant, or other available fitting. The transonde produces a continuous vibration or throbbing in the pipe. This vibration can be detected at the ground surface with a sensitive geophone or ground motion detector tuned to the transonde-generated frequency.

2.6.5 - Vibrocator cont.

Figure 2.5 - A Vibrocator Being Demonstrated in a Non-environmental Remediation Work Area. (Photo courtesy of Enviroscan, Inc.)

There are two limitations of this technology. One is that all non-metallic pipes to be traced must be available for connection directly to the transmitter. The second is that excessive energy imparted to the pipe may cause damage to the pipe.

2.7 - Training Workers for Borehole Clearing Tasks

The following are considered to be minimum levels of training for individuals performing the tasks associated with clearing a borehole:

- 40-Hour OSHA HAZWOPER training (required for HAZWOPER sites).
- Some level of internal training and prior drilling experience regarding safe locations in which to drill.

Specific drilling tasks may require more experience and training for the:

- Individual who makes the decision that the location is acceptable to drill,
- Quality Assurance (QA) Point Person.

A senior-level project team member should consult with the field personnel during the final location of the borehole.

2.8- Obtaining Required Permits

Determine the permits required for drilling activities under applicable local, state, and federal laws. Prepare the permit applications and proper documentation for submittal to permitting agencies or third parties. Examples of the various permits that may be required include, but are not limited to, the following:

- Work permits for agencies,
- Hot work permits for the facility,
- Work permit for the facility,
- Excavation permits for the facility, and
- Site work permits may also be required as mandated by site policies and procedures.

2.9 - Borehole Protection Steps

The following steps are recommended to reduce the potential for encountering subsurface utilities during drilling:

- Conduct a site walkthrough and verify utility location checklist is complete,
- Review proposed locations and the site with on-site personnel and obtain other historical information,
- Locate boreholes a safe distance (at least 5 feet) perpendicular from utility mark-out lines,
- Carefully break surface cover if present,
- Clear location to a depth of the utility window BGS (varies from client to client and location to location) and at least 120% of the borehole diameter, and

Proceed with caution when advancing the drill or probe.

2.10 - The Clearance Process

The goal of the entire clearance process is to verify absence of subsurface structures to avoid damage to property, the environment and injury to workers or others.

The first step in the clearance process is to contact the local area *ONE CALL* Utility Locate Service or, if inside a facility, the appropriate facility personnel. The local one call utility locator service must be contacted well ahead of the project, especially if directional drilling is planned. The service should be informed of the type of equipment to be used, and should be asked to space locator marks close together. This will allow the team to visualize sudden shifts or turns in the utility's path.

The clearance process is influenced by two geometric planes: vertical and horizontal. Considerations for completing the clearance process are:

1. Consider the depth and diameter of clearance.

    - When drilling vertically, the utility window profile depth must be considered. This can certainly vary with the amount of development in an area. The depth to clear will vary with the client, and may go until refusal is reached. Often the deeper utilities are high-pressure pipelines or high voltage power cables, which are very dangerous and warrant extreme caution.

- In all cases, it is preferable to clear a hole to about 120% of the diameter of the largest tool used for drilling, so as not to miss structures that might be just slightly tangential to the borehole. For instance, if a 10-inch hollow stem auger is being used to drill, a cleared area 12 inches in diameter should be used. The cutting head is often the largest diameter tool used for drilling and the cleared footprint should be 20% larger than the cutting head.
- When *angle* drilling, clearance should consider 120% of borehole length, along with the utility window profile. If possible, it is recommended to at least clear intended areas where the drill string will enter and exit the ground, and to use any means possible to positively identify the location and depth of any utilities that will be crossed in the boring process. The same vertical and horizontal considerations described for the vertical drilling should be used for angled or horizontal drilling.

2. In addition to completing all locates and completing clearance of subsurface locations along the path of the drilling head, additional excavations can be completed as described below:

    - If possible, excavate small areas to visually monitor the drill bit. A buried drill bit makes it impossible to tell a utility has been struck. Verify the drill bit remains at least 5 feet away from the utility. Keep the hole open until the drill bit has been pulled back and the drilling is complete.
    - Carefully excavate to expose utilities so the drill bit path can be monitored.

3. Calibrate the drill bit and locating device at the beginning of the project. Remember, the locating device can monitor the drill bit on the initial pass, but cannot monitor the backream head.

4. Workers should stay at least 5 feet (to 10 feet if space is available) away when boring parallel to buried utilities. Carefully excavate to expose utilities so the drill bit path can be monitored.

2.11 - Clearance Methodologies

Before drilling within 10 feet of an underground utility, the utility depth must be verified. Flags and locator marks indicate the direction the utility is running, but not how deeply it is buried. The only way to be sure of utility depth is to carefully expose and examine the utility line.

Clearance methodologies can be broken into two major categories:

- Those that can involve direct contact in order to reveal a subsurface structure, and
- Those that attempt to avoid the contact.

Direct contact is not universally acceptable. The following methods should be pursued only by experienced personnel. Proper hand-digging tools and techniques will protect both the workers and the utility.

- A blunt-nosed shovel is used to loosen the soil and a regular shovel is used to remove the soil. A pickax or a pointed spade should never be used. Do not stab at the soil or stomp on the shovel with both feet.
- Work with a gentle prying action and dig at an angle, so the shovel will slide along the surface of the wire, conduit, or pipe. Or, dig to the depth the utility is expected to be, but off to the side. Then, use a prying motion to break away soil as you approach the utility laterally.

2.11 - Clearance Methodologies cont.

Proper hand-digging tools and techniques must be used to safely verify the depth of any buried utilities that must be crossed or are located in close proximity to the work. Several types of direct contact methods include:

- Hand augers,
- Post hole diggers,
- Steel rods, and
- Hand digging tools.

A backhoe or similar machine may be used to uncover a utility. Clearly, the use of heavy equipment can produce severe damage to underground structures if not carefully performed. Due to hard soil structure or dense strata, use of hand tools to locate buried utilities may be precluded. In these instances, the clearance procedure requires excavation equipment. Extra measures must be taken to locate and identify buried utilities prior to excavation to protect against injury.

Methods that avoid direct contact:

- Air knifing or water jetting, and
- Vacuum soil excavation or wet vacuuming.

Air knife technology uses compressed air to break soil structure and allow for removal of the soil while reducing the potential for direct contact between buried utilities and the air knife operator. The compressed air essentially insulates the operator from directly contacting the buried utility. Compressed air, typically 90 to 100 psig, is converted to a supersonic jet while flowing through a nozzle especially designed for the purpose. Several nozzles are commercially available.

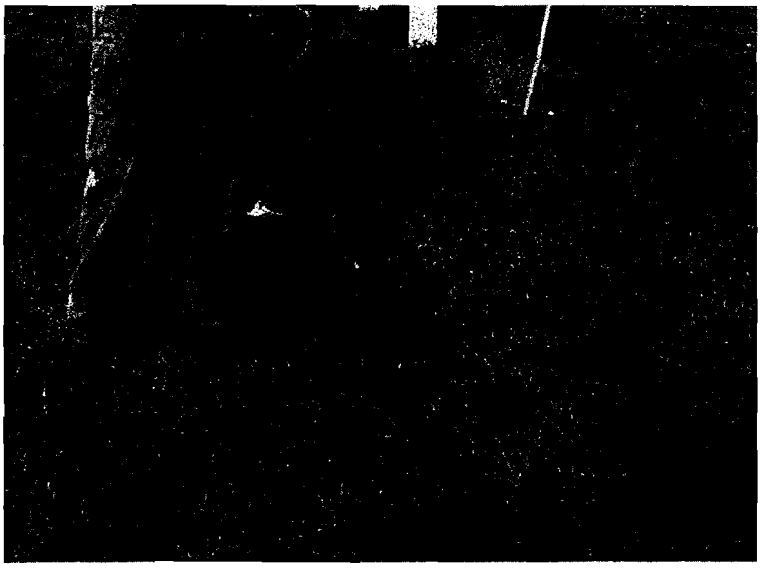


Figure 2.6 - Using an Air Knife (Photo courtesy of ATC Associates, Inc.)

2.11 - Clearance Methodologies cont.

As the stream leaves the nozzle, it expands concentrically, since it is surrounded by atmospheric air. This high velocity air penetrates the ground to a depth of about a foot, creating a momentary cavity of about a foot in diameter, in which the soil structure is crumbled.

Hard clays and other very hard soils will be slow during the first several inches of depth, and will produce increased scatter. But somewhat deeper, where the soil has usually retained greater moisture, the scatter will reduce, and the excavation rate will improve.
Both dry and wet applications of these technologies can be performed. Both methods have inherent problems associated with compromising the borehole for collection of environmental samples. Typically, dry air knifing and vacuum extraction are preferred where soil samples must be collected in the top 5 feet of profile. Water jetting or wet vacuuming may also compromise future collection of groundwater samples, so is usually selected for boreholes advanced for remediation wells only.

SECTION 3 - MOBILIZATION, SET UP, AND DEMOBILIZATION

This section applies to mobilization and demobilization for the following types of site operations: air knifing, air vacuuming, drilling, using geoprobes, and hand-augers. This section does not cover safety related to site mobilization in passenger vehicles.

3.1 - Performing Pre-Mobilization Tasks

3.1.1 - Inspections and Maintenance

- It is important to ensure vehicles are road worthy (that is, that they have been properly maintained and inspected) before using them on public roadways or project sites. Federal, state, and local laws require that vehicles be properly maintained and safe to operate upon our highways. It is the responsibility of the owner or operator to ensure that:
    - All drivers are properly licensed for the equipment that they are to be driving and that they are trained in safe driving procedures.
    - Equipment is inspected prior to being moved and any deficiencies corrected prior to moving the equipment.
    - Complete annual inspections of vehicles is performed.
    - All drivers should have in their possession the Federal Motor Carrier Safety Regulations Pocketbook. These regulations require that no motor vehicle be driven unless the driver thereof has satisfied him or her self that the following parts and accessories are in good working order, nor will any driver fail to use or make use of such parts and accessories when and as needed:
        - Service brakes, including trailer brake connections
        - Parking (hand) brake
        - Steering mechanism
        - Lighting devices and reflectors
        - Tires
        - Horn
        - Windshield wiper or wipers
        - Rear-vision mirror or mirrors
        - Coupling devices
        - Seat belts

The above is a representative list of items that must be checked prior to moving a vehicle. These and other items are included in Attachment 3.A - *Pre-Mobilization Checklist / Drilling Safety Guidance Document.*

Perform a final examination to verify that the vehicle and load are safe to be moved. Know the height, width and weight of the load. Verify that any needed permits are obtained or will be obtained en route to the drill site.

Verify that all necessary traffic-control devices for each site to be visited that day are loaded in the vehicles before they leave the office.

- For contract traffic-control services, verify that they are scheduled to be at the site with all needed equipment.

3.2 - Loading and Unloading a Truck Mounted Drill Rig

When loading or unloading a drill rig on a trailer or a truck, follow these precautions:

- Select an area of level ground for loading and unloading
- Have a spotter guide the driver off of the trailer or truck.
- Before using a ramp, verify the brakes of the drill rig are in working order
- Ensure that any ramps used are designed for this purpose and provide a sturdy and solid enough base to bear the weight of the drill rig with carrier including tooling.
- Verify that when the drill rig is on the trailer, the weight of the drill rig, carrier and tools are centered on the centerline of the trailer. In addition, some of the trailer load should be transferred to the hitch of the tow vehicle. Refer to the trailer recommendations for weight distribution provided by the manufacturer.
- Verify the drill rig is secured to the towing vehicle with ties, chains, or load binders that can handle the required weight.

3.3 - Physically Accessing the Equipment and Vehicles

Use proper mounting and dismounting techniques when climbing into and from vehicles or equipment. Some tips are:

- Face the equipment and use the hand and footholds provided – maintain three points of contact with the equipment
- Do not jump off equipment.
- Use vehicle ladders to access truck beds.
- Do not climb on tires.

3.4 - Traveling to the Site

3.4.1 - Driver Requirements

All drillers and drivers must:

- Be properly licensed and operate vehicles in compliance with federal, state, and local regulations
- Be aware that every car, truck, tractor, and drill rig has its own handling characteristics; every new driver should learn these characteristics in the company of an experienced driver.
- Every employee should be qualified on each type of vehicle and equipment the employee will operate prior to operating the vehicle or equipment unsupervised.
- Every employee knows the dimensions of any equipment he or she is driving, including the required overhead clearance, and the width, length and weight of the rig. The driver also knows the load limits for highways and bridges, and verifies that the vehicle is not exceeding those limits.

NOTE: Service stations and other facilities frequently have canopies and electrical service lines that are too low for a drill rig to clear, extreme caution must be used in these areas.

3.4.2 - Road Travel and Vehicle Safety

Perform a pre-trip vehicle inspection and obey state and federal DOT guidelines. Check vehicle maintenance records to assure any needed maintenance has been performed. Pre-operate equipment before leaving for the site and be familiar with operator's manual. Leave early, practice defensive driving, and observe the speed limit.

- Drill rigs are top-heavy:
    - Maneuver highway ramps or tight curves at a slow and safe speed, avoid quick lane changes.
    - Allow a safe distance between you and the vehicle ahead and use your turn signals.
    - Know the traveling height of your equipment.
    - Secure any load(s) properly.
    - Inspect trailer and hitch, safety chains, wiring connectors, lights, and brakes, if applicable.
- While traveling to and from the site observe the following:
    - Move disabled vehicle off the road and set out flares and reflectors or cones, and leave trouble lights on and flashing.
    - Never work under a vehicle unless steps have been taken to prevent it from rolling. In addition to setting the parking brake, use chock blocks or other methods to secure the vehicle to prevent movement.
    - Never leave mobile equipment unattended unless the controls are placed in gear or the Park position and the parking brake is set. When parked on a grade, chock the wheels or turn them into the bank.
    - Allow for mast overhang when cornering or approaching other vehicles or structures.
    - Do not operate trucks 1-ton and above unless equipped with automatic backup alarms.
    - Wear seatbelts at all times as driver or passenger when the vehicle is in motion

3.4.3 - Transporting Drill Rigs

When transporting a drill rig onto and off of a drilling site, follow these procedures:

- Verify all measurements of the drill rig with carrier including the traveling height (overhead clearance), width, length, and the highway and bridge load, width and overhead limits. Allow adequate margins, it is your responsibility to verify they are not exceeded.
- Prior to moving a drill rig, check to verify that the brakes are in reliable working order.
- When cornering or approaching other vehicles or structures remember to allow room for the mast overhang.
- Keep in mind that the drill rig mast is often too tall to clear the canopies of service stations and other facilities, even in the travel position
- Monitor low hanging electrical lines, particularly at the entrances to drilling sites, restaurants, motels, or other commercial sites.
- When traveling on a street, road, or highway, the mast of the drill rig must be completely lowered.
- If the rig is being left unattended, remove all ignition keys.
- Passengers are not allowed to ride on the drill rig
- Use caution when driving equipment with a high center of gravity, such as a portable drill rig. Allow for the increased and higher weight by making turns slowly and allowing for a greater stopping distance than normally needed.
- Always know where your helper or driller is. Never move the drill until they are accounted for.
- Establish, learn, and use the proper signals when moving a drill rig.
- Never move the drill rig with the mast up- even short distances.

3.4.4 - Entering the Site

It is the responsibility of the owner or operator or the vehicle or rig to ensure that the drill site is safe to enter and that it is safe to begin work. Such inspections often include the following:

- Are high voltage overhead power lines or any other utility lines present in the immediate area? A safe distance of thirty or more feet laterally to either side of the overhead utility should be observed when setting up in the vicinity of overhead lines. This distance may need to be adjusted, depending on the hazards involved, size of mast on the drill rig, and other considerations.
- Have all underground utilities been identified?
- Is there a danger of being struck by other moving vehicles?
- Is there a danger because of possible instability of high walls, banks, pits, rivers, and other related items?
- Are poisonous plants, animals, or insects in the area of the drill site?
- Is the site designated as a Hazardous Waste Site or have other hazards been identified or suspected, such as H_2S, Methane, or other chemicals? If so, are proper procedures for working in these environments in place, including proper training of employees and certification of safety equipment?
- Is there a danger of lightning strikes? This subject must be addressed regardless of time of year or current weather conditions.
- MSDS sheets must be on hand for all materials and chemicals brought to the site.

3.5 - Confirmation Activities for Clearances and Borehole Positioning

3.5.1 - Permits

Copies of all necessary permits will be provided to the Lead Driller or Acting Lead Driller, and any further information relevant to the drilling operation.

It is the driller's responsibility to verify the necessary permits have obtained and it is safe to drill.

Based on either site conditions or the planned ground disturbance activities, to ensure the safety of all on-site personnel and subsurface structure integrity, consideration should be given to locking out selected site utilities or temporarily shutting down a portion of or the entire facility.

3.5.2 – Markings

- Complete utility location prior to drilling [One Call: (800) 321-ALERT] and coordinate with the drilling contractor and site personnel.
- Mark locations in white.
- Field verify utility locations.
- Document all utility locates on a plot plan or other map of the site.
- Observe the area for indications of utilities.
- Hand dig if questions remain or if required by the property owner.
- Refer to your specific *Utility Clearance and Isolation* procedure.

3.5.3 - Site Communication and Safety Review

Verify all new drill rig workers are informed of safe operating practices and emergency procedures on and around the drill rig and provide each new drill rig worker with a copy of the organization's drilling operations safety manual and, when appropriate, the drill rig manufacturer's operations and maintenance manual. The safety supervisor should assure that each new employee reads and understands the safety manual. If applicable, the emergency shut off/kill switch location and use should be reviewed with all crew members as well as visitors to the site.

If the site poses a chemical safety hazard, review potential signs and symptoms of exposure, routes of exposure, and protective measures to be used to minimize or prevent exposures (such as protective clothing and monitoring).

3.5.4 - Walk Through and Visual Inspection

Upon arriving at the drill site, verify that it is safe to enter and set up on the site. As mentioned earlier, it is important to:

- Look for overhead and underground power and other utility lines.
- If present, verify that the rig is being set up a safe distance from these lines.
- Investigate and note all overhead obstructions.
- Check boring locations for proximity to any overhead lines.
- Maintain required clearance from electrical lines. Refer to section 4 – *Drilling Operations* for more detail. High-tension lines require greater clearances.
- Consider having lines in the work area covered to provide a greater safety margin
- If necessary, contact someone to verify that these lines are safe to work near (that they have been de-energized provided that they were supposed to have been deenergized).
- Assume a line is energized until you have verified it isn't.
- If in doubt, do not raise the mast - ASK!

Examine the actual location where the drill is to be set. If possible, it is best to have a level and clean area. Remove rock and other debris that may interfere with the drilling operation or pose safety hazards.

Be sure to follow the instructions contained in the site health and safety plan. This includes the wearing of special chemical protective clothing, air purifying respirators or self-contained breathing apparatus before moving into location.

Walk the line the rig is to travel in order to delineate any soft or wet ground. Look for field tile washouts, hidden ditches or drop-offs, boulders, debris, or other potential obstacles.

3.6 - Preparing for Drilling

3.6.1 - Preparing the Site

Prior to drilling, adequate site clearing and leveling should be performed to accommodate the drill rig and supplies and provide a safe working area. Drilling should not be commenced when tree limbs, unstable ground, or site obstructions cause unsafe drilling conditions. Housekeeping should be done to ensure a clear area for all site personnel.

Prior to move-in, the site should be adequately cleared and leveled to accommodate the drilling equipment and supplies, and to minimize fire hazards.

Evaluate the drilling site prior to setting the leveling jacks, especially if the location is on water saturated, frozen, or loose, caving soil. Do no set up on sloped ground. If necessary, build up solid, compacted earth where the jacks will contact the ground.

If it is necessary to drill within an enclosed area, verify that exhaust fumes are conducted out of the area. Exhaust fumes can be toxic and some cannot be detected by smell.

3.6.2 - Traffic Control

Traffic control devices may consist of items such as:

- Traffic cones
- Flags
- Caution tape
- Other devices such as signs, barricades, amber flashing lights, or fencing

It is recommended that each work area be cordoned off with traffic cones or other traffic control devices as appropriate to site-specific conditions. To increase visibility to vehicular traffic, it is recommended that every other cone have a flag inserted through its middle. Caution tape should be used to join all of the traffic control devices so that no one can easily walk through the work area. It is also recommended that work vehicles be used to shield field personnel from traffic hazards when practical. In addition, high-visibility clothing should be worn by workers.

3.6.3 - Considerations for Retail Service Stations and Other Onsite Locations

As there are no lanes marked out for traffic flow through most of these sites, and there are typically numerous entry points onto them, field personnel are vulnerable to traffic from all sides. In order to minimize the risk of being struck by a vehicle while performing tasks on site, field personnel may consider the following guidelines when developing work site traffic control plans:

- Review the site-specific Health and Safety Plan (HASP) for safety and any special traffic control details for the site you will be working on and the tasks you will be performing.
- Wear the appropriate PPE for the work to be performed as indicated in the HASP.
- Assess the work location for potential traffic exposure. Stay alert at all times since vehicular traffic is often continuous and uncontrolled on these sites. Evaluate all possible directions from which traffic may approach including the possibility of vehicles backing up. Never assume any potential pathway to be safe. Attempt to set up the work area on site with field personnel facing toward the highest potential for traffic while they work.
- Conduct a site pre-job safety meeting and complete the Daily Site Checklist, if included in the HASP, and sign-off on both the checklist and the HASP.
- Using the traffic control devices, establish your work zone as per the specifications detailed within the HASP.
- Perform all work to be completed within the work zone before breaking down the traffic control system.
- Clear the work area and break down the traffic control system.

3.6.4 - Working in or Near Active Roadways

Traffic control in these areas should be managed through development of an appropriate traffic control plan. A traffic control plan specific to the work site should be developed and included in the HASP, prior to performing work in these areas. Local and state requirements should also be consulted for possible permitting or additional traffic control requirements prior to performing any work in these areas.

3.6.5 - Establishing Work Areas Using Monitoring or Barricades

The field supervisor will designate the work zone based on site constraints before drilling begins. Preferably, the geotechnical workstation should be set up outside of the immediate drilling work area a distance of at least 1.5 times the mast height away from the drill.

- Post No Smoking signs around work area
- Establish designated smoking area away from work area
- Monitor air concentrations using direct-reading, real-time instruments such as OVM and colorimetric detector tubes
- Define and secure all work areas with safety cones, safety tape, construction fence, other barriers, or signs as appropriate.

3.6.6 - Establishing Site Security

Confirm required security is in place and as dictated by the site or HASP prior to beginning drilling operations. This may involve security personnel, physical barriers, or both.

3.6.7 - Storage and Material Handling

The key for a safe and smooth startup is to organize the work area prior to commencing drilling operations:

- Do not attempt to commence drilling before everything is unloaded and organized. Drilling will progress smoothly and accidents will be less likely if the driller takes the time to properly set up and organize first.
- The first requirement for safe field operation is that everyone understands and fulfills the responsibility for maintenance and housekeeping on and around the drill rig.
    - Suitable storage locations should be provided for all tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor. Store items so that the work can proceed in an orderly fashion, with sufficient room in the work area to move about without tripping over supplies or equipment. Do not store equipment in places that would interfere with escape routes in an emergency.
    - Avoid storing or transporting tools, materials, or supplies within or on the mast of the drill rig.
    - Establish a suitable location for storage of tools, equipment and supplies so those items can be safely and conveniently stored and located when needed. Keep all tools supplies and equipment in their proper places.
    - Every crewmember must inspect their work site upon arrival to verify that equipment is in safe condition and the job site is in proper order. Return the job site to proper order prior to proceeding with work.
    - Drill rod, casing, augers and similar tools should be stacked orderly on racks to prevent sliding, rolling, spreading, or falling. When stationed on the ground prior to use, these tools may need to be chocked to prevent inadvertent or unanticipated rolling.
    - Work areas, platforms, walkways and other access-ways should be kept free of obstructions such as materials and tools, and substances such as debris, grease, ice, and mud, in order to minimize the tripping, slipping and falling hazards around the drill rig.
    - All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, visitors or animals from stepping or falling into the hole.
    - Use approved cleaning solvents instead of flammable liquids as cleaning agents on or near a drill rig.
    - Never use compressed air for the purpose of cleaning clothes.
    - All trash should be placed in bags and stored in areas outside of the immediate work area.
    - All controls, meters, dials, and operational and warning lights should be kept free of dirt, grease, and mud.
    - Keep all flammable liquids in proper containers and stored away from heat and spark sources.
    - All drilling fluids must be contained and disposed off-site
    - Pipe, drill rods, casing, augers, and similar drilling tools should be orderly stacked on racks or sills to prevent spreading, rolling, or sliding.
    - Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.
    - Work areas, platforms, walkways, scaffolding, and other access-ways should be kept free of materials, debris, and obstructions and substances such as ice, grease, or oil that could cause surfaces to become slick or otherwise hazardous.

3.6.8 - Fire Prevention

Fire prevention must be addressed prior to commencing any job. Failure to prevent a fire on a job site could result in severe injury or even death of employees. In addition to the potential for loss of life, severe equipment damage can result along with damage to surrounding areas. It is therefore the responsibility of the owner, operator, driller, helper, and anyone else involved in the drilling operation to take proper steps to reduce the possibility of a fire. Such steps should include:

- When possible, the surrounding area should be cleared of materials that are readily combustible, such as weeds, grass.

NOTE: Some areas are environmentally sensitive. This type of clearing may not be allowed.

- No smoking policies should be observed when working on drilling operations.
- Fire extinguishers of the appropriate size and type for the particular fire hazard involved must be present on the drill site. It is recommended and required on some jobs, that a fire extinguisher be present in every vehicle involved with the drilling activities.

NOTE: Operators must verify that fire extinguishers are serviced at appropriate intervals and that an inspection is performed on the fire extinguishers at least monthly. Such inspections and servicing must be documented.

- Only onsite personnel, trained in basic fire fighting techniques and in the proper operating procedures associated with the use of fire extinguishers, should respond to fires.

The best method, of course, is to prevent the fire entirely. Proper storage of fuels and good maintenance of hoses, and equipment on the rig will prevent many fires. A proactive approach is by far better than the best reactive solution to any problem.

3.6.9 - Safety Equipment

Safety equipment to consider includes but is not limited to traffic cones, PPE, barricades, barrier tape, signage, A fire extinguisher, blood borne pathogen kit, and first aid kit should be kept or available on site. Telephone access is essential. Identify the location of the nearest available telephone and, unless specifically forbidden by the site owner, ensure the team has access to a cell phone (unless prohibited). If the team is planning to use a cell phone, check for adequate signal strength upon arrival at the site. Refer to section 4.8 for additional information about safety equipment.

3.7 - Moving People and Equipment at the Site

Navigating across the site requires special attention. Many safety incidents occur in and around moving vehicles and equipment. The following guidelines will help eliminate some common dangers.

3.7.1 - Placing the Equipment

Figure 3.1 – Placing Equipment

The following safety suggestions relate to off-road movement:

- Never drive onto an off-road site or move a drill rig without first walking the route to check for depressions, rocks, stumps, gullies and similar obstacles.
- Check the brakes of the drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mounting.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire-pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely, not at an angle.
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- After the drill has been moved to a new drilling site, set all brakes and locks. When grades are steep, block the wheels.
- Never move a drill rig with the mast up.
- Maintain eye contact with the operator when directing the rig on to a boring location.
- Always walk around the truck prior to backing to assure that the area behind the truck is clear of equipment and workers.
- Never back out of a site onto a highway, unless traffic control is provided.
- Always position the vehicle in the safest possible place at drilling locations
- When working in a lane-closure do not enter the lane closure until it is set up, do not work in an improperly set up lane closure.
- CDL holders required by DMV to wear corrective lenses must wear them at all times performing Safety sensitive duties.
- When overhead electrical power lines exist at or near a drilling site or project, consider all wires energized.

3.7.1 - Placing the Equipment cont.

- Watch for sagging power lines before entering a site. Do not lift power lines to gain entrance. Call the utility and ask them to lift or raise the lines or de-energize (turn off) the power.
- Before raising the drill rig mast on a site in the vicinity of power lines, walk completely around the drill rig. Determine what the minimum distance from any point on the drill rig to the nearest power line will be when the mast is raised and while being raised. Do not raise the mast or operate the drill rig if this distance is less than 20 feet (6 m) or, if known, the minimum clearance stipulated by Federal, state, and local regulations.
- Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.
- If there are any questions concerning the safety of drilling sites in the vicinity of overhead power lines, call the power company. The power company will provide expert advice at the drilling site as a public service and at no cost.
- Watch for overhead obstructions. Never travel between borehole locations with the mast, or feed cylinders, in a raised position.
- Know the location(s) of any other heavy equipment moving or working on-site.
- Weekly, inspect the complete drive train of a carrier for loose or damaged bolts, nuts, studs, shafts, and mountings.
- When travel takes you off road and into hill terrain, use the front axle (for 4x4, 6x6, etc. type vehicles or carriers). If equipped with multiple speed transfer case, operate in low range. Always refer to the manufacturer's recommendations.

3.7.2 - Loading and Unloading Rigs

When loading or unloading a drill rig on a trailer or a truck, follow these precautions:

- Verify you are on level ground for loading and unloading
- Have someone on the ground guiding you.
- Before using a ramp, verify the brakes of the drill rig are in working order
- Ensure that any ramps used are designed for this purpose and provide a sturdy and solid enough base to bear the weight of the drill rig with carrier including tooling.
- When the drill rig is on the trailer, verify the weight of the drill rig, carrier and tools are centered on the centerline of the trailer. In addition, some of the trailer load should be transferred to the height of the towing vehicle. Refer to the trailer recommendations for weight distribution provided by the manufacturer.
- Verify the drill rig is secured to the towing vehicle with ties, chains, or load binders that can handle the required weight.
- Inspect the trailer tires before loading or unloading. A flat tire will cause the rig and trailer to lean and equipment could come off the trailer.
- When traveling on the road, be sure the rig's slide base is in fully, that the rig is completely on the trailer, in the proper position, and secured.
- Skidding the rig off the trailer and to boring locations requires forethought and caution. Do not ride the skids when moving the rig. Avoid potential rollovers by skidding the rig perpendicular up a slope, not parallel or at a shallow angle to the slope.
- Provide a secure base and use cribbing of the appropriate size to level the rig.
- Secure the rig to the pavement, floor, or ground with anchor bolts, frost augers, chains, cables, or as appropriate.

3.7.3 - Start Up

Precautions for Setting up and Blocking the Drilling Rig

It is the driller's responsibility to verify the rig is properly set up. The stability of the drilling rig is critical to assure safe drilling operations. Some things to consider when setting up are provided below. Refer to section 4 – TITLE for more detailed information.

- Whenever possible, the driller should choose a dry, level, and reasonably smooth drilling site. Verify the rig's parking brake is engaged and that the wheels which will remain on the ground are blocked. Blocking the rig will help to provide a more stable drilling structure by distributing the weight of the rig evenly. If the rig is equipped with jacks or outriggers, they will be extended from the rig to the ground, raising the rig partially or entirely off the ground. Proper blocking of the rig will prevent differential settling which could result in the rig toppling sideways. Blocks should be placed between the jack swivel and the ground to provide more support area under the pad.
- All drill rig personnel and visitors should be instructed to stand clear of the drill rig immediately prior to and during starting of an engine.
- Before start-up, check that all brakes are set, all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers or air controls are in the correct position, and the cathead rope is not on the cathead.
- Follow all guidelines provided by manufacturers with regards to starting up engines.
- Check for warning or lockout tags on the controls. Do not start any engine without having the tag removed by the person responsible for the install.
- Prior to lowering the leveling jacks, we recommend that a timber or plank be placed beneath the jack. By performing this function, it will be less likely that the jacks will sink into the ground. Even on asphalt, jacks could possibly, over time, sink down to the point that the rig might not remain level. Insure that the rig is level and everything is secured prior to raising the mast. Before the mast is raised, the rig must be leveled and stabilized with the leveling jacks.
- Verify before drilling is started with a particular drill, that the operator (who may be the safety supervisor) has had adequate training and is thoroughly familiar with the drill rig, its controls, and its capabilities.
- Inspect the drill rig when it first arrives onsite and then at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, damaged pressure gauges, and pressure relief valves.
- Check and test all safety devices such as kill switches at least daily and preferably at the start of a drilling shift. Drilling should not be permitted until all kill switches and warning systems are working correctly. Do not wire around, bypass, or remove an emergency device.
- Verify all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds on each starting of an engine.
- Verify nothing is loose on the mast that would fall when the mast is raised to its upright position. When the mast is raised, take measures to secure it properly.

3.8 - Shut Down - Temporary (Daily) and Permanent

3.8.1 - Temporary Shut Down

- Inspect equipment at the start of each shift (pre-op) and at the end of each shift (post-op).
- Correct all major defects and safety defects prior to the start of work.
- All air and water lines and pumps should be drained when not in use if freezing weather is expected. If appropriate, the rig should be winterized at the end of each day.
- All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole.
- For remote, idled, or access controlled sites, clearance holes can be left open, however, use hazard cones, fencing or other methods to identify the hazard.

3.8.2 - Demobilization

- Refer to the pre-travel inspection and safe driving procedures outlined in Section 1 and 2 when demobilizing.
- When loading equipment prior to demobilization, be especially alert to potential back injuries. Use proper lifting techniques including getting help if necessary.
- Verify any waste materials have been removed from the site or properly contained, labeled and scheduled for pickup.
- All open boreholes should be covered and protected or backfilled adequately and according to local and state regulations on completion of the drilling project.

SECTION 4 - DRILLING OPERATIONS

4.1 - Rig Set-up

The drilling contractor is responsible for ensuring that the rig is properly set-up. This includes such tasks as stabilizing the rig, clearing the location of overhead obstructions that may contact the mast as it is being raised or is in the fully raised position, and raising the mast. Each task is discussed in greater detail below.

4.1.1 - Drill Rig Stabilization

Rig stability is essential for conducting safe drilling operations. Components to assuring proper stabilization include rig placement (or location), use of hydraulic leveling jacks, use of blocking (or cribbing), and use of wheel chocks. Specific items to consider include the following:

Rig Placement

- To the extent possible, situate the rig on dry, level, and stable ground surface.
- To the extent possible, avoid rough terrain and sites that do not allow sufficient space for worker access and egress to and from rig and associated support equipment.
- Carefully evaluate the drilling site prior to setting the leveling jacks, especially if the location is on water saturated, frozen, or loose, caving soil.
- Avoid situating rig on sloped ground. If necessary, build up solid, compacted earth where the jacks contact the ground.
- Avoid situating rig where overhead obstructions, such as tree limbs, canopies, overhead power lines, and piping racks, create unsafe drilling or tool handling conditions.
- Engage the emergency brake once the rig has been positioned.

4.1.1 - Drill Rig Stabilization cont.

Jacks

- Lower or extend leveling jacks and outriggers to raise the rig partially, or in some cases entirely, off the ground and to minimize the potential for the rig to tip over once the mast is raised.
- Do not position hands on or near jacks as jacks are being lowered or raised.
- Maintain jacks in lowered position as long as mast is raised.

Blocking and Cribbing

- When drilling on non-compacted soil, use blocks of sufficient strength to support the weight of the rig and to provide a more stable drilling structure. Blocks will more evenly distribute the rig's weight and will prevent differential settling.
- Recheck the status of blocking and cribbing at the beginning of each shift to evaluate stability.
- Locate blocks between the jack swivel and ground.
- Re-level drill rig if settling occurs after initial set-up.

4.1.1 - Drill Rig Stabilization cont.

Wheel Chocks

- If the rig is positioned on an incline and leveling of ground is impossible or impractical:
  - Chock the wheels of the rig remaining in contact with the ground.
  - Chock wheels of all support equipment and trailers.
  - It is highly recommended that wheel chocks be used even if the rig is on level ground.

4.1.2 - Overhead Hazards

Contact with overhead obstructions when raising the rig mast can result in property damage, injury, and, most importantly, loss of life. The most frequent cause of job-related death in the drilling industry is electrocution caused by contact of the drill rig with overhead power lines. Additionally, contact with overhead power lines can result in electrical shock and electrical burns. Drilling should not commence without first determining the risk posed by obstructions such as tree limbs, protruding objects and structures, and overhead power lines. The proposed drilling location should be inspected by the drilling contractor prior to setting-up the rig to ensure that all such obstructions have either been removed or that the risk of contacting such obstructions has otherwise been mitigated. Specific items to consider include the following:

Structures

- Prior to raising mast, review location for the presence of overhead structures, such as canopies, trees, or piping racks.
- Maintain sufficient horizontal space (approximately 10 ft) between overhead structures and rig to allow for mast to go past vertical when being raised.

Overhead Power Lines

- Contact the power company for expert advice on drilling in the vicinity of overhead power line(s) at a specific location and to determine if the power line(s) can be de-energized during drilling operations. Never assume a line is de-energized - ASK! If in doubt, do not raise the mast.
- Inspect location for sagging power lines before making entry with rig. Never lift power lines to gain entry to location.
- Note location of overhead utilities on all boring location plans and site work plans. Whenever possible, locate borings to avoid any possibility of contact with power lines. Walk completely around the rig to determine what the distance will be between the nearest power line and the mast as it is being raised and in the raised position
- When drilling near overhead power lines is unavoidable, allow sufficient space between the mast and the overhead lines. Because of the difficulty in estimating distances from the ground and the effects of wind on the power lines and hoist lines of the mast, it is advisable to maintain a 20-foot clearance.
- Post signs on ground level to alert workers to the presence of overhead utilities.
- Never raise the mast of the rig without a designated spotter.

4.1.2 - Overhead Hazards cont.

- Except where electrical distribution and transmission lines have been de-energized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following per 29 CFR 1926.550(ii):
  - For lines rated 50 kV or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet,
  - For lines rated over 50 kV, minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV over 50 kV, or twice the length of the line insulator, but never less than 10 feet,
  - In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 kV, and 10 feet for voltages over 50 kV, up to and including 345 kV, and 16 feet for voltages up to and including 750 kV.
- Unless a more conservative spacing requirement is stipulated by state or local regulations, use the following table as minimum spacing guidance:

TABLE 4.1 - Spacing Guidelines for Electrical Service

Nominal Voltage (Phase to Phase)	Minimum Required Clearance (feet)
≤ 50,000	10
Over 50,000 to 75,000	11
Over 75,000 to 125,000	13
over 125,000 to 175,000	15
over 175,000 to 250,000	17
over 250,000 to 370,000	21
over 370,000 to 550,000	27
over 550,000 to 1,000,000	42

Adapted from Code of Safe Drilling Practices, California Dept. of Transportation, Division of Engineering Services, Revised April 30, 2004

- Because of the difficulty in estimating distances from the ground and the effects of wind on the power lines and hoist lines of the mast, it is advisable to maintain at least a 20-foot clearance.
- Confirm with the power company that overhead power lines have been de-energized prior to drilling.
- Never drive the drill rig from hole to hole with the mast in the raised or partially raised position.

4.1.2 - Overhead Hazards cont.

If contact between rig and power line occurs:

Assume the entire rig to be electrified. Do not attempt to enter or leave the rig or touch any part of it. Although people in the rig may not be affected, anybody touching the rig while in contact with the ground is in danger of being electrocuted.
Have someone call the power company and the local fire rescue squad immediately for assistance.
Do not touch any person who may be in contact with the current.
If a rescue is attempted, use a dry, clean rope or a dry, unpainted wood pole to remove the victim. Do not touch the victim until he has been removed from the current.
If the victim is unconscious when released from the current, check his breathing and pulse and, if needed, begin CPR immediately.

- Under most circumstances, the operator and other personnel on the seat of the vehicle should remain seated and not leave the vehicle. Do not move or touch any part, particularly a metallic part, of the vehicle or the drill rig.
- If you are on the ground, stay away from the vehicle and the drill rig, do not let others get near the vehicle and the drill rig, and seek assistance from local emergency personnel, such as the police or fire department.

4.2 - Raising the Mast

Once the rig has been properly stabilized and the location cleared of overhead obstructions, the rig mast can be raised. Specific items to consider include the following:

Starting the engine

- Start all engines in accordance with the manufacturer's manual.
- All drilling rig personnel and visitors should be instructed to stand clear of the drilling rig immediately prior to and during starting of an engine.
- Check for warning or lockout tags on the engine controls. If a warning or lockout tag is attached to the switch, do not start the engine until the warning tag has been removed by the person who installed it.
- Verify all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the correct non-actuating positions, and the cathead rope is not on the cathead before starting a drilling rig engine.

4.2.1 - Jump Starting an Engine with a Dead Battery

Use the following procedure when jump starts are necessary:

☑ NOTE: do not connect the negative clamp to the negative (-) terminal of the discharged battery.

1. Connect one of the positive (+) cable clamps (red) to the positive terminal of the discharged battery.
2. Connect the positive clamp (red) from the other end of the jumper cable to the positive (+) terminal of the good battery.
3. Connect the clamp from the negative jumper cable (black) to the negative (-) terminal of the good battery.
4. Connect the negative cable clamp (black) on the other end of the jumper cable to the engine block or other good engine metal surface on the vehicle with the discharged battery. Do not connect the negative clamp to the negative (-) terminal of the discharged battery. This may trigger a spark and result in explosion of the gases surrounding the battery, causing injury.

Raising the Mast

- Before raising the mast, look up to check for overhead obstructions.
- Remove all loose objects, such as equipment and tools from the mast and inspected for damaged parts
- Raise the mast only after the leveling jacks are down. Do not raise the jacks until the mast has been lowered completely.
- Before raising the mast, all drill rig personnel (with exception of the operator) and visitors should be cleared from the areas immediately to the rear and the sides of the rig. No other work should be performed in the vicinity of the mast while it is being raised or lowered.
- Only qualified personnel may raise or lower the mast.
- Raise the mast a few inches in order to check brakes.
- Never drive the drill rig from hole to hole with the mast in the raised or partially raised position.

Securing Mast

- Secure or lock the mast in upright position according to the drilling manufacturer's recommendations.

4.3 - Auger Drilling

Auger drilling uses direct power to rotate (screw) flighted augers into the ground. Drill rigs must have kill switches in operable condition. Familiarize yourself with their location and operation. At least two persons must be present when operating the rig. Do not wear loose clothing, jewelry, hair, or equipment near the auger

The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must assure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.

Be aware of the following hazards which may be unique to this type of drilling:

- Clean the auger's male and female ends with a wire brush. Do not clean out bolt holes with your fingers. When applicable, couple the rig to the next auger while that auger is on the ground, then allow the machine to pick it up and place it on the down-hole string. Idle the machine down before engaging the rotation.
- Only use the manufacturer's recommended method of securing the auger to the drill drive coupling. Do not touch the coupling or the auger with your hands, a wrench, or any other tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground, or over other hard surfaces such as the drilling rig platform.
- Never allow feet to get under the auger section that is being hoisted.
- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Use low-profile auger pins.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation.
- When rotating augers, stay clear of the rotating augers and other rotating components of the drilling rig. Never reach behind or around a rotating auger for any reason whatsoever.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about 1 foot or more below the ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.
- An auger guide can facilitate the starting of a straight hole through hard ground or a pavement.
- Never place your hands between the drill rig and an auger, even when attempting to free damaged or bound sampling equipment from the auger.
- Use a long-handled shovel to move auger cuttings away from the auger. Never use hands or feet to move cuttings away from the auger. It is preferable to move cuttings while the auger is inactive.
- Augers should be cleaned only when the drill rig is in neutral and the augers have stopped rotating.
- After loosening the top auger from the down-hole string, allow the machine to pick up the auger off of the string and set it on the ground, then uncouple from the machine.
- Care should be taken to ensure augers are properly stored and secured when not in use and during transport.

4.3 - Auger Drilling cont.

When using screw together augers consider the following:

- When coupling augers, idle the machine down while screwing together the augers and remove the auger catcher before rotating the auger string.
- When uncoupling augers, clean off the area where the pipe wrench jaws will engage the bottom auger.
- Drillers should remove their hands from the rotation lever or clutch handle while allowing the helper to place the wrench in the proper position. The helper should loosely hold on to a rope attached to the end of the pipe wrench to maintain tension. After breaking the auger, drillers should remove their hand from the rotation lever or clutch handle while allowing the helper to remove the wrench and put the auger catcher in place.

When using bolt-together augers, consider the following:

- Do not use bolts with excessively rounded heads or worn out threads.
- Do not use a worn out socket or breaker bar.
- Pull on the breaker bar to tighten bolts. Do not push.
- Drillers should remove their hands from the rotation lever or clutch handle while auger bolts are removed and the auger catcher is positioned.
- If the top auger will not disengage from the string, strike the auger with a hammer on the thick area of the female coupling end.
- Do not strike the flights, bolt holes, or the body (tube) of the auger.
- If the auger cap bolt will not loosen by hand, tap it with a hammer or use the breaker bar and socket.
- If the top cap will not disengage from the auger, strike the cap with a hammer.

When using solid stem flight augers, consider the following:

- Place the C-pin so the movement of cuttings up the flights will not disengage it.
- Drillers should remove their hands from the rotation lever or clutch handle while allowing the helper to remove the C-pin and put the auger catcher in place.
- When hoisting a string of augers from the borehole, use the proper top adapter that will not allow the string to become disengaged from the hoist line.

4.4 - Rotary Drilling

The term *mud rotary* means direct rotary drilling using mud slurry or water circulation to remove cuttings and keep the borehole wall stabilized. Be aware of the following hazards which may be unique to this type of drilling:

- Lifting heavy equipment (such as drill rods, flight augers)
- Rotating equipment and parts, flight augers, and
- Slippery or dangerous work areas caused by messy mud pits or troughs (workers could fall in), keep work area clear.
- Water swivels and hoisting plugs should be lubricated and checked for frozen bearings before use.
- Do not hold on to the discharge hose, or allow it to coil around your feet, while the tools are rotating.
- When unscrewing a side-mount water swivel from the drill string, be sure the string is sitting on the bottom of the borehole. Do not hold on to the back-up wrench while tools are rotating.
- Use the proper size wrench to makeup and breakout joints of casing. Put yourself in a stable position and pull, do not push, on the wrench.
- Keep hands away from the bottom of the bit assembly when removing it from, or inserting it into, the casing or boring. Set the assembly on the ground and remove it from the overshot - do not allow it to hang from the wire line.
- Use full grip circle wrenches to assemble and disassemble core barrels.
- Keep hands away from the bottom of the core barrel or inner tube when removing it from, or inserting it into, the casing, augers, or drill rods.

Air rotary is direct rotary drilling using high pressure air circulation to remove cuttings and keep the bit cool. Be aware of the following hazards which may be unique to this type of drilling:

- Rotating/lifting equipment,
- High pressure air lines,
- Air discharge of cuttings at high velocity (use a cover to control discharge of cuttings),
- Heavy drill rods being lifted,
- High noise levels, wear hearing protection,
- Space limitations (large drill rig and support vehicle), and
- Dust generation in dry formations (move upwind and use a cover or water spray for dust control).

4.4 - Rotary Drilling cont.

Listed below are general rotary (air and mud) drilling hazards:

- Do not brake drill rods during their lowering into the hole with drill rod chuck jaws.
- Drill rods should not be held or lowered into the hole with pipe wrenches.
- If a string of drill rods is accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.
- In the event of a plugged bit or other circulation blockage, high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.
- When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your unprotected hands to clean drilling fluids from drill rods.
- If work must progress over a portable drilling fluids (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with a rough surface or cover panels of adequate strength to hold drilling rig personnel.
- Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay down the rods in a safe area.
- Drill rod chuck jaws should be checked periodically and replaced when necessary.
- The capacities of hoists and sheaves should be checked against the anticipated weight of the drill rod string plus other expected hoisting loads.
- Only the operator of the drill rig should brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.

4.5 - General Drilling Safety

4.5.1 - Training

- Employees working in the proximity of an operating drilling rig and the support equipment required to complete wells should be thoroughly familiar with the operational hazards involved.
- Prior to commencing investigative work, all employees must review the Site-Specific HASP and the hazards surrounding a drill operation. Document this by having the employees read and agree with the provisions of the Site-Specific HASP and then by having them sign an acknowledgement form.

4.5.2 - Housekeeping On and Around the Drill Rig

Good housekeeping is a proactive approach to keeping the job-site clean which in-turn reduces accidents and injuries. A clean work environment adds to drilling speed and efficiency. Customers like it when you keep and leave a work-site clean because it shows professionalism. Together, good housekeeping improves working conditions and safety practices. Every crewmember should inspect the work site upon his arrival to assure that equipment is in safe condition and the job site is in proper order. Return the job site to proper order prior to proceeding with work.

NOTE: The right time to clean-up is immediately after a mess is made.

Housekeeping means cleaning-up, *which is an ongoing part of drilling*, rather than an occasional activity. Follow these suggestions to make your housekeeping efforts more efficient:

- Identify where to unload equipment and supplies
- Put materials in a convenient place where they can be safely handled without hitting or falling on anyone
- Find a safe place for tools you pick up, not on the edge of a truck bed
- Drill rods, casing, augers, and similar tools should be orderly stacked on racks to prevent sliding, rolling, spreading, or falling
- Place fire extinguishers and first aid kits in easily accessible locations
- Decide on a location for trash collection: All trash should be placed in bags and stored in areas outside of the immediate work area.
- Determine a steam cleaning site that reduces the mess
- Every crew member is responsible for site clean-up
- Good housekeeping can eliminate most trip hazards

NOTE: When you are not given a task to do, *clean-up something*.

4.5.2 - Housekeeping On and Around the Drill Rig cont.

The first requirement for safe field operation is that everyone understands and fulfills the responsibility for maintenance and housekeeping on and around the drill rig.

- Suitable storage locations should be provided for all tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor, without creating tripping hazards, and without protruding at eye or head level.
- Avoid storing or transporting tools, materials, or supplies within or on the mast of the drill rig.
- Pipe, drill rods, casing, augers, and similar drilling tools should be stacked orderly on racks or sills to prevent spreading, rolling, or sliding.
- Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.
- Work areas, platforms, walkways, scaffolding, and other access ways should be kept free of materials, debris, and obstructions and substances such as ice, grease, or oil that could cause surfaces to become slick or otherwise hazardous.
- Keep all controls, control linkages, warning and operation lights, and lenses free of oil, grease, and ice.
- Do not store gasoline in any portable container other than a self-closing, non-sparking, red container with flame arrester in the fill spout and having the word *gasoline* clearly visible. The container must also comply with all other hazard communication requirements.
- Dirty or contaminated pipe, drill rods, augers, or sampling equipment, should be moved away from the work area to prevent possible exposure to non-protected personnel and also to prevent cross-contamination of clean materials.
- Wastewater and drilling fluids must be properly contained and labeled and stored out of the operational area.
- The use of additional footing safeguards (mats) should be evaluated on a case-by-case basis.
- Remove and dispose of empty bags or other containers, which have held drilling mud, cement or other dust producing materials.
- Do not leave items such as hand tools, rakes, shovels, or other small equipment left lying on the ground to pose a trip hazard.
- Welding gas cylinders should be stored in an upright and secured position. Protective caps should be in place when the cylinders are not in use.
- Never use compressed air for cleaning clothes.
- All unattended boreholes must be adequately covered or otherwise protected to prevent personnel, site visitors, or animals from falling into the hole. All open boreholes should be covered, protected, or back filled adequately and according to local and state regulations or customer requirements upon completion of the drilling project.
- Walk around, not over, obstacles. Carefully choose a walking path to avoid ruts and steep slopes. Walk around freshly placed fill, gravel, or rip-rap. Keep your eyes on the path.
- Avoid storing or transporting tools, materials, or supplies within or on the mast of the drill rig.

4.5.3 - Equipment Inspection

- Inspect equipment at the start of each shift (pre-op) and at the end of each shift (post-op).
- Correct all major defects and safety defects prior to the start of work.

4.5.4 - General Inspection Routine

- Inspect drilling equipment, cranes, winches, generators and compressors prior to use - correct any identified problem before proceeding with work
- Verify that the emergency shutoff switch works
- Verify that preventative maintenance has been conducted
- Wear proper PPE: Hardhat, safety glasses with side shields, and steel-toed boots as a minimum
- Conduct tailgate safety meetings and facilitate a safe work culture
- Pre qualify drilling subcontractors
- Verify that Drillers and Helpers have proper training and experience
- Refer to company specific *Drilling Safety Guidelines*, *Subcontractor Health and Safety Requirements*, and *Behavior Based Safety* procedures.

4.5.5 - Set-up

- **See details below for set-up precautions related to proximity to power lines.**

4.5.6 - Start-up

All Drillers will:

- All personnel should know location and use of emergency shut-down/kill switch.
- Identify potential pinch points and hazards which could injure fingers and toes.
- Traffic barricades should be positioned.
- Operate as a team in which every crewmember is responsible for their own safety and that of each of the other crewmembers.
- Know their individual duties so that work can progress smoothly, efficiently and safely.
- Stay alert with their minds on their jobs.
- Stay observant for safety problems and correct them as they occur or report the problem to the lead worker.
- Use all required and recommended safety equipment.
- Refrain from engaging in practical jokes/horseplay around the drilling rig and work site.
- Get proper rest and nutrition so that they report to work in a physically and mentally fit condition.
- Never work under the influence of alcohol or drugs, whether legal or illegal.
- Pass an operational capability test administered by the employee's supervisor or supervisor's representative on each type of equipment the employee will operate on state business prior to operating the equipment unsupervised.
- Always use the buddy system whenever working near areas of vehicular traffic, public roads or public property.
- Remove cuttings with a long-handled shovel, not your hand or foot.

4.5.7 - Drilling

Considerations during general operation:

No visitors are permitted in the vicinity of the work area without proper protective clothing and authorized permission.
Only personnel necessary to achieve drilling objectives should remain within the exclusion zone. All others should remain outside the exclusion zone.
Effective communication (hand signals), especially under high noise conditions, is essential to safety. Clarify use of hand signals.
If the operator of the rig must leave the area of the controls, he operator should shift the transmission controlling the rotary drive and the feed control to neutral.
All crew members should be familiar with basic controls of the rig, including how to stop the engines, align the kelly with the borehole, raise and lower the drive head, raise and lower hoists, and chuck or unchuck the rods.
Do not climb the rig mast while equipment is running. Shut down/lock out equipment and use full body safety harness if climbing mast is necessary.
The operator of a drilling rig should only operate the rig from the position of the controls.
The operator should shut down the drilling engine before leaving the vicinity of the drilling rig.
Drilling should always proceed cautiously, especially at depths less than ten feet.
Operation of drilling equipment should be limited to qualified personnel.
Do not exceed the manufacturers' technical specifications for items such as speed, force, torque, pressure, and flow.
If drilling in an enclosed area, make certain the exhaust fumes are vented from the work site.
If drilling with air, direct the exhaust and cuttings away from the workers.
Never operate the drill rig with any of the machinery guards removed.
Drill rods and sampling barrels should never be left unsecured, leaning against or balanced across the drill rig.
Never exceed the pipe and rod racks design maximum load.
Always make provisions to prevent stock from accidental rolling.
When core is being extruded from a core barrel, hands should be kept out of line of the end of the barrel.
Attach safety chains or cables swivel, air, and other pressure hoses.
When cranking pumps or other motors keep head well back of the crank area to avoid being hit when motor turns over.
Fugitive dust control is to be used during dry drilling, especially in potential areas of naturally occurring asbestos.

4.5.7 – Drilling cont.

- When adding and removing drill rod:
  - Only the drill operator will brake or set the chucks, to eliminate the possibility of engaging the transmission prior to removing the chuck wrench.
  - Do not use the chucks as a brake on a string of drill rods that are being lowered into a hole. Braking the drill string with the chuck will result in metal slivers on the drill rod and consequent hand injuries, and could result in losing the drill rod down the hole.
  - Check the chuck jaws periodically and replace them as necessary.
  - Never place hands on wrenches where they can get trapped between the wrench and the drill rig.
  - Ensure that wrenches are removed from rods before starting to drill.
  - Do not take hold of the male thread end of drill rod. Watch for sharp burrs on rods and casing, and file sharp edges off rods when necessary.
  - Do not use extension leverage (cheaters) on pipe wrenches to break drill rod. If extension leverage is needed, the wrong tool is being used.
  - Clean drill rods with a rubber wiper or other suitable device when being removed from a hole.
  - Allow drilling fluids to drain from drill rods into the mud pit before setting the rod to the side, to minimize the amount of mud around the work area.
  - The operator knows the capacity of the hoist and mast, and the weight of the drill rod, to prevent the hoist capacity from being exceeded.
  - The drill rig operator must exercise care to lower the hoist slowly while the drill rod is being carried away from the hole.
  - There should be at all times at least three wraps of hoisting line on the hoist drum to prevent a line load from being applied directly to the fastening clamp.
  - Do not guide or hold onto moving wire line work cables with bare hands.

4.5.8 - Adding and Removing Drill Rods

When adding and removing drill rod:
Only the drill operator will brake or set the chucks, to eliminate the possibility of engaging the transmission prior to removing the chuck wrench.
Do not use the chucks as a brake on a string of drill rods that are being lowered into a hole. Braking the drill string with the chuck will result in metal slivers on the drill rod and consequent hand injuries, and could result in losing the drill rod down the hole.
Check the chuck jaws periodically and replace as necessary.
Never place hands on wrenches where they can get trapped between the wrench and the drill rig.
Ensure that wrenches are removed from rods before starting to drill.
Do not take hold of the male thread end of drill rod. Watch for sharp burrs on rods and casing, and file sharp edges off rods when necessary.
Use of extension leverage (like a cheater pipe) on pipe wrenches to break drill rod should be avoided whenever possible. If extension leverage is needed, the wrong tool is probably being used. In rare instances where extension is required, use extreme caution to avoid slippage and possible injury.
Clean the drill rod with a rubber wiper or other suitable device when being removed from a hole.
Allow drilling fluids to drain from drill rods into the mud pit before setting the rod to the side, to minimize the amount of mud around the work area.
Do not guide or hold onto moving wire line work cables with bare hands.

4.5.9 - Positioning Pipe and Casing

When positioned in the mast, drill pipe or casing should be secured until attached and in the drilling position

If work stops during positioning of drill pipe or casing into the mast, lower any suspended load to the ground or lay it down on the support vehicle. The following are general field practices that apply to all drilling operations regardless of method:

- Direct water discharge hoses away from leveling blocks

4.5.10 - Pressurized Systems

- No repair or maintenance will be performed on pressurized systems unless all pressure has been relieved
- Extreme caution will be used when opening any valve
- All relief valves will be installed so that any discharge will be directed away from workers and equipment
- Any extensions necessary for proper venting of relief valves will be secured against whipping and incorporate whip checks

4.5.11 - Most Common Injuries

- Slipping and falling
- Getting dirt in the eye while steam cleaning or while hitting auger and rods with hammer
- Cutting fingers from handling augers and heavy objects
- Injuring back from improper lifting

4.5.12 - Near Losses, Incidents and Injuries and Treatment

- No matter how minor, all near losses, incidents, and injuries will be reported to a supervisor immediately.

4.5.13 - First Aid Kits/Fire Extinguishers

- Each rig will be equipped with a fully supplied, approved first aid kit and an ABC fire extinguisher of suitable size for the fire hazard to be encountered at the job site.

4.5.14 - Underground utilities

- Complete utility locates prior to drilling [One Call: (800) 321-ALERT] and coordinate with the drilling contractor and site personnel.
- Mark locations in white
- Field verify utility locations
- Document all utility locates on a plot plan or other map of the site.
- Observe the area for indications of utilities
- Hand dig if questions remain or if required by the property owner
- Refer to your specific *Utility Clearance and Isolation* procedure

4.5.15 - Environmental Contamination (if applicable)

- Before Visqueen or other plastic is laid down, the site will be cleared of trip hazards, obstacles or debris such as rocks, sticks, ruts and holes.
- Contain cuttings in drums or plastic sheeting
- Wear proper PPE and minimize contact with soil, sediment, groundwater, or other contamination.
- Work upwind of the boring
- If unusual soil discoloration or odors are encountered, stop work, evacuate area and contact the safety manager. The approach will need to be re-evaluated and Level C PPE may be required
- Follow all provisions of the Health and Safety Plan

4.5.16 - Working on Streets or Highways

- Follow state and local laws concerning traffic control signage, cones, and barricades.
- Do not work before sun-up, after sundown, or any time visibility is poor.
- Position support vehicle(s) between the work area and oncoming traffic.
- Use safety strobe lights on all vehicles and equipment.
- Wear appropriate reflective safety vests.
- Use radios when flagging.

4.5.17 – Operating the Drilling Rig

- Only employees will operate the drilling rig or handle equipment associated with drilling operations, including winches, augers, drive rods, ropes, and cables. Technicians, field personnel and any visitors must be aware of the location of the emergency shut-down/kill switches and operation of these devices, and the devices must be in safe working condition prior to the start of the project and thereafter.
- The Technician should never leave the controls of the drilling rig while the tools are rotating unless all employees are clear of rotating equipment.
- During drilling operations the Well Technician at the controls must be aware of the Assistant Technicians position and actions at all times. Operation of the winches and or rotary actions should only occur once the Well Technician has visually or verbally confirmed that the Assistant Technician is all clear. During assembly operations (auger attachment or rodding connection) no mechanical operations should occur until body position or hand placement is confirmed to be in a non-pinch or crush position.
- Only employees necessary to run the rig are allowed in close proximity, except during essential sampling and other activities.
- Technicians will not reach into or near pinch points, the borehole, or the rotating equipment, unless the drilling rig has been shut down.

4.5.18 - Working on the Mast - General Repairs

- Drillers should not climb the mast to make repairs if the mast can be lowered. If the mast cannot be lowered to make repairs, workers may use a ladder or may climb the mast if proper fall protection, such as a harness and attached lanyard, is available. Fall protection devices, in the form of a harness and lanyard, will be used where workers are 6 feet or greater in height (if a ladder or personal lift is not available). No one should climb the mast to make repairs while the drilling rig is operating
- During general repairs or maintenance actions Technicians must also consider extra caution with respect to hand tools and potential slippage actions. Keep tools clean and free of grease and oils, plus thoroughly clean any bolt heads or parts before wrenching. These actions may prevent slippage and possible hand injuries. Where possible, leather gloves should be worn (cotton gloves may be worn where dexterity is an issue).

4.5.19 - Special Precautions for Drilling in Landfills

In addition to the usual physical hazards of drilling, employees drilling in landfills may experience an increased hazard from methane gas. Methane, a decomposition product of organic materials is a very flammable gas, which may accumulate in the borehole or in the general work area. To help reduce the hazards due to the presence of methane while drilling in landfills, the following procedures should be implemented:

- No smoking within 75 feet from the drilling area.
- The drilling rig should be equipped with a spark-arresting muffler; a diesel engine can sometimes be preferred.
- All ignition sources should be at least 75 feet from the borehole and, if possible the rig should be located upwind of the borehole,
- Monitor methane concentrations as frequently as possible using a Combustible Gas Indicator (CGI).
    - The frequency of monitoring must be established in the Site-Specific (HASP).
    - The meter should be kept near the rig.
    - Results of the monitoring data should be entered into the field log,
    - Calibrate the CGI against a reference gas at least weekly.
- **All work will stop if gases are detected at 10 percent or greater of the lower explosive limit (LEL)** in the hole being drilled.
- Under such circumstances it may become necessary to inert, ventilate, or flood the borehole with water during drilling to reduce the risk of down-hole explosions.

4.5.20 - Lighting

Lighting around a drilling operation should be sufficient to provide illumination at all times. See the table below for guidance.

Table 4.2 - Minimum Illumination Intensities in Foot-Candles

Foot-Candles	Area of Operation
5 Foot-Candles	General construction area lighting.
3 Foot-Candles	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas.
5 Foot-Candles	Indoors: warehouses, corridors, hallways, and exit ways.
5 Foot-Candles	Tunnels, shafts, and general underground work areas: (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights shall be acceptable for use in the tunnel heading)
10 Foot-Candles	General construction plant and shops (batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active store rooms, mess halls, and indoor toilets and workrooms.)
30 Foot-Candles	First aid stations, infirmaries, and offices.

NOTE: The above are minimum requirements. Many circumstances, including weather, may warrant higher lighting values.

4.6 – Electrical Safety

4.6.1 - Supplying Power to the Job Site

Drilling projects sometimes require around the clock operations and, therefore, require temporary electrical lighting. In general, all wiring and fixtures used to provide electricity for drilling operations should be installed by qualified personnel in accordance with the National Electrical Code (NFPA70 1999) with consideration of the American Petroleum Institute's recommended practices for electrical installations for production facilities (API RP 500B). Lights should be installed and positioned so that the work area and operating positions are well lighted without shadows or blind spots. The following are specific recommendations for land based drilling operations:

- Before working on an electrical power or lighting system, lockout the main panel box with your own lock and keep the key on your person at all times.
- Install all wiring using high quality connections, fixtures, and wire. Be sure that the wiring is insulated and protected with consideration for the drilling environment.
- Do not use makeshift wiring and equipment.
- Place all lights positioned directly above working areas in cages or similar enclosures to prevent loose or detached lamps or vapor tight enclosures from falling on workers.
- Install lights so as to eliminate glare or blind spots on tools, ladders, walkways, platforms, and the complete working area.
- Locate and guard electrical cables to prevent damage by drilling operations or by the movement of personnel, tools, or supplies.
- Use only three prong, U blade, grounded type plug receptacles and have adequate current carrying capacity for the electrical tools that may be used.
- Use only electrical tools that have three prong, U blade, ground wire plugs, and cords.
- Do not use electrical tools with lock on devices.
- Provide adequate grounding for all electrical welders, generators, control panels, and similar devices.
- Provide secure protective enclosures on control panels, fuse boxes, transformers, and similar equipment.
- Avoid attaching electrical lighting cables to the mast or other components of the drill rig. If this must be done, use only approved fasteners. Do not string wire through the mast.
- Do not use poles used to hold wiring and lights for any other purpose.
- Turn power off before changing fuses or light bulbs.
- Require all workers in a drilling area illuminated with electrical lighting to wear safety head gear that protects the worker's head, not only against falling or flying objects, but also against limited electrical shock and burns according to ANSI Z89.1 and Z89.2.
- Allow only trained, designated personnel to operate electrical equipment.
- Do not permit unqualified field personnel to work on or near electric lines or devices.

4.6.2 - Safe Use of Electricity

Electrical shock can occur if equipment is maintained improperly or operated unsafely. Care and common sense minimizes danger and reduces the chance of fire resulting from electrical faults.

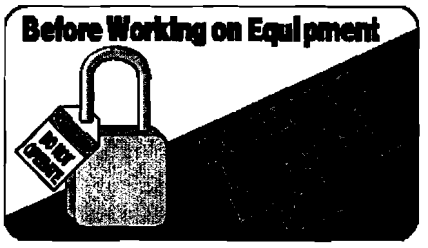


Figure 4.2 – Lockout Tagout Reminder

- Do not work on electrical parts unless you are sure they are disconnected
- Never splice, connect, or handle live circuits
- Verify test flow or possible leaks will not spray water into any electrical enclosures such as starters, control boxes, or connection boxes during testing
- Verify all electrical equipment is properly grounded

4.6.3 - Reacting to Contact with Electricity

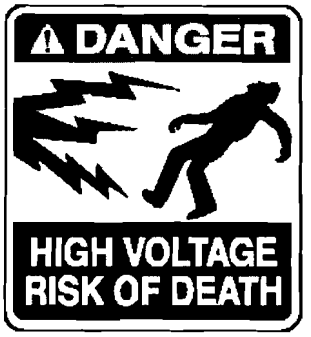


Figure 4.3 – High Voltage Warning Sign

- If a drill makes contact with electrical wires, it may or may not be insulated from the ground by the tires of the carrier. Under either circumstance, the human body, if it simultaneously comes in contact with the drill rig and the ground, will provide a conductor of the electricity to the ground. Death or serious injury can be the result.

4.6.4 - Electrical Equipment

Get permission from the owner's representative before utilizing electrical outlets on-site. Do not operate electrical equipment in standing water or excessively wet conditions.

4.7 - General Equipment Safety

4.7.1 Safe Use of Hand Tools

With a vast number of hand tools that are likely to be used on a drill rig or during repair, the best rule of thumb is to use a tool only in the manner for which it was intended. Keep cutting tools sharp. If an accident occurs, treat all cuts and scratches immediately with simple first aid measures to prevent infection, which can occur in a matter of hours. Some other guidelines are:

Inspect tools prior to use
Use tools for their intended use only
Do not use damaged tools
Pull, do not push wrenches - verify there is a good grip
Never use excessive force on a tool. If excessive force is required, the wrong tool is being used.
Keep all tools clean and orderly stored when not being used.
- Do not leave tools on ladders or other overhead working spaces.
- Do not leave tools on the ground.

Never throw or drop tools. Use hoists or hand lines to raise or lower tools.
Always use non-sparking tools in areas of potentially explosive materials or atmosphere.

Hand Tools

As many different types of hand tools may be used on or around a drill rig and in repair shops, there are an equal number of instructions for proper use. *Use the tool for its intended purpose* - is the most important rule.

The following suggestions apply to safe use of several hand tools that frequently are used on and around drill rigs:

- When a tool becomes damaged, either repair it before using it again or get rid of it.
- Do not use tools with split or defective handles or worn parts. If a tool becomes damaged, repair it before using it again or replace it.
- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- When using any kind of chisel or punch, for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and stored appropriately when not in use

Hammers

Use only hammers that are in good condition with handles firmly attached. Repair or replace hammers with defective handles or mushroomed heads. If the head has mushroomed, dress it prior to using it. When repairing a handle, never use nails as a substitute for a wedge.
Always grip the handle close to the end. Choking the grip near the head is less accurate and effective.
Set nails with a light blow to minimize the possibility of finger injuries.
Always use a hammer with a flat face to drive nails, never use a machinist's hammer for this purpose.
Never pound objects with the hammer's handle.
To prevent flying metal splinters, never strike a hardened object such as a wrench or another hammer with anything but a rawhide or soft-metal hammer.

Wrenches

- Keep all pipe wrenches clean and in good repair. Use a wire brush frequently to clean the jaws of pipe wrenches. An accumulation of dirt and grease can cause wrenches to slip.
- Use a wrench of adequate size, a larger wrench is safer than using a cheater pipe.
- If using an adjustable wrench, note that the fixed jaw is stronger than the movable one.
- If possible, pull on a wrench using your arm muscles rather than push on it.
- Maintain good footing, one foot bracing behind the other, when using a wrench. Remove sharp objects from the area in case of a fall.
- Position your hands so they will not be crushed or smashed if the nut or joint releases.
- Never apply a wrench to moving machinery.
- Never use a wrench as a hammer.
- Wire brush the jaws of pipe wrenches frequently, and replace worn jaws periodically.
- Use wrenches - not pliers - on nuts.
- Never use pipe wrenches in place of a rod holding device.
- Replace hook and heel jaws when they become visibly worn.
- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be pinched between the wrench handle and the ground or the platform if the wrench should slip or the tool joint suddenly let go.
- When using a wrench on a tight nut: first use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Do not push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing -- check the place where you may fall for sharp objects.
- Never use a cheater bar on an aluminum pipe wrench

Screwdrivers

Always use a screwdriver that closely fits the screw slot.
Never use a screwdriver with a worn, chipped, or broken tip.
Never use a screwdriver as a substitute for a chisel or pry bar.
Keep cutting tools sharp.
If an accident occurs, treat all cuts and scratches immediately with simple first aid measures to prevent infection, which can occur in a matter of hours.

Pinch points

Never place your hand or other body parts under auger or in holes in the auger
Attach one flight at a time
Stand clear of outriggers
Wear leather gloves
Identify any and all places where moving equipment could trap a body part and act to eliminate the hazard.

Power Tools

- Always read the owner's manual of the tool that you are using to learn the correct application and the limitation of the tool.
- Lubricate tools as recommended by the manufacturer.
- Properly ground power tools.
- Never operate power saws or grinders without safety guards.
- Never run power tools in damp or wet locations.
- Always have proper lighting when using power tools.
- Do not abuse the cord - never carry a tool by its cord, or yank the cord to remove the plug from a receptacle.
- Secure the work with clamps to allow both hands to be free to operate the tool.
- Remove adjusting keys and wrenches prior to starting the power tool.
- Keep the work area clean and free of clutter that can interfere with the work or get caught in the power tool.
- Do not overreach, keep good footing and balance when using power tools.
- Do not carry plugged-in tools with your finger on the start switch.
- Disconnect all tools from power source when not in use and when servicing.

4.8 - Personal Protective Equipment

4.8.1 - Individual Protective Equipment

Certain personal protective equipment (PPE) must be worn because of the physical hazards posed by the drilling operation. For most geotechnical, mineral, and groundwater drilling projects, individual protective equipment must include a safety hat, safety shoes, safety glasses, and close fitting gloves and clothing. The Site-Specific Health and Safety Plan will dictate other PPE and precautions necessary to address site related hazards and risks. All protective equipment is provided by the respective employer(s).

Hard Hats

Hard hats must be worn by everyone working or visiting at or near a drilling site (worn with the brim in front, only). All hard hats must be kept clean and inspected each working day to assure they are in good repair with the headband and crown straps properly adjusted for the individual drill rig worker or visitor. A hard hat is the number one piece of safety equipment. They should be worn on all drilling sites, shop or yard areas where work might be performed under heavy objects, or where there is the possibility of injury from falling objects. A hard had protects you from falling objects. For your protection, OSHA regulations allow government inspectors to assess fines for not wearing hard hats.

Safety Shoes or Boots

Safety shoes or boots should be worn by all drilling personnel and all visitors to the drill site that observe drilling operations within close proximity of the drill rig. All safety shoes or boots must meet the requirements of ANSI.

Gloves

All drilling personnel should wear gloves for protection against cuts and abrasions that could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods and other drilling or sampling tools. All gloves must be closefitting and not have large cuffs or loose ties that can catch on rotating or translating components of the drill rig.
Where possible, leather gloves should be worn (cotton gloves may be worn where dexterity is an issue).

Gloves should be worn when work activities involve handling the drilling equipment, sampling devices or even when servicing the drill unit. The type of glove will be dependent upon the task being performed and potential for chemical or other contaminants. At a minimum leather gloves should be worn when assembling tooling or servicing and repairing the drill unit. If dexterity is an issue (small bolts or screws), cotton or nitrile gloves maybe adequate.

Eye Protection

- All drilling personnel should wear safety glasses. General prescription glasses and sunglasses are not safety glasses. All safety glasses must meet the requirements of ANSI.
- Use safety glasses whenever using a hammer, chisel, power tool or any other tool that can cause particles to fly.

Hearing Protection

- Hearing protection devices such as ear plugs and ear muffs should be worn as required when the noise exposure is 85 dBA or greater over an 8-hour workday. Although noise levels vary with the type of drilling equipment used, potentially hazardous noise levels are likely to be generated during split-spoon sampling and air drilling. Typically, speech at normal conversational levels becomes difficult at 2 to 3 feet when noise levels are in excess of 85 dBA.
- When appropriate, each drill rig worker must wear noise-reducing hearing protection that meets the requirements of ANSI.

Fall Protection

- Fall protection is required when working at heights of greater than 6 feet (guard rails or a personal fall arrest system). Establish a good solid footing and that walking and working surfaces are as clean and dry as possible.
- Work to be done above three feet on the mast should require use of a safety harness, or the mast must be lowered. At a minimum fall protection must be used in accordance with applicable regulatory or client requirements. The most stringent being applicable.

Clothing

The clothing of the individual drill rig worker is not generally considered protective equipment, however, the worker's clothing should be comfortable but must be close fitting, without loose ends, straps, draw strings, belts or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry must not be worn during a work shift. In addition to loose clothing, hair should be tied back, as loose long hair can catch in mechanical equipment. All jewelry, including rings must be removed before beginning each shift. All personnel should wear clothing appropriate for the weather conditions.

High Visibility Clothing

High visibility clothing is required when working in environments that are regulated by Department of Transportation and or when working on active roadways or other high traffic areas such as service stations. It is also required for night work operations.

Other Protective Equipment

For some drilling operations, the environment or regulations may dictate that other protective equipment be used. The requirement for such equipment must be determined jointly by the management of the drilling organization and the safety supervisor. Such equipment might include face shield, respirator, and insect repellent. When drilling is performed in chemically or radiological contaminated environment, special protective equipment, and clothing may, and probably will, be required. The design and composition of the protective equipment and clothing must be determined jointly by the management and the client who requests the drilling services, and under some circumstances, with the concurrence of a health and safety professional.

4.9 - Weather and Night Work

4.9.1 - Weather Considerations

Cold

Extended exposure to windy, cold weather can lead to frostbite, hypothermia, and possibly death. The cold stress equation is as follows:

LOW TEMPERATURE + WIND SPEED + WETNESS = INJURY & ILLNESS

The Occupational Safety and Health Administration (OSHA) and the Mine Safety and Health Administration (MSHA) offer the following steps for recognizing, evaluating, and controlling cold stress:

- Recognize the environmental and workplace conditions that lead to potential cold-induced illnesses and injuries.
- Learn the signs and symptoms of cold-induced illnesses/injuries and what to do to help the worker.
- Drink warm, sweet beverages (sugar water, sports-type drinks). Avoid drinks with caffeine (coffee, tea, or hot chocolate) or alcohol, which cause dehydration. Eat warm, high-calorie foods like hot pasta dishes.
- Dress appropriately, layer clothing to adjust to changing environmental temperatures. Wear a hat and gloves, in addition to underwear that will keep water away from the skin (i.e., polypropylene).
- Take frequent breaks in warm, dry shelters to allow the body to warm up.
- Perform work during the warmest part of the day.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Workers are at greater risk when they have predisposing health conditions such as cardiovascular disease, diabetes, and hypertension, they take certain medications (check with a doctor, nurse, or pharmacy to see if any medications being taken have adverse affects while working in cold environments), or they are in poor physical condition, have a poor diet, or are older.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- All air and water lines and pumps should be drained when not in use if freezing weather is expected. If appropriate, the rig should be winterized at the end of each day.
- Take breaks as necessary to warm up.

Heat

- During hot weather take frequent breaks and drink plenty of fluids.
- Dress appropriately for the conditions expected.
- Maintain a supply of drinking water.
- Take breaks as needed to cool off.

Inclement Weather

- Drilling operation should be terminated during an electrical storm, and the complete crew should move away from the drill rig.
- Although drilling operations can proceed through a wide range of weather conditions, operations must cease if weather conditions are severe enough to create a safety hazard.
- Safety hazards from weather may include, but are not limited to, low visibility for approaching traffic, inability for the driller's to see, grasp, or handle equipment, and rough seas while working on the barge. Other conditions can create safety hazards, and can be decided in the field.
- The Driller has the responsibility to determine if the severity of the conditions warrants stopping the drilling operation.
- If performing tasks during inclement weather, work deliberately and adjust the work procedures to address the changed conditions.
- Stay away from the drill during electrical storms.

Lightning

Because of the high potential for lightning strike on the mast of a drilling rig, drilling must cease when thunder and lightning storms approach and are within 5 miles. Workers should take shelter away from the rig during the potential for lightening. If possible, the mast should be lowered prior to the advancement of thunder and lightning storms. A minimum of 20 minutes should be allowed after a lightning strike before drilling resumes.

4.9.2 - Night Work Safety

Schedule night work in advance to allow employees to adjust their schedules and avoid unnecessary fatigue.
Wear required protective clothing:
Orange or lime-green vests with reflective strips, and
White coveralls.
Use sufficient illumination.
Traveling public must be able to identify all locations where employees are grouped together and engaged in work activities.
The lighting must be oriented so that the traveling public is not temporarily blinded.
- The intensity of the illumination should not be any brighter than that necessary to perform the work.

4.10 - Wire Rope, Hoists and Cat Head Safety

This section concerns rotating equipment, catheads, wire ropes, and hoists (the part of the drilling rig which may cause serious injuries), and drilling techniques most commonly used during auger and rotary drilling:

- Use tools only for the job for which they were intended.
- Stay clear of cables while lifting equipment or while drilling rig is under heavy strain.
- Do not ride on hook, ropes, or other traveling lines of the rig.
- When moving or hoisting stabilizers or drill collars, tag lines should always be used. A helper should not use his hands to hold or control heavy tooling. Instead, he should loop a rope around it and hold onto both ends of the rope.
- Inspect pulley sheaves for wear and cable and rope positioning.

4.10.1 - Wire Rope Safety

Worn or misused wire rope is potentially one of the most dangerous pieces of equipment on any drilling rig. When a wire rope breaks, it is typically under significant tension and therefore has a tendency to snap back, like a rubber band. Be constantly aware of the condition of wire rope, which is used to hoist drill pipe or other heavy object. Wire rope used for such purposes and has begun to fray or unravel, or which has a number of breaks, should be removed from service and replaced prior to mobilization. This also applies to hemp rope, which is used to hoist the hammer during split-spoon sampling. See the chart below.

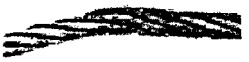
 **Mechanical damage due to rope movement over sharp edge projection while under load.**	 **Typical wire fractures because of bending fatigue.**
Localized wear due to abrasion on supporting structure. Vibration of rope between drum and jib head sheave. 	 **Wire fractures at the strand, or core interface, as distinct from crown fractures, caused by failure of core support.**
Narrow path of wear resulting in fatigue fractures, caused by working in a grossly oversize groove, or over small support rollers. 	**Strand core protrusion because of torsional unbalance created by drop ball or other shock loading application.** 
Two parallel paths of broken wires indicative of bending through an undersize groove in the sheave. 	 **Break up of IWRC resulting from high stress application. Note nicking of wires in outer strands.**
 **Severe wear, associated with high tread pressure. Protrusion of fiber main core.**	 **Typical example of localized wear and deformation created at a previously kinked portion of rope.**
 **Severe wear in Lang Lay, caused by abrasion or cross-over points on multi-layer colling application.**	 **Multi strand rope bird-caged due to torsional unbalance. Typical of build up seen at anchorage end of multi-fall crane application.**
 **Corrosion of severe degree caused by immersion of rope in chemically treated water.**	 **Protrusion of IWRC resulting from shock loading.**

Figure 4.1 – Types of Wire Rope Wear

4.10.1 - Wire Rope Safety cont.

Listed below are guidelines regarding wire ropes and hoists:

- Always wear the appropriate gloves when handling wire ropes.
- Minimize shock loading on wire rope, apply loads smoothly and steadily.
- Protect wire rope from sharp corners or edges.
- Do not guide wire ropes onto cable drum with your hands.
- Discard cable when kinked or frayed.
- Thoroughly inspect all wire ropes that have not been used for a period of a month or more.
- Install all connections and end fittings, which consist of spliced eyes and various manufactured devices, according to the manufacturer's specifications.
- If a ball bearing type hoisting swivel is used to hoist drill rods, inspect and lubricate swivel bearing daily to assure that the swivel freely rotates under load.
- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device, do not hoist more than 1 ft. (0.3 m) of the drill rod column above the top of the mast, do not hoist a rod column with loose tool joints, and do not make, tighten, or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to break the fall of the rods by hand or by tensioning the slipping device.
- Most sheaves on drill rigs are stationary with a single part line.
- Never increase the number of parts of line without first consulting with the manufacturer of the drill rig.
- Wire ropes must be properly matched with each sheave. If the rope is too large, the sheave will pinch the wire rope. If the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger sized wire ropes.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Use replacement wire ropes that conform to the drill rig manufacturer's specifications.
- Apply loads smoothly and steadily to minimize shock loading of a wire rope.
- There should be at all times at least three wraps of hoisting line on the hoist drum to prevent a line load from being applied directly to the fastening clamp

DANGER!

Do not subject a cable to *shock load*. Rapidly engaging and disengaging the hoist while attached to a load puts an enormous strain on the cable and may lead to catastrophic failure.

4.10.1 - Wire Rope Safety cont.

All wire ropes and fittings should be visually inspected prior to and during use and thoroughly inspected at least once a week for:

- abrasion
- broken wire
- wear
- reduction in rope diameter
- reduction in wire diameter
- fatigue, corrosion
- damage from heat
- improper reeving
- jamming, crushing
- bird caging
- kinking,
- core protrusion
- damage to lifting hardware

Wire ropes should be replaced when inspection indicates excessive damage. End fittings and connections consist of spliced eyes and various manufactured devices. All manufactured end fittings and connections should be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications.

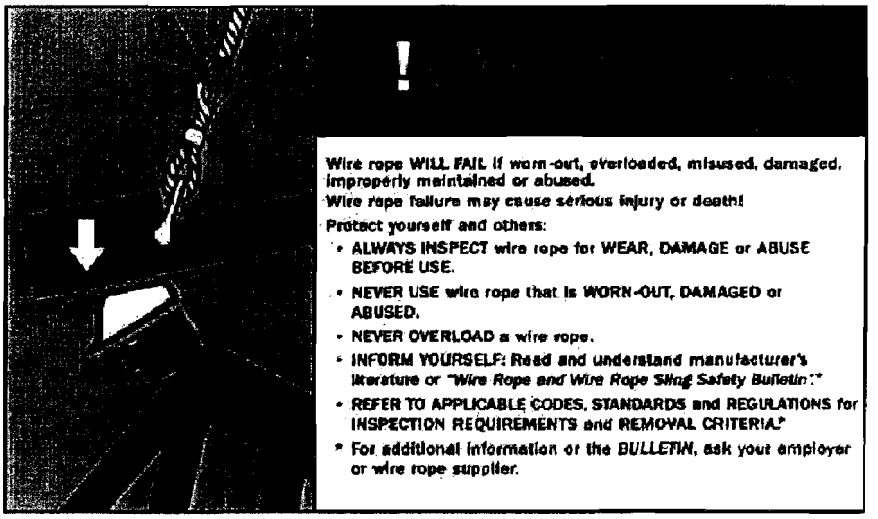


Figure 4.2 – Wire Rope Warning Sign

4.10.2 - Hoist Safety

DANGER!
Drill rig hoists and masts are designed for *vertical* lifting of drilling tools only. Do not attempt to lift something away from the borehole as damage to the cable, sheave, or structural failure may occur.

Listed below are guidelines regarding wire ropes and hoists:

- Replace damaged safety latches on safety hooks before using.
- Always use proper lifting devices.
- Use tool handling hoists only for vertical lifting of tools (except when angle hole drilling).
- Do not use tool handling hoists to pull on objects away from the drill rig, however, drills may be moved using the main hoist of the drill if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.
- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill.
- Do not use hydraulic leveling jacks for added pull to the hoist line or to the feed mechanism of the drill.
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Replace faulty guides and rollers.
- Know the working load of the equipment and rigging being used and the weight of the load being lifted. Never exceed these limits.
- Periodically inspect and test hoist clutches and brakes.
- Know and do not exceed the rated capacity of mast hooks rings, links, swivels, shackles, and other lifting aids.
- Never conduct any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never use a hoist line to ride up the mast of a drill rig.
- The drill rig operator must exercise care to lower the hoist slowly while the drill rod is being carried away from the hole.

4.10.3 - Sheaves

Inspect and lubricate sheave wheels, shafts, and pins often. Use the proper sheave diameter and width to match the hoist line that runs over it.

- Most sheaves on drill rigs are stationary with a single part line.
- Replace worn sheaves or worn sheave bearings.

4.10.4 - Cat Head Safety

The following safety procedures should be employed during cathead operation:

- Only drilling personnel familiar with cathead operation should be allowed to operate equipment.
- Keep the cathead clean and free of rust and oil and grease.
- The cathead should be cleaned with a wire brush if it becomes rusty.
- Check the cathead periodically, when the engine is not running, for rope-wear grooves. If a rope groove forms to a depth greater than 1/8 inch (3 mm), the cathead should be replaced.
- Always use a clean, dry, sound rope. A wet or oily rope may grab the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope grab the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator should also back away and stay clear. If the rope grabs the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator should keep careful watch on the suspended tools and should quickly back away after turning off the engine.
- Do not operate the cathead in rain.
- The rope should always be protected from contact with all chemicals. Chemicals can cause deterioration of the rope that may not be visibly detectable.
- Never wrap the rope from the cathead (or any other rope, wire rope, or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg, or any other part of your body.
- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing, or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.
- Never operate a cathead (or perform any other task around the drill rig) with loose, unbuttoned, or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.
- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.
- When using the cathead and rope for driving or back-driving, verify that all threaded connections are tight and stay as far away as possible from the hammer impact point.
- The cathead operator must be able to operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.
- Never use more wraps of the rope than are required to hoist the load. Extra laps can lead to the rope feeding on to the drum by itself resulting in entanglement.

4.10.4 - Cat Head Safety cont.

- Use extreme caution when returning to the rig and while turning off the engine.

DANGER!

If the cathead rope becomes entangled, immediately release the rope, sound an alarm to notify other personnel in the area, and quickly move a safe distance away from the area in a direction perpendicular to the orientation of the drill rig.

4.11 - Health and Hygiene

4.11.1 - Personal Hygiene Requirements

The Site-Specific HASP should identify exclusion zone requirements and decontamination needs. Often a break area outside the restricted work areas will be established with a hand and face washing facility. Before eating, drinking, or smoking, all employees should thoroughly wash their hands and face. To help limit the potential for ingestion of contaminants, eating, drinking, chewing, or smoking is not allowed when working in the immediate vicinity of the drilling rig or in any restricted work areas (exclusion and decontamination zones).

4.11.2 - Chemical Hazards

- Review material safety data sheets
- Follow manufacturer's instructions for use, handling and storage
- Use recommended protective equipment
- Label all containers

4.11.3 - Dust

- Minimize generation of dust from soil, sand or bentonite.
- Stay out of visible dust clouds.
- Wet materials if necessary to eliminate visible dust.

4.11.4 - Noise

- Wear hearing protection when operating or working near the rig.

4.11.5 - Ambient Air Monitoring

Vapors

Approach areas where vapors are suspected from the upwind direction and stay upwind or crosswind from potential sources of vapors (use flagging, wind socks, or similar devices to indicate wind direction).

4.11.6 - A Sample Hazard Communication and Chemical Safety Program

Attachment 4.A represents a sample hazard communication and chemical safety program document from the fictional MAKEHOLE Drilling Company. It may be used as an example for developing customized plans for environmental remediation drillers.

Safety Sensitive Employees

All safety sensitive employees are *prohibited* from the following conduct:

- **Alcohol**
  - Perform safety sensitive functions while under the influence of alcohol.
  - Operate a commercial vehicle while possessing alcohol. This includes the possession of medicines containing alcohol (prescription or over-the-counter), unless the packaging seal is unbroken.
  - Use alcohol while performing safety-sensitive functions.
  - Perform safety-sensitive functions within four (4) hours after using alcohol.
  - Use alcohol for eight (8) hours after an accident requiring a post-accident alcohol test or until a post-accident is administered, whichever occurs first.
  - Refuse to submit to a post-accident, random, reasonable suspicion, or follow-up alcohol test

- **Drugs or Controlled Substances** (include marijuana, cocaine, amphetamines, opiates and phencyclidines)
  - Perform a safety-sensitive function when the driver uses any controlled substance, except when the use is under the instructions of a physician who has advised the driver that the substance does not adversely affect the driver's ability to safely operate a commercial vehicle.
  - Refuse to submit to a post-accident, random, reasonable suspicion, or follow-up drug test.

NOTE: Any CDL holder who has engaged in prohibited conduct will be immediately removed from the performance of any safety-sensitive function related to a commercial vehicle, including driving, and may not perform any safety-sensitive functions until certain evaluations have been met.

4.12 - Materials Handling

4.12.1 - Proper Lifting

Back injury is a common drilling injury. Improper lifting causes lower-back pain even for those who are strong and in good condition. Almost 65 percent of workers have back pain at some point during their working career.
Think through the process - How can you move the material or equipment and still minimize total weight, distance traveled, and frequency of movement? Be sure of your footing. When possible, let the drill rig do the work or use other mechanical devices to lift and move materials. Ask others to help with awkward or heavy items and equipment. Offer to help someone else with lifting. Stretch and warm-up muscles before lifting. Use proper lifting techniques. Move heavy objects with the aid of handcarts whenever possible.

Proper lifting takes the hazard out of moving heavy objects. Ask someone who knows how to demonstrate the following procedures. Then use them whenever you lift something either at work or at home:

- Establish you can lift the load safely or ask for help
- Use a mechanical lifting device if available
- Inspect route to be traveled making sure of sufficient clearance
- Look for any obstructions or spills
- Inspect the object to decide how it should be grasped
- Look for sharp edges, slivers, or other things that might cause injury
- Do not move any object that will obstruct your field of vision when transporting the load.

Before lifting a relatively heavy object:

1. Approach the object by bending at the knees,
2. Keeping your back vertical and un-arched while obtaining a firm footing.
3. Grasp the object firmly with both hands.
4. Stand slowly and squarely while keeping your back vertical and un-arched.

☑ NOTE: Lift with the muscles in your legs, not the muscles in your lower back. If the object is in excess of 50 pounds, request assistance.

4.12.2 - Heavy Materials, Drums and Containers - Lifting and Moving

- Do not lift or move heavy containers without assistance
- Do not lift or move awkward loads without assistance.
- Use proper bending and lifting techniques by lifting with arms and legs and not with back
- If possible, use powered lift truck, drum cart, or other mechanical means
- Take breaks if feeling faint or overexerted
- Spot drums in storage area prior to filling
- Wear appropriate PPE including leather gloves and steel-toed boots

4.12.3 - Drum Handling

- If a hoist is used to load drums, only lifting attachments specifically designed for drum lifting should be used. Do not use makeshift lifting attachments.
- Use only the proper tools and equipment to move, load or unload drums.
- Drums should be lined with a clear plastic before any material is placed in them.
- All drums should be placed into spill containment basins. If basins are not available, drums should be stored or placed on edge in such a manner as to avoid the accumulation of rainwater on the lids. The exterior of drums should be wiped clean before being stored to eliminate run off contaminants due to rain.
- Use chemical and leather gloves will to protect hands from cuts caused by mill burrs or rough edges.
- Avoid pinching or crushing hands or fingers between other drums or objects while moving.
- Before drums are pulled over on their sides, all caps and bungs should be secured and there should be sufficient clearance for hands and feet.
- When opening closed drums that have been exposed to heat from the sun or other sources, personnel should stand clear and open slowly until any pressure is relieved.
- All fluid and material containers should be clearly labeled to avoid improper use.
- Hazardous materials should be labeled and handled accordingly.
- Hazardous waste drums must be labeled in accordance with applicable federal and state regulations.
- Position hands and fingers to avoid pinching, smashing, or crushing when closing drum rings
- Do not lift or move heavy containers without assistance
- Use proper bending and lifting techniques by lifting with legs and avoid lifting with the back.
- If possible, use powered lift truck, drum cart, or other mechanical means
- Designate an appropriate drum storage area

4.13 - Forklift Operations

NOTE: Do not operate a forklift or any other equipment unless you have completed the appropriate training for that forklift or other equipment. Doing so may be grounds for disciplinary action.

4.13.1 - Forklift and Forktruck Operations

- Only drivers and operators authorized by the employer and trained in the safe operations of industrial trucks and forklifts or industrial tow tractors are permitted to operate such vehicles. Devise methods to train operators in safe operation of powered industrial truck and forklifts.
- Stunt driving and horseplay are prohibited.
- No riders are permitted on vehicles unless provided with adequate riding facilities.
- Employees may not ride on the forks of lift trucks.
- Employees may not place any part of their bodies outside the running lines of an industrial truck and forklift, or between mast uprights or other parts of the truck where shear or crushing hazards exist.
- Employees are not allowed to stand, pass, or work under the elevated portion of any industrial truck and forklift, loaded or empty, unless it is effectively blocked to prevent it from falling.
- Drivers will check the industrial truck and forklift at least once per shift, and if it is found to be unsafe, report the matter immediately to your supervisor. Do not put the vehicle in service again until it has been made safe. Check for the proper functioning of tires, horn, and any other warning devices, lights, battery, controller, brakes, steering mechanism, cooling system, and the lift system for fork lifts (forks, chains, cable, and limit switches).
- No industrial truck and forklift will be operated with a leak in the fuel system.
- Industrial trucks and forklifts will not exceed the authorized or safe speed, always maintaining a safe distance from other vehicles, keeping the truck under positive control at all times and observe all established traffic regulation. For trucks traveling in the same direction, a safe distance may be considered to be approximately 3 truck lengths or preferably a time lapse-3 seconds-passing the same point.
- Do not pass trucks traveling in the same direction at intersections, blind spots, or dangerous locations.
- Slow down and sound the horn at cross aisles and other locations where vision is obstructed. If the load being carried obstructs forward view, travel with the load trailing.
- Look in the direction of travel and do not move a vehicle until certain that all persons are in the clear.
- Industrial trucks and forklifts will not be driven up to anyone standing in front of a bench or other fixed object of such size that the person could be caught between the truck and object.
- Grades will be ascended or descended slowly.
  - When ascending or descending grades in excess of 10 percent, loaded trucks should be driven with the load upgrade.
  - On all grades the load and load engaging means should be tilted back if applicable, and raised only as far as necessary to clear the road surface.
  - Motorized hand and hand-rider trucks should be operated on all grades with the load-engaging means downgrade.
- Carry the forks as low as possible, consistent with safe operations.

4.13 - Forklift Operations cont.

NOTE: When the operator is over 25 feet (7.6 meters) from or out of sight of the industrial truck and forklift, the vehicle is *unattended* and (A) above should apply.

- When leaving a industrial truck or forklift unattended, either:
  - The power will be shut off, brakes set, the mast brought to the vertical position, and forks left in the down position. When left on an incline, block the wheels, or
  - The power may remain on provided the brakes are set, the mast is brought to the vertical position, forks are left in the down position, and the wheels will be blocked, front and rear.
- When the operator of an industrial truck and forklift is dismounted and within 25 feet (7.6 meters) of the truck which remains in the operator's view, the load engaging means will be fully lowered, controls placed in neutral, and the brakes set to prevent movement. Exception: Forks on fork-equipped industrial truck and forklifts may be in the raised position for loading and unloading if the forks are raised no more than 42 inches above the level where the operator and loaders are standing and the power is shut off, controls placed in neutral and the brakes set. If on an incline, the wheels will be blocked.
- Vehicles will not be operated on floors, sidewalk doors, or platforms that will not safely support the loaded vehicle.
- Prior to driving onto trucks, trailers and railroad cars, check their flooring for breaks and other structural weaknesses.
- Cross railroad tracks diagonally, wherever possible. Parking closer than 8 ½ feet from the centerline of railroad tracks is prohibited.
- Do not load trucks in excess of their rated capacity.
- Do not move a loaded vehicle until the load is safe and secure.
- Take extreme care when tilting loads. Tilting forward with the load engaging means elevated is prohibited except when picking up a load. Elevated loads will not be tilted forward except when the load is being deposited onto a storage rack or equivalent. When stacking or tiering, backward tilt will be limited to that necessary to stabilize the load.
- Place the load-engaging device in such a manner that the load will be securely held or supported.
- Take special precautions in securing and handling of loads by trucks equipped with attachments, and during the operation of these trucks after the loads have been removed.

Every employee who operates an industrial truck and forklift will be instructed in the following procedures and in any other practices dictated by the work environment. Such information will be provided at the time of initial employment. Copies of these instructions, printed in a language understood by the majority of the employees, will be conspicuously posted at a place frequented by the drivers.

4.13.2 - Employee Operating Instructions

- Securely fasten your seat belt.
- Where possible, avoid operating the forklift/industrial truck near ditches, embankments, and holes.
- Reduce speed when turning, crossing slopes, and on rough, slick, or muddy surfaces.
- Stay off slopes too steep for safe operation.
- Watch where you are going, especially at row ends, on roads, and around trees.
- Do not permit others to ride.
- Operate the forklift/industrial truck smoothly-no jerky turns, starts, or stops.
- Hitch only to the drawbar and hitch points recommended by forklift manufacturers.
- When forklift is stopped, set brakes securely and use park lock if available.

Every employee who operates an industrial truck or forklift will be required to check the industrial truck or forklift prior to operation each day and if it is unsafe report the matter immediately to a foreman or mechanic and will not use the industrial truck or forklift again until it has been made safe.

Employees are prohibited from stunt driving or horseplay while operating an industrial truck or forklift.

No repairs will be performed on any agricultural or industrial trucks, forklifts or tractors until arrangements have been made to reduce the probability of injury to repairmen or others caused by sudden movement or operation of such equipment or its parts.

4.14 - Fire Protection

4.14.1 - Fire on the Rig

Always carry an approved Class ABC fire extinguisher on the drill rig that meets the requirements of DOT regulation 49 CFR 393.95. The fire extinguisher should be located to permit visual determination of whether it is fully charged and is readily accessible for use

- Learn how to use fire extinguishers and know where they are located on the drilling rig and support vehicles.

- Remember the four letter word *PASS* and the fire is controllable, you can put a fire out successfully.

  P - **PULL** the pin
  A - **AIM at** the base of the fire standing approximately eight feet from the fire
  S - **SQUEEZE** the handle
  S - **SWEEP** the fire by moving the extinguisher back and forth as you aim at the base of the fire until it is out.

- Fire Extinguishers will be inspected monthly for condition and expiration date and tag with the date of annual inspection and inspector's name. If the tag is not located on the extinguisher, replace it with one that is properly tagged.
- Place the fire extinguisher in an easily accessible location within 10 ft of drilling of drilling rig.

4.14.2 - Other Fire and Explosion Precautions

- Do not refuel an engine while it is running or while it is still hot.
  - o Use a funnel when refueling from a can.
  - o No Smoking while handling or dispensing fuels.
  - o Fuels should be handled, transported, and stored in approved, properly marked containers.
  - o Store fuels away from equipment exhaust.
  - o Do not store fuels inside a building.
- Flammable and combustible materials are typically present at drilling sites.
  - o These materials include gasoline, diesel fuel, polyethylene, wood, weeds, and others.
  - o To help prevent these materials from igniting, employees should first and foremost ensure that all sources of ignition (such as matches or lighters) have been identified and maintained at a safe distance from flammable and combustible materials.
- Smoking, open flames, or spark producing equipment should not permitted within 75 feet of drilling rigs, open wells, gasoline-driven pumps, or fuel storage areas.
- Flammable liquids (includes empty and full cans) should not be stored or left within 50 feet of drilling rigs, pumps, or other related machinery.
- Containers used for fuel will be bonded and grounded during dispensing to prevent the discharge of static electricity.
- Safety fuel containers must be returned to a designated safe storage area after fueling is completed.

4.15 - Rig Inspections and Maintenance

Drilling contractors are responsible for maintaining the drilling rig in proper working condition. Conducting routine inspection of the rig and associated support equipment and performing all required maintenance are key components to ensuring proper working condition. Specific items to consider when performing inspection and routine maintenance are discussed in greater detail below.

Inspections

The drilling contractor should inspect the drill rig when it first arrives onsite and at least daily thereafter for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, or damaged pressure gauges and pressure relief valves. Daily inspections should include the following:

- Inspect and test major systems to ensure proper operating condition and to identify signs of excessive wear.
  - o Kill Switches
  - o Protective Guards
  - o Cable Systems
  - o Leveling Jacks and Outriggers
  - o Drill Controls
  - o Hydraulic Lines
  - o Connections, fittings, and valves
  - o Exhaust Systems
  - o Brake Systems
- Immediately notify Senior Driller of any equipment or safety device in need of repair.
- Correct all identified equipment and safety device defects prior to drilling.

4.15 - Rig Inspections and Maintenance cont.

An example checklist is included as Attachment 4.B - *Drill/Direct Push Type Rig Inspection Checklist.*

Maintenance

The drilling contractor should maintain logs, documenting all preventative maintenance performed on a given rig. Any maintenance determined to be necessary once the rig has arrived on location should be completed prior to drilling. Maintenance activities should never be performed while drilling. Specific items to consider when performing maintenance include the following:

General

- Never use gasoline or other flammables to perform cleaning duties around the rig.
- Place all transmissions, gearboxes, hydraulic valves, and hoist levers in neutral before initiating repairs.
- Have all preventative maintenance, or other scheduled maintenance, completed as recommended.
- Shut down the drill rig and remove the positive cable from the battery to clean, repair or lubricate fittings, unless the adjustment requires the rig to be running. The operator and lubricator must coordinate their efforts to successfully perform the maintenance safely.
- While performing maintenance, either remove or tag the key to prevent accidental starting of the rig.
- Apply grease and oil only through oil and grease inlets.

- Always chock wheels, lower leveling jacks, and set hand brakes prior to working under a drill rig.
- Whenever possible, reduce operating systems to a zero energy state, that is, release all pressure from hydraulic, drilling fluid and air pressure systems, prior to performing maintenance. Use extreme caution when opening drain plugs, pressure caps, valves, and removing hoses and hydraulic lines.
- Never weld or cut on or near a fuel tank.
- Replace all caps, plugs, clamps, cables and guards prior to returning the rig to service.
- Never modify any part of the mast without permission from the equipment shop.
- If it should become necessary to drain oil, fuel, hydraulic fluid or any other industrial fluid in the field, never allow the fluid to drain onto the ground. The fluid must be containerized and disposed of in an appropriate manner according to site-specific requirements. Avoid spillage.
- All cab areas should be clean and free of loose materials, equipment, tools, and unsecured personal items.

4.16 - Decontamination

Decontamination procedures are used to remove or neutralize contaminants that have accumulated on personnel, samples, tools or equipment and to ensure the protection of personnel from permeating substances, chemicals, and infectious agents. Decontamination reduces or eliminates transfer of these contaminants to clean areas, prevents the mixing of incompatible substances, and minimizes the likelihood of sample contamination. Various decontamination methods will physically remove, inactivate by chemical detoxification, disinfection, sterilization, or remove contaminants by both physical and chemical means. In many cases, gross contamination can be removed by physical means.

4.16.1 - Typical Cleaning Methods

Typical cleaning methods work by either dissolution or by forcing the contaminant off a surface with pressure. In general, less of the equipment surface is removed using non-abrasive methods.

- High-Pressure Water - using a high-pressure pump, an operator controlled directional nozzle, and high-pressure hose. Operating pressure usually ranges from 340 to 680 psig, which relates to flow rates of 20 to 140 lpm.
- Steam Cleaning - using water delivered at high pressure and high temperature in order to remove accumulated solids or oils.
- Mechanical - using brushes with metal, nylon, or natural bristles or utilizing appropriate tools to scrape, pry, or otherwise remove adhered materials.
- Dissolving - using chemicals to dissolve surface contaminants as long as the solvent is compatible with the equipment and protective clothing. Organic solvents include alcohols, ethers, ketones, aromatics, straight-chain alkanes, and common petroleum products. Halogenated solvents are generally incompatible with protective clothing and are toxic.
- Surfactants reduce adhesion forces between contaminants and the surface being cleaned and prevent reposition of the contaminants. Non-phosphate detergents dissolved in tap water is an acceptable surfactant solution.
- Disinfection and Sterilization - using chemical disinfectants to inactivate infectious agents. Standard sterilization methods are impractical for large equipment and personal protective clothing.

4.16.2 - Personnel and Equipment Decontamination Plan

As part of the site-specific health and safety plan, a personnel and equipment decontamination plan should be developed and set up before any personnel or equipment enters the areas of potential contamination. These plans should include:

- Number and layout of decontamination stations,
- Decontamination equipment needed,
- Appropriate decontamination methods,
- Procedures to prevent contamination of clean areas,
- Methods and procedures to minimize worker contact with contaminants during removal of protective clothing,
- Methods and procedures to prevent cross-contamination of samples and maintain sample integrity and sample custody, and
- Methods for disposal of contaminated clothing, equipment, and solutions.

Revisions to these plans may be necessary for health and safety when the types of protective clothing, site conditions, or on-site hazards are reassessed based on new information.

4.16.3 - Standard Materials and Equipment

The following are standard materials and equipment that may be used as a part of the decontamination process:

- Appropriate protective clothing,
- Air purifying respirator (APR),
- Field log book,
- Non-phosphate detergent,
- Selected high purity, contaminant-free solvents,
- Long-handled brushes,
- Drop cloths (plastic sheeting),
- Trash containers,
- Paper towels,
- Galvanized tubs or equivalent (baby pools),
- Tap water,
- Contaminant-free distilled or deionized water,
- Metal or plastic container for storage and disposal of contaminated wash solutions,
- Pressurized sprayers, water,
- Pressurized sprayers, solvents,
- Trash bags,
- Aluminum foil,
- Sample containers,
- Safety glasses or splash shield, and
- Emergency eyewash bottle.

Specific decontamination materials and equipment will be specified in the site-specific HASP.

4.16.4 - Field Sampling Equipment Cleaning Procedures

The general equipment cleaning steps that may be followed for general field sampling activities are provided below:

1. Physical removal
2. Scrub with non-phosphate detergent plus tap water.
3. Tap water rinse.
4. 10% nitric acid (required during sampling for inorganics only).
5. Distilled or deionized water rinse.
6. Solvent rinse (required during sampling for organics only).
7. Total air dry (required during sampling for organics only).
8. Triple rinse with distilled or deionized water.

4.16.4 - Field Sampling Equipment Cleaning Procedures cont.

This procedure can be expanded to include additional or alternate solvent rinses that will remove specified target compounds if required by site-specific work plans or as directed by a particular client.

Table 4.2 - Decontamination Solvents Table

Solvent	Soluble Contaminants
Water	Low-chain compounds Salts Some organic acids and other polar compounds
Dilute Bases • Detergent • Soap	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents (note: some solvents can degrade or permeate protective clothing) • Alcohols (methanol) • Ethers • Ketones • Aromatics • Straight-chain alkanes (hexane) • Common petroleum products (fuel oil, kerosene)	Non-polar compounds (such as some organic compounds)

Special considerations for solvents:

- Solvent rinses are not necessarily required when organics are not a contaminant of concern.
- An acid rinse is not necessarily required if analysis does not include inorganics.
- Always reference appropriate analytical procedure for specific decontamination solutions required for adequate removal of the contaminants of concern.
- Sampling equipment that requires the use of plastic or Teflon tubing should be disassembled, cleaned, and the tubing replaced with clean tubing, if necessary, before commencement of sampling or between sampling locations.
- The use of distilled or deionized water may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte-free distilled or deionized water.
- The use of an untreated potable water supply may not be an acceptable substitute for tap water.

4.16.5 - Preventing the Spread of Contamination

Several procedures can be established to minimize contact with waste and the potential for contamination including:

- Employing work practices that minimize contact with hazardous substances (avoid areas of obvious contamination, avoid touching potentially hazardous substances),
- A specified area will either be available or can be constructed where fluids generated during decontamination can be captured for disposal.
- Use of remote sampling, handling, and container-opening techniques,
- Covering monitoring and sampling equipment with plastic or other protective material,
- Use of disposable outer garments and disposable sampling equipment with proper containment of these disposable items,
- Use of disposable towels to clean the outer surfaces of sample bottles before and after sample collection, and
- Encasing the source of contaminants with plastic sheeting or over packs.

4.16.6 - Hazards of Decontamination

Due to the presence of water, chemicals, solvents, heat, pressure, and heavy equipment, decontamination activities can be very dangerous. The following are safety items to be considered during equipment decontamination.

Proper procedures for dressing prior to entrance into contaminated areas will minimize the potential for contaminants to bypass the protective clothing. Generally, all fasteners (zippers, buttons, and snaps) should be used, gloves and boots tucked under or over sleeves and pant legs, and all junctures taped, which should be detailed in the site health and safety plan.

- Only properly trained personnel should operate cleaning equipment.
- Use PPE as directed in the health and safety plan, which may include safety glasses with face shield, goggles, poly-coated Tyvek®, aprons, gloves (nitrile, neoprene, or leather), steel toed boots, chemical resistant rubber boots, and respirators to prevent physical contact with potential contaminants and debris.
- Be aware of the slipping hazards of wet or dry plastic inside the decontamination area.
- When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. NEVER use unprotected hands to clean drilling fluids from drill rods.
- Practice good housekeeping at all times, keeping the decontamination area free of slip, trip, or fall hazards.
- Do not allow eating, smoking, drinking, chewing, or any hand-to-mouth contact in decontaminant areas.
- Monitor affects of heat or cold stress or overexertion in the decontamination area.
- Monitor air concentrations using direct-reading, real-time instruments such as organic vapor monitors (OVMs) and Draeger tubes.
- Establish action levels or limits for ambient air concentration, explosive atmosphere, O_2 deficient atmosphere, and make sure these action levels are understood by decontamination personnel.

4.16.6 - Hazards of Decontamination cont.

- Monitor air concentrations using direct-reading, real-time instruments such as OVM and Draeger tubes.
- Upgrade PPE as necessary (safety glasses with splash shields or goggles, respirators, neoprene gloves, and slicker suit or laboratory apron).
- Stay upwind (use flagging or similar device to indicate wind direction)
- Avoid blocking traffic and stay out of the way of drilling activities.
- Set up near a water supply and keep natural drainage in mind to reduce run-off and clean up.
- Position equipment so over-spray does not get on vehicles or private property.
- Allow for adequate ventilation because exhaust fumes can be lethal.
- Do not operate near anything flammable where a spark or open flame could start a fire or explosion.

4.16.7 - Wastewater and Decontamination Fluids

- Reference MSDS of decontamination solutions for incompatibilities with site contaminants, skin or inhalation hazards, or flammable properties.
- Avoid decontamination chemicals/solutions that permeate, degrade, or damage personal protective equipment.
- Adhere to all Federal, State, and local agency laws, codes, and regulations when handling, transporting, and storing of wastewater, drilling fluids and decontamination fluids.
- The material being removed from drill sites must be packaged, moved, stored, treated, and disposed of in a manner that prevents its release into the environment.
- Drums and containers used to transport drilling waste will meet the appropriate US Department of Transportation (DOT), OSHA, and EPA regulations for the materials that they contain. Appropriate manifest and chain of custody documentation should be used and the waste generator should maintain records as required by applicable regulations.
- Drums and containers used to contain and store drilling wastes and other hazardous materials must be appropriately labeled in accordance with federal and state regulations.
- Drums and containers will be inspected as required by regulations.
- Drum and container integrity will be assured prior to being moved.
- If leakage or spillage occurs, it will be cleaned up immediately. If necessary, the waste material will be transferred to another container to minimize leakage and appropriate measures taken to prevent reoccurrence.
- The drums will have exterior contamination removed at the worksite prior to transportation.
- Blocking devices to plug flow paths to create a collection point for filtration and protection of material entering drain inlets or contaminating drill sites are to be used if necessary (such as waddles, sand bags, or plastic dams).

4.16.8 - Steam Cleaning/Pressure Washing

- The steam cleaner flame may not be intrinsically safe.
- Check hose for possible weakness or potential break points prior to use.
- Avoid pointing any cleaning wand toward body and never use steam, high pressure water, or compressed air for the purpose of cleaning clothes because injury can occur from contact with a high-pressure stream, water, or air.
- Be aware of heat and hot water from steam cleaner.
- Burns can occur from contact with hot equipment or water
- Wear appropriate eye protection as foreign objects may enter eyes due to splashing.
- Be aware of slip/trip hazards while walking on wet surfaces.
- Avoid contact of skin with hazardous rinsing agents (solvents or acids)
- Keep hoses, troughs, and support equipment in good condition.
- Do not spray inside vehicle cab.
- Avoid spraying painted surfaces to keep from removing paint.
- When shutting down steam cleaner, press spray gun release lever for two minutes or until cool water flows out
- Drain hoses and debris into storage containers.

4.16.9 - Health and Safety Hazards of Sampling

Soil and groundwater sampling present various hazards. Besides the usual physical hazards of normal drilling activities and hazards that the individual sites pose, chemical, biological, radiological, and explosive hazards are added when drilling and sampling from monitoring wells. Drilling and sampling activities expose workers to various chemicals that were placed in the ground, either accidentally or intentionally and extreme caution must always be taken when performing these activities in areas of known or suspected waste sites. Not only should workers be aware of the hazards that individual chemicals pose, but of the potential effects of mixtures or chemical interactions because the combination of substances at a waste site may have a more powerfully adverse effect on human health than they would individually. Some of the most significant hazards identified when sampling in known or suspected hazardous waste areas are:

- Exposure to chemicals or waste
- Strains
- Sprains
- Cuts
- Pinch points
- Slips trips, falls.

Sampling procedures are highly complex and must be tailored to fit the chemical being monitored, the hydrogeologic situation, and the design of the monitoring wells. Detailed descriptions of groundwater and soil sampling techniques can be found in publications by the Environmental Protection Agency (Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, EPA 542-S-02-001, EPA-540-S-95-504), ASTM (D5088-02), National Ground Water and National Drilling Associations as well as various scientific journals.

4.16.10 – Work Area Monitoring

Before sampling in areas of potential contamination, it is important to understand what potential physical or chemical hazards the site may pose in addition to the chemical hazards of the materials and preservatives being brought onsite for the purpose of sampling. Historical land use, waste manifests, environmental site assessments, surveys, as built drawings or any other historical documentation may be used to help provide site information. Once a site is ready to be sampled or drilled, the real or potential dangers from fire, explosion, airborne contaminants, radiation, or oxygen deficient atmospheres may need to be monitored. The following details hazards and the equipment used to identify those hazards. Action limits should be set prior to entering the field based on the known or suspected contaminants that may be encountered onsite.

- Combustible Gases -- The atmosphere in any location capable of containing or generating a combustible concentration of gases should be monitored with a combustible gas meter. Actions should be taken in response of the meter reaching a defined percentage of the lower explosive limit (LEL); 25% is often used to cause an immediate evacuation of the site.
- Oxygen Deficiency -- A location capable of containing or generating an oxygen deficiency either by depletion or displacement should be monitored with an oxygen meter. Any reading less than 19.5% oxygen will result in the use of self-contained breathing apparatus (SCBA).
- Organic Vapors and Gases -- The atmosphere can be monitored with either a photoionization detector (PID) or a flame ionization detector (FID). When appropriate, cyanide gas and halogenated vapors will also be monitored. Any response above background concentrations may trigger an upgrade in PPE and respiratory protection. In addition, chemical specific Draeger tubes can also be used to identify presence of specific chemicals.

- Inorganic Vapors and Gases -- There are only a few direct reading instruments with the capability to detect and quantify non-specific inorganic vapors and gases. PIDs have a very limited capability in this area. If specific inorganics are known or suspected of being present, an attempt should be made to provide appropriate monitoring if possible. In the absence of a monitoring capability always assume a worse case scenario and upgrade the level of protection to a level that gives respiratory and skin protection that is appropriate to a worse case assumption.
- Radiation - When radiation may be encountered at a site, a Geiger-Mueller detector for beta and gamma radiation should be used to monitor airborne levels.

Hazards

- Explosions from methane gas produced by the decay of organic materials in sanitary landfills. An explosion potential also exists in monitoring work involving hydrocarbon recovery.
- Toxic substances used in manufacturing pesticides, herbicides, solvents, paints, and other common products. Sometimes certain nontoxic chemicals placed in a disposal site will react with other chemicals to produce highly toxic chemicals.
- Biologic wastes from hospitals or medical laboratories at universities that contain bacteria and viruses.
- Chemical wastes that are corrosive, highly reactive, flammable, or explosive.
- Radioactive wastes from hospitals and industrial and university laboratories.
- Before attempting to conduct monitoring work at a waste site, the drilling contractor should learn exactly what types of wastes were handled there, provide the necessary protective clothing and training for personnel, and stress that any physical changes in a worker's health may be caused by contact with the waste. Always be prepared for worst case conditions.

Precautions

The following precautions should be assessed when sampling:

- Maintain good housekeeping practices, store sampling supplies, coolers, tools, and equipment orderly and out of the main traffic area to avoid unnecessary slip, trip, and fall hazards.
- Be aware of the electrical hazards associated with using groundwater-sampling pumps.
- Use ground fault circuit interrupters in wet or moist conditions.
    - Inspect wires for cuts, wearing and fraying. Remove these wires from service and mark DANGER DO NOT USE if faulty.
    - Follow manufacturer's instructions when using generators.
    - Use intrinsically safe electrical equipment in areas suspected to have flammable or explosive hazards.
- Be aware of biological hazards when revisiting wells for sampling. Often wasps, bees, ants, spiders and other insects and animals take up residence inside or around monitoring wells. Be aware of these potential hazards as wells caps are opened.
- Request MSDSs for sample preservatives as well as site constituents. Wear appropriate chemical gloves when handling samples as preservatives often contain acidic or corrosive chemicals.
- When using bailers for groundwater sampling, consider the following:
    - Use caution and proper lifting techniques when utilizing larger bailers as they are extremely heavy and awkward when full of sampling liquid.
    - Use increased level of PPE, Tyvek, respirator (if necessary), goggles, splashguard, gloves, chemical resistant boots, or booties to protect skin and eyes from contact with contaminated liquids.

4.16.10 – Work Area Monitoring cont.

- When moving equipment consider the following:
  - Avoid wearing loose or baggy clothing.
  - Wear appropriate PPE including leather gloves.
  - Wear appropriate PPE including gloves, goggles, Tyvek suit, respirator, rubber boots, or splashguard when handling contaminated materials as detailed in the health and safety plan.
  - Upgrade PPE as site conditions change and additional PPE is warranted.

- When handling sharp sampling tools:
  - Use correct tools for opening soil sleeves.
  - Cut away from body when opening sleeve or cleaning soil cores.
  - Always use a sturdy surface when cutting and handling soil cores.
  - Consider using a carrot peeler or metal putty knife in lieu of knifes while preparing and cutting soil samples.

Avoid sample cross contamination by:

- Decontaminating or disposing of sampling equipment between sampling locations.
- Double-checking sample labels to ensure accuracy and adhesion to containers.

When performing standard penetration test, consider the following:

- Split barrel samplers should be inspected daily for excessive wear to threads or bowing of split-tube halves.
- Keep the ball check free of debris to ensure proper operation.
- Keep hands away from the bottom of the sampler when removing it from, or inserting it into, the casing or augers.
- When using pipe wrenches to disassemble the sampler, put yourself in a stable position, and place hands and fingers such that they will not be smashed between the handle and the ground.
- Inspect 140 lb Safety Hammer daily for cracks or excessive wear to the hammer body, top bail, or threads. Do not hold on to the sampling rods while operating the hammer
- Do not use hands to manipulate the own hole hammer when transferring it to vertical use.
- Inspect inner workings of the automatic hammer regularly and lubricate lifting mechanism(s) often.

When conducting Shelby Tube Sampling, consider the following:

- Use the correct size socket-head bolts.
- Keep the ball check free of debris to ensure proper operation.
- Pull, do not push, the pipe wrench while turning the sampling rods to break the sample free while down hole.
- Do not use the machine to turn the rods.
- Keep hands away from the bottom of the sampler when removing it from, or inserting it into, the casing or augers.
- When removing a tube from the head, do not suspend the sampling rods from a slip ring.

4.16.10 – Work Area Monitoring cont.

Consider the following when using all types of core barrels:

- Use full grip circle wrenches to assemble and disassemble core barrels.
- Keep hands away from the bottom of the core barrel or inner tube when removing it from, or inserting it into, the casing, augers, or drill rods.

When using a sample extruder (hydraulic ram), consider the following:

- There are two extremely dangerous pinch points that can crush or sever extremities.
    - The first pinch point is located at the hydraulic ram, where the ram is inserted into the top of the Shelby tube. This is typically a tight fit and a potential pinch point.
    - The second pinch point area is where the Shelby tubes seats against the front plate.
- The Shelby tube often becomes unseated when retracting the hydraulic ram, which can cause the Shelby tube to be shoved up onto the ram header and split the metal at the top of the tube causing sharp metal fragments to be become high-speed projectiles or for the tube to bend abruptly and hit the person operating the extruder. To prevent this ALWAYS steady the Shelby tube by placing your hand on the mid-portion of the tube while retracting the ram.
- Use proper lifting techniques when moving this equipment.
- Only trained and qualified personnel should operate sample extruders
- Always use side shield safety glasses or goggles when operating the extruder and operate the extruder slowly.
- Be aware of pinch points and keep hands and clothing away from these areas.
- When extruding very moist soils, be aware of formation water spraying from the end of the Shelby tube.
- Inspect hydraulic fluid lines of the hydraulic extruder leading to and from the ram assembly for wear or cuts. If cuts occur, hydraulic fluid could be expelled from a line at high velocity.

SECTION 5 - WELL CONSTRUCTION, DEVELOPMENT, AND ABANDONMENT

5.1 - Introduction

Well construction consists of placing a well screen and casing (riser) into the open borehole. A drawing is provided as Attachment 5.A - *Simplified Well Construction Diagram.* The materials of construction can include screen and blank casing composed of polyvinyl chloride (PVC), low carbon steel, fiberglass, stainless steel, and other more exotic materials. Annular materials such as gravel or filter pack (surrounding the screen), fine sand seal, (above the gravel pack), bentonite pellets, (above the fine sand seal) and a grouting material (impervious materials such as cement or high-solids bentonite grout) are placed in the annulus between the borehole and screen or riser casing, after the screen and casing are installed. Finally a surface completion consisting of a well pad, locking riser and protective bollards are installed to protect the above ground portions of the well.

Well development includes the operations, performed on the constructed well, which mitigate the formation damage caused by the drilling methods. Both chemical and physical techniques can be used during well development operations. Chemical methods include treating the well with specialty chemicals such as polyphosphates, acids and other specific compounds designed to increase the flow from the formation into the well. Physical methods may include, high pressure jetting of water into the well, surging, bailing, swabbing or even the introduction of dry ice or compressed air into the well to create a low pressure environment inside the well screen and casing.

Well abandonment activities are performed on extraction, injection and monitor wells when the well is no longer needed for its intended function. Wells can be abandoned by simply installing and impermeable material (grout) inside of the well, or requirements may dictate that the entire well must be removed from the ground (over drilling).

5.2 - Roles and Responsibilities

In most instances the consultant or owner determines the depth of the well and the precise location of the well materials. The data are then provided to the driller who physically installs the well materials into the borehole. Depending on the contractual arrangements, the driller or owner may purchase the well materials and transport the materials to the actual well site. Well development criteria are also provided to the driller by the owner or consultant. Finally, well abandonment parameters are many times determined by state and local regulations.

5.3 - Personal Protective Equipment (PPE)

The PPE requirements for well construction are similar to the protection worn during the drilling operations. At a minimum the following PPE is required:

- Hard hat
- Steel toed boots
- Gloves
- Safety glasses
- Hearing protection

Additional dermal and respiratory protection is dictated by the site-specific health and safety plan. The field personnel must remember that as the well materials are being added to the borehole, fluids are being displaced and may rise to the ground level in the borehole. Therefore, the PPE should mitigate potential exposure to the contaminants present in the subsurface or ground water.

PPE for well development must also be determined based on the chemicals used for well development and the potential for exposure to contaminated ground water.

5.4 - Waste containment

Two waste streams will be generated during well construction, subsurface materials such as soil and ground water and rubbish including, empty filter pack and cement bags, five gallon pails, boxes and bags from the well screen and casing along with other packing containers.

The soil cuttings and ground water should be contained in the same manner as the material generated during the drilling operations.

The rubbish and trash must be properly controlled in labeled containers during well construction. Placing the material in receptacles as they are used eliminates the potential for slips, trips, and falls caused by personnel movement around the well site.

Well development activities generate a rubbish waste stream (from packaging of the chemicals) and the ground water produced during pumping activities.

5.5 - Traffic

Many times the well is constructed in a high traffic area such as a retail service station. The traffic control plan developed for the drilling operations should also be used for the well construction, development, and abandonment phases of the project.

5.6 - Housekeeping of Bagged Material

Filter pack, transition sand, cement, and high solids bentonite grout are normally packaged in paper bags weighing between 50 lbs and 100 lbs. Many times the bagged material is stored on the project location in inclement weather conditions. Rain and sunlight can and will degrade the packaging material which leads to breakage and spillage of sand, gravel and grout material. Additionally, the bagged material must be stacked in a manner which is safe for personnel moving the sacks.

The following sections detail the steps used in well construction activities along with potential hazards of the operations.

5.7 - Transport Well Materials to Location

Prior to the movement of materials to the well location the following items will need to be considered:

- Distance from supply vehicle to the well location
- Weight, size and length of the materials
- Site terrain and pathways
- Method of movement and equipment to be used

5.7.1 - Well Casing and Annular Materials

Movement of the well casing material (PVC, Stainless) and annular materials (filter pack, seal materials and cement or grout) may involve the use of manual or mechanical handling methods such as:

- Forklift
- Manually (PVC screen and casing, individual bags of gravel, sand and grout)

5.7.2 - Potential Hazards for Moving Well Materials

Potential hazards include:

- Manual lifting of heavy bags and awkward lengths of pipe
- Slips trips and falls
- Pinch points
- Obstructions (overhead and pathway)
- Long lengths of piping
- Traffic

5.8 - Install Screen and Casing

Prior to installation of well screen and casing into the borehole the following items should be considered:

- Type of screen and casing PVC (manual installation) steel and stainless steel (rig installation)
- Weight of casing string (rig capacity)
- Overhead obstructions and clearance
- Connection type (threaded, welded)

Potential Hazards for Screen and Casing Installation include:

- Manual screen slotting
- Manual lifting of awkward lengths or heavy pipe
- Pinch points
- Obstructions (overhead and pathway)
- Connections
    - Torque
    - Pinch Points
    - Pipe length and weight
    - Hand Tools - pipe wrenches

5.9 - Install Annular Materials

Prior to the installation of annular materials the following should be considered:

- Weight of bagged materials (typically 50 - 100 lbs)
- Package shape, bags, pails
- Dust and chemical issues (minimization of dust generation)
- Distance from the staging area or off-load location to the well

Potential Hazards of annular material installation include:

- Silica and other dust (Avoid skin and eye contact; Wear respiratory protection)
- Pressurized lines during grout mixing and placement
- Opening bags
- Knives, box cutters, hammers, screw driver
- Trash obstacles

5.10 - Develop the Well

In most cases, well development activities are performed by a separate rig and crew - not by the drilling rig and crew. Therefore the development rig crew must consider the same operational safety checks as the drilling rig. Refer to previous sections of this guide for information about:

- Pre-Mobilization Tasks
- Traveling to Site
- Confirmation Activities
- Preparation and Set Up
- Moving People and Equipment to Site
- Rig Set Up
- Raising the Mast

Prior to well development the following should be considered:

- Methods
- Physical
    - Swab
    - Bail
    - Airlift
    - Overpump
- Chemical
    - Acid
    - Mud thinners (polyphosphates, liganosulfates)
- Fluid containment - drums tanks
    - Labeling
    - Long term storage
    - Hauling

5.10.1 - Potential Hazards of Well Development

- Pinch points
- Tool lengths
- Moving cables
- Contaminated fluids
- Acids and polyphosphates
- Electricity
- Noise
- Pressurized lines

5.11 - Surface Completion

Prior to well surface completion the following should be considered:

- Type of completion - flush mount, above grade, locking
- Bollard location and clearances

5.11.1 - Potential Hazards of Surface Completion:

- Traffic control
- Mixing concrete
- Heavy vaults and boxes
- Striking underground utilities
- Vault settlement - trip hazard, surface water intrusion

5.12 - Abandoning Wells

Prior to well abandonment the following should be considered:

- Rig mobilization and rig up - from *Section 4 – Drilling Operations*
- Method
    - Over drill
    - Abandon in place

5.12.1 - Potential Hazards of Over Drill

- All previous sections of the guideline apply.

5.12.2 - Potential Hazards of Abandon in Place

- Silica and other dust – Skin and eye contact must be avoided and respiratory protection worn.
- Pressurized lines during grout mixing and placement
- Opening bags – knives, box cutters, hammers, screw drivers may be unsafe if not used properly
- Trash obstacles
- Fluid containment
- All pipe handling safety guidelines apply

Each job location has site-specific parameters that govern the means and methods for well installation, development and abandonment activities. The drilling method and drill rig will dictate the specific hazards involved. Daily tailgate meetings and job safety analysis should be developed for the specific tasks based on the drilling method and rig, type of well materials, or location of material staging area.

Specific job safety analysis for well construction may include:

- Proper lifting techniques
- Loading and unloading of forklift or truck beds
- Hand tool usage
- Drum handling

Attachment 5.B - *Typical Job Safety Analysis for Equipment Loading and Unloading* is included as an example.

REFERENCES AND RESOURCES

- Federal Motor Carrier Safety Regulations Pocketbook
- American Iron and Steel Institute *Wire Rope Users Manual*
- American Public Works Association: http://www.apwa.net/
- Common Ground Alliance: http://www.commongroundalliance.com/
- Gas Utility Manager: http://www.gasindustries.com/
- National Utility Locating Contractors Association: http://www.nulca.org/
- Underground Focus: http://www.undergroundfocus.com/

Code of Safe Drilling Practices, California Dept. of Transportation, Division of Engineering Services, April 30, 2004

Attachment 1.A - Typical Health and Safety Plan (HASP) Organization and Contents

☑ NOTE: The list of topics offered below is presented as an example. It is not comprehensive or intended to be adequate for all project applications and work plans.

MAKEHOLE HEALTH AND SAFETY PLAN - TABLE OF CONTENTS

COVER - REVIEW SIGNATURE PAGE

EMERGENCY CONTACT SHEET

MAP TO HOSPITAL

PROCEDURES FOLLOWING AN INCIDENT

SECTION 1 - INTRODUCTION
- Purpose and Policy
- Organization of This Health and Safety Plan
- Site Description and History
- Scope of Work
- Project Team Organization

SECTION 2 - INCIDENT NOTIFICATION AND REPORTING
- Forms and Procedures

SECTION 3 - HAZARD ANALYSIS
- Hazards Analysis of Work Tasks
- Chemical Hazards
- Physical Hazards
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- Vehicle Operation
- Avoiding Traffic
- Underground and Overhead Utilities
- Trip and Fall
- Fire and Explosion
- Heat Stress
- Cold Related Illness
- Environmental Biological Hazards

SECTION 4 - PERSONNEL PROTECTION AND MONITORING
- Medical Surveillance
- Site-Specific Training
- Personal Protective Equipment and Action Levels
- Monitoring Requirements
- Routine Monitoring
- Oxygen Monitoring

MAKEHOLE HEALTH AND SAFETY PLAN
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Attachment 1.B - Example JSA for Clearance Activities

JOB SAFETY ANALYSIS FORM			
JOB TITLE/TASK: Pre-Ground Disturbance Clearance Activities			
PROJECT ID		PROJECT MANAGER:	
DATE:	REVISION:	HEALTH/SAFETY DIRECTOR:	
RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE): _X_ Safety Glasses w/ Sideshields _X_ Steel-toed Boots _X_ Hard Hat _X_ Nitrile Gloves _X_ Leather Work Gloves _X_ Other _As specified in HASP and JSA Job Step_____			

JOB STEP	POTENTIAL HAZARDS	PREVENTATIVE/CORRECTIVE ACTION	APPLIES TO PROJECT (Y/N)
All Pre-Ground Disturbance Clearance Activities including Site Inspection, Subsurface Features Mark-out, Removal of Surface Cover and Ground Clearance	Slips, Trips, Falls	Keep work area free of excess material and debris	
		Remove all trip hazards by keeping materials/objects organized and out of walkways	
		Keep work surfaces dry when possible	
		Wear appropriate PPE including non-slip rubber boots if working on wet or slick surfaces	
		Install rough work surface covers where possible	
		Stay aware of footing and do not run	
	Heat/Cold Stress	Take breaks if feeling faint or overexerted	
		Consume adequate food/beverages (water, sports drinks)	
		If possible, adjust work schedule to avoid temperature extremes	
	Biological Hazards: Insects, Snakes, Wildlife, Vegetation	Inspect work areas when arrive at site to identify hazard(s)	
		Use insect repellant if observe mosquitoes/gnats	
		Survey site for presence of biological hazards and maintain safe distance	
		Wear appropriate PPE including leather gloves, long sleeves and pants, and snake chaps as warranted by site conditions	
	Traffic (including pedestrian)	Notify attendant or site owner/manager of work activities and location	
		Use cones, signs, flags or other traffic control devices as outlined in the Traffic Control Plan	
		Set up exclusion zone surrounding work area using cones, signs, flags or other traffic control devices	
		Wear appropriate PPE including high visibility clothing such as reflective vest	
		Inspect area behind vehicle prior to backing and use spotter	
	Fire/Explosion	Post No Smoking signs around work area	
		Establish designated smoking area away from work area	

JOB SAFETY ANALYSIS FORM			
JOB TITLE/TASK: Pre-Ground Disturbance Clearance Activities			
PROJECT ID		PROJECT MANAGER:	
DATE:	REVISION:	HEALTH/SAFETY DIRECTOR:	
RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE): _X_ Safety Glasses w/ Sideshields _X_ Steel-toed Boots _X_ Hard Hat _X_ Nitrile Gloves _X_ Leather Work Gloves _X_ Other _As specified in HASP and JSA Job Step_____			

JOB STEP	POTENTIAL HAZARDS	PREVENTATIVE/CORRECTIVE ACTION	APPLIES TO PROJECT (Y/N)
		Ensure type ABC, 20-lb, fully charged fire extinguisher on-site and within inspection period	
		As site conditions/activities warrant, establish Hot Work Permit including air monitoring using direct-reading, real-time instruments such as LEL/O meter	
		Stop work if hazardous conditions (explosive atmosphere) are identified	
Ambient Air Monitoring	Vapors	Approach area where vapors are suspected from upwind direction and stay upwind/crosswind of from potential sources of vapors (use flagging or similar device to indicate wind direction)	
	Ineffective Air Monitoring	Ensure personnel using have been trained on instrument use	
		Calibrate instrument prior to use	
Breaking-Up and Removing Asphalt/ Concrete Cover by Saw Cutting or with Heavy Equipment	Heavy Equipment Movement	Heavy equipment should be equipped with back-up alarm or use horn when backing	
		Do not allow personnel to stand within the swing radius of equipment booms/arms when equipment is in operation	
		Stay clear of operating equipment and heavy equipment when moving	
		When approaching heavy equipment, approach should be made from the front ensuring eye contact is made with operator	
	Suspended Loads	Do not walk under suspended loads	
		Wear appropriate PPE including hard hat	
	Ignition Sources	Ensure electrical equipment properly grounded	
		Apply water as necessary to address surface sparking potential	
		Equip heavy equipment with non-sparking bucket/blade	
	High Noise Levels	Hearing protection required when working around operating equipment if levels are suspected to be >85 dBA (if have to yell to person at a dist of 3 ft to be heard, likely exceeding 85 dBA).	
	Airborne Particulates and Debris	Use water as necessary to control dust in area	
		Wear appropriate PPE including face shield or safety glasses with side shields, dust mask, leather gloves and long sleeves	
	Heavy Material Lifting	Use heavy equipment to lift	
		Do not lift or move heavy materials (greater than 50 lbs) without	

JOB SAFETY ANALYSIS FORM			
JOB TITLE/TASK: Pre-Ground Disturbance Clearance Activities			
PROJECT ID		PROJECT MANAGER:	
DATE:	REVISION:	HEALTH/SAFETY DIRECTOR:	
RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE): _X_ Safety Glasses w/ Sideshields _X_ Steel-toed Boots _X_ Hard Hat _X_ Nitrile Gloves _X_ Leather Work Gloves _X_ Other _As specified in HASP and JSA Job Step_____			

JOB STEP	POTENTIAL HAZARDS	PREVENTATIVE/CORRECTIVE ACTION	APPLIES TO PROJECT (Y/N)
		adequate assistance	
		Bend and lift with legs and arms, keeping back straight	
		Wear appropriate PPE including leather gloves, long sleeves and pants, and steel-toed boots	
	Impact to Subsurface Lines	Ensure all underground features have been identified in area per Subsurface Clearance Protocol (SCP) prior to start of activities	
	Equipment Rollover	If soil appears unstable, the soil should be assessed by a qualified professional engineer to ensure safe conditions with implementation of design control measures prior to start of work	
Soil Clearance using hand tools or heavy equipment (probe, auger, air knife rig, backhoe)	Heavy Equipment Movement	Heavy equipment should be equipped with back-up alarm	
		When approaching heavy equipment, approach should be made from the front ensuring eye contact is made with operator	
	Physical Injury from Managing Equipment	Take breaks if feeling faint or overexerted	
	Ignition Sources	Ensure equipment properly bonded and grounded	
		Use sufficient hose so that equipment does not have to be located in critical zone	
		Apply water as necessary to address sparking potential if equipment comes in contact with rocks/buried objects	
		Equip heavy equipment with non-sparking bucket/blade	
	High Noise Levels	Hearing protection required when working around operating equipment if levels are suspected to be >85 dBA (if have to yell to person at a dist of 3 ft to be heard, likely exceeding 85 dBA).	
	Airborne Debris	Wear appropriate PPE including leather gloves, long sleeves and pants, and face shield or safety glasses with side shields	
	Vapors and Airborne Particulates	Monitor air concentrations using direct-reading, real-time instruments such as OVM and Draeger tubes	
		Stop work if hazardous conditions (explosive atmosphere, O_2 deficient atmosphere) identified until precautions are taken	
		Wear appropriate PPE including dust masks and respirators	
		Stay upwind (use flagging or similar device to indicate wind direction)	
	Impact to	Ensure underground features in area have been identified to extent	

JOB SAFETY ANALYSIS FORM		
JOB TITLE/TASK: Pre-Ground Disturbance Clearance Activities		
PROJECT ID		PROJECT MANAGER:
DATE:	REVISION:	HEALTH/SAFETY DIRECTOR:
RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE): _X_ Safety Glasses w/ Sideshields _X_ Steel-toed Boots _X_ Hard Hat _X_ Nitrile Gloves _X_ Leather Work Gloves _X_ Other _As specified in HASP and JSA Job Step_____		

JOB STEP	POTENTIAL HAZARDS	PREVENTATIVE/CORRECTIVE ACTION	APPLIES TO PROJECT (Y/N)
	Underground Lines/ Tanks	possible per SCP (line locators, drawing review,)	
		Wear insulating gloves or stand on insulating mat when advancing hand tools	
	Open Excavation	Personnel should stay at least two feet away from edge	
		Install orange construction fence or temporary chain link fence around excavated area if to be left unattended	
Solid Waste Management/ Disposal	Vapors and Airborne Particulates	Monitor air concentrations using direct-reading, real-time instruments such as OVM and Draeger tubes	
		Stop work if hazardous conditions (explosive atmosphere, O_2 deficient atmosphere) identified until precautions are taken	
		Wear appropriate PPE including safety glasses with side shields, dust masks and respirators	
		Stay upwind (use flagging or similar device to indicate wind direction)	
	Contaminated Materials and Container Pinch Points	Wear appropriate PPE including nitrile and leather gloves	
		Position hands/fingers to avoid pinching/smashing/crushing when closing drum rings	
	Heavy Materials and Container Lifting/Moving	Do not lift or move heavy containers without assistance	
		Use proper bending/lifting techniques by lifting with arms and legs and not with back	
		If possible, use powered lift truck, drum cart, or other mechanical means to move containers	
		Take breaks if feeling faint or overexerted	
		Spot drums in storage area prior to filling	
		Wear appropriate PPE including leather gloves and steel-toed boots	

Attachment 1.C - Example JSA for Drilling or Boring and Soil Sampling

JOB SAFETY ANALYSIS FORM			
JOB TITLE/TASK: Drilling/Boring and Associated Soil Sampling			
PROJECT ID		PROJECT MANAGER:	
DATE:	REVISION:	HEALTH/SAFETY DIRECTOR:	
RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE): _X_ Safety Glasses w/ Sideshields _X_ Steel-toed Boots _X_ Hard Hat _X_ Nitrile Gloves _X_ Leather Work Gloves _X_ Other __Hearing protection and High Visibility Vest ___X___			

JOB STEP	POTENTIAL HAZARDS	PREVENTATIVE/CORRECTIVE ACTION	APPLIES TO PROJECT (Y/N)
All Drilling/ Boring Activities	Slips, Trips, Falls	Keep work area free of excess material and debris	
		Remove all trip hazards by keeping materials/objects organized and out of walkways	
		Keep work surfaces dry when possible	
		Wear appropriate PPE including non-slip rubber boots if working on wet or slick surfaces	
		Install rough work surface covers where possible	
		Stay aware of footing and do not run	
	Heat/Cold Stress	Take breaks if feeling faint or overexerted	
		Consume adequate food/beverages (water, sports drinks)	
		If possible, adjust work schedule to avoid temperature extremes	
	Biological Hazards: Insects, Snakes, Wildlife, Vegetation	Inspect work areas when arrive at site to identify hazard(s)	
		Use insect repellant if observe mosquitoes/gnats	
		Open enclosures slowly	
		Survey site for presence of biological hazards and maintain safe distance	
		Wear appropriate PPE including leather gloves, long sleeves and pants, and snake chaps as warranted by site conditions	
	Traffic (including pedestrian)	Notify attendant or site owner/manager of work activities and location	
		Use cones, signs, flags or other traffic control devices as outlined in the Traffic Control Plan	
		Set up exclusion zone surrounding work area using cones, signs, flags or other traffic control devices	
		Wear appropriate PPE including high visibility clothing such as reflective vest	
		Inspect area behind vehicle prior to backing and use spotter	
	Fire/ Explosion	Post No Smoking signs around work area	

JOB SAFETY ANALYSIS FORM			
JOB TITLE/TASK: Drilling/Boring and Associated Soil Sampling			
PROJECT ID		PROJECT MANAGER:	
DATE:	REVISION:	HEALTH/SAFETY DIRECTOR:	
RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE): _X_ Safety Glasses w/ Sideshields _X_ Steel-toed Boots _X_ Hard Hat _X_ Nitrile Gloves _X_ Leather Work Gloves _X_ Other __Hearing protection and High Visibility Vest___X____			

JOB STEP	POTENTIAL HAZARDS	PREVENTATIVE/CORRECTIVE ACTION	APPLIES TO PROJECT (Y/N)
		Establish designated smoking area away from work area	
		Ensure type ABC, 20-lb, fully charged fire extinguisher on-site and within inspection period	
		As site conditions/activities warrant, establish Hot Work Permit including air monitoring using direct-reading, real-time instruments such as LEL/ O_2 meter	
		Stop work if hazardous conditions (explosive atmosphere) are identified	
Ambient Air Monitoring	Vapors	Approach area where vapors are suspected from upwind direction and stay upwind/crosswind of from potential sources of vapors (use flagging or similar device to indicate wind direction)	
	Ineffective Air Monitoring	Ensure personnel using have been trained on instrument use	
		Calibrate instrument prior to use	
Concrete Coring	Ignition Sources	Ensure electrical equipment properly grounded	
		Apply water as necessary to address surface sparking potential	
	High Noise Levels	Hearing protection required when working around operating equipment if levels are suspected to be >85 dBA (if have to yell to person at a dist of 3 ft to be heard, likely exceeding 85 dBA).	
	Airborne Particulates and Debris	Use water as necessary to control dust in area	
		Wear appropriate PPE including face shield or safety glasses with side shields, dust mask, leather gloves and long sleeves	
	Sharp Rough Materials	Wear appropriate PPE including leather gloves, long sleeves and pants, and steel-toed boots	
	Impact to Subsurface Lines	Ensure all underground features have been identified in area per SCP prior to start of activities	
Drill Rig Set-Up	Rig Roll Over	Do not move rig with mast raised	
		Cross all hills and obstructions head on	
		Set riggers prior to raising mast	
		If soil appears unstable, the soil should be assessed by a qualified professional engineer to ensure safe conditions with implementation of design control measures prior to start of work	
	Contact with Electric Lines	Position rig to avoid overhead utility lines by distance defined by voltage and local regulations	

JOB SAFETY ANALYSIS FORM			
JOB TITLE/TASK: Drilling/Boring and Associated Soil Sampling			
PROJECT ID		PROJECT MANAGER:	
DATE:	REVISION:	HEALTH/SAFETY DIRECTOR:	
RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE): _X_ Safety Glasses w/ Sideshields _X_ Steel-toed Boots _X_ Hard Hat _X_ Nitrile Gloves _X_ Leather Work Gloves _X_ Other __Hearing protection and High Visibility Vest ___X____			

JOB STEP	POTENTIAL HAZARDS	PREVENTATIVE/CORRECTIVE ACTION	APPLIES TO PROJECT (Y/N)
	and Other Overhead Obstacles	Use a spotter when raising mast to confirm clearance of overhead lines and other obstructions	
	Rig Movement	Heavy equipment should be equipped with back-up alarm or use horn when backing - use spotter when available	
		Stay clear of operating equipment and rig when moving	
	Heavy Equipment Lifting/ Carrying	Use at least 2 people to lift and carry sections, use mechanical lift devices whenever possible, bend and lift with legs and arms, not back	
	Sharp or Elevated Equipment	Wear appropriate PPE including steel-toed safety boots, leather gloves and hard hat	
		Establish communication system between workers involved in moving/attaching sections	
Ground Disturbance: Auger/Boring Advancement	Faulty or Inappropriate Equipment	Qualified driller must inspect drill rig prior to use, if faulty or inappropriate, do not proceed until repaired or replaced	
		Inspect all hand tools prior to use, if faulty or inappropriate, do not proceed until repaired or replaced	
	Moving Equipment	Clear area of obstructions and communicate with all workers involved that drilling is beginning	
		Do not exceed manufacturer's recommended speed, force, torque, or other specifications. and penetrate the ground slowly with hands on the controls for at least the first foot of soil to minimize chance of auger kick-out	
		Stay clear of rotating auger	
		Use long-handled shovel to clear away cuttings when auger has stopped	
		Do not wear loose clothing	
		Wear appropriate PPE including leather gloves and steel-toed boots	
	Suspended Loads	Do not walk under suspended loads	
		When possible, remove overhead hazards promptly	
		Wear appropriate PPE including hard hat and steel-toed boots	
	High Noise Levels	Use hearing protection if within 20 feet of active drill rig	
	Vapors and Airborne	Monitor air concentrations using direct-reading, real-time instruments such as OVM and Draeger tubes	

JOB SAFETY ANALYSIS FORM		
JOB TITLE/TASK: Drilling/Boring and Associated Soil Sampling		
PROJECT ID		PROJECT MANAGER:
DATE:	REVISION:	HEALTH/SAFETY DIRECTOR:
RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE): _X_ Safety Glasses w/ Sideshields _X_ Steel-toed Boots _X_ Hard Hat _X_ Nitrile Gloves _X_ Leather Work Gloves _X_ Other __Hearing protection and High Visibility Vest___X____		

JOB STEP	POTENTIAL HAZARDS	PREVENTATIVE/CORRECTIVE ACTION	APPLIES TO PROJECT (Y/N)
	Particulates	Stop work if hazardous conditions (explosive atmosphere, O_2 deficient atmosphere) identified until precautions are taken	
		Wear appropriate PPE including face shield or safety glasses with side shields, dust masks or respirators, long sleeves and pants	
		Stay upwind (use flagging or similar device to indicate wind direction)	
	Impact to Subsurface Lines/Tanks	Only drill in areas where underground features have been identified and cleared per Subsurface Clearance Protocol (SCP) if hole has to be moved, clear new location first	
		Wear appropriate PPE including insulating gloves or stand on an insulating mat when in contact with drill rig	
		Ensure first aid responders are trained to deal with electric shock and flash burns	
Ground Intrusion: Split Spoon	Faulty Equipment	Inspect rope/cable/rod for wear, fraying, oils and moisture prior to use, do not use if faulty until repaired or replaced	
		Inspect cathead for rust and rope grooves prior to use, do not use if faulty until repaired or replaced	
	Moving Equipment	Do not wrap rope around any part of the hand or body	
		Maintain distance of at least 18-inches from in-running points on running/reciprocating equipment	
		Eliminate excess rope	
		Do not wear loose clothing	
		Wear appropriate PPE including leather gloves	
Soil Sampling	Contaminated Materials	Wear appropriate PPE including Nitrile gloves	
	Sharp Sampling Tools	Use correct tools for opening sleeves	
		When opening sleeve, cut away from body	
		Place soil core on sturdy surface prior to cutting	
	Vapors	Wear appropriate PPE including respirator if conditions warrant	
	Sample Cross Contamination	Decontaminate or dispose of sampling equipment between sampling locations	
		Double-check sample labels to ensure accuracy and adhesion to containers	

JOB SAFETY ANALYSIS FORM			
JOB TITLE/TASK: Drilling/Boring and Associated Soil Sampling			
PROJECT ID		PROJECT MANAGER:	
DATE:	REVISION:	HEALTH/SAFETY DIRECTOR:	
RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE): _X_ Safety Glasses w/ Sideshields _X_ Steel-toed Boots _X_ Hard Hat _X_ Nitrile Gloves _X_ Leather Work Gloves _X_ Other __Hearing protection and High Visibility Vest ___X___			

JOB STEP	POTENTIAL HAZARDS	PREVENTATIVE/CORRECTIVE ACTION	APPLIES TO PROJECT (Y/N)
Solid/Liquid Waste Management/ Disposal	Vapors and Airborne Particulates	Monitor air concentrations using direct-reading, real-time instruments such as OVM and Draeger tubes	
		Stop work if hazardous conditions (explosive atmosphere, O_2 deficient atmosphere) identified until precautions are taken	
		Wear appropriate PPE including safety glasses with side shields, dust masks and respirators	
		Stay upwind (use flagging or similar device to indicate wind direction)	
	Contaminated Materials and Container Pinch Points	Wear appropriate PPE including Nitrile and leather gloves	
		Position hands/fingers to avoid pinching/smashing/crushing when closing drum rings	
	Heavy Materials and Containers Lifting/ Moving	Do not lift or move heavy containers without assistance	
		Use proper bending/lifting techniques by lifting with arms and legs and not with back	
		If possible, use powered lift truck, drum cart, or other mechanical means	
		Take breaks if feeling faint or overexerted	
		Spot drums in storage area prior to filling	
		Wear appropriate PPE including leather gloves and steel-toed boots	

Attachment 3.A - Pre-Mobilization Checklist / Drilling Safety Guidance Document

Check When Completed	Checklist of Items
	Participate in boring, utility, locate and walk site
	Verify equipment needs
	Verify equipment staging area(s)
	Verify sequence of onsite mobilizations
	Service brakes, including trailer brake connections
	Service Parking (hand) brake
	Service Steering mechanism.
	Service Lighting devices and reflectors
	Service Tires
	Service Horn
	Service Windshield wiper or wipers
	Service Rear-vision mirror or mirrors.
	Service Coupling devices
	Inspect the windshield for cracks, repair or replace as necessary
	Verify that an appropriate, permitted fire extinguisher is within the driver's grasp and that the extinguisher is properly secured.
	Verify supply of sufficient flares or reflectors which can be used in the event of a breakdown while on the highway.
	Verify that seat belts are in good working condition.
	Verify all windows function properly. Repair or replace as necessary
	Verify all doors lock and function properly. Repair or replace as necessary.
	Verify back-up alarms are installed and function properly. Repair or replace as necessary.
	Verify that all lug nuts are properly tightened and that the wheels appear to be in good condition. While performing this task, the driver should make certain that the spare tire is in good condition, properly inflated, and that a suitable jack and lug wrench are available.
	Verify the mast, jacks, deck (s), and tools are completely secured prior to moving the vehicle.
	Verify all tool boxes are closed and properly secured.
	Inspect all spools containing wire rope (cable) and verify they are secured and that the cables will not unwind while driving down the road.

Attachment 4.A - Sample Hazard Communication and Chemical Safety Program

MAKEHOLE Drilling Co. - Hazard Communication and Chemical Safety Program

Section 1 - Purpose

This document serves as the MAKEHOLE Drilling Hazard Communication Program. It provides detailed safety guidelines and instructions for receipt, use, and storage of chemicals at our jobsites by employees and subcontractors. Our goal is to provide all employees and affected personnel with the tools, knowledge and information necessary to protect their selves and co-workers from hazards encountered in the work place.

Section 2 - Scope

In general, employees do not handle hazardous chemicals as part of their normal work routine; however, employees work in facilities that manufacture, transport and store hazardous chemicals. Thus management has included a Hazard Communication and Chemical Safety Program for the purpose of MAKEHOLE employee awareness. Employees are instructed not to handle potentially hazardous chemicals and to alert proper facility officials in the event that a substance of unknown origin is spotted. In addition to hazardous substance training and right to know training, employees receive specific awareness training for Asbestos, Benzene, Hydrogen Sulfide and lead exposure.

Section 3 - Regulatory References

This Hazard Communication and Chemical Safety Program is intended to comply with the following OSHA requirements. 29 CFR 1910.1200,

Section 4 - Company Policy

A written Hazard Communication Program shall be developed, implemented and maintained at each work site. Company HS&E manager shall have full authority and responsibility for implementation and execution throughout operations. Business unit managers shall have full authority and responsibility for implementation and execution within their areas of control and senior site supervisors shall have full authority and responsibility for implementation and execution within their areas of control.

- All employees and affected personnel shall receive Hazard Communication and Chemical Safety Program training. In addition, employees and affected personnel shall receive training and information regarding hazardous chemicals and safety precautions specific to their assigned work sites.
- Employees shall not handle potentially hazardous chemicals unless they have been properly trained and instructed to do so.
- Employees shall immediately alert proper facility officials in the event that a substance of unknown origin is spotted.
- Employees shall immediately report all chemical spills, releases or exposures to their immediate supervisor or proper facility official.
- Each company operation and job-site shall establish emergency response and evacuation plans per company Emergency Preparedness Program.
- All containers shall have the appropriate label, tag or marking prominently displayed that indicates the identity, safety and health hazards.
- Each job-site shall have a copy of the Material Safety Data Sheet (MSDS) for each hazardous chemical present.
- A Master Chemical information List (CIL) shall be maintained by Manager of HS&E. Each site-operation

and jobsite may use this master or develop a subset CIL covering chemicals present at those specific jobsites.

- Non-routine tasks shall be evaluated by the Project Supervisor before the task commences, to determine all hazards present.

Section 5 - Responsibilities

- **Management**
  - Business unit managers have full authority and responsibility for the implementation and execution of this Hazard Communication and Chemical Safety Program, within his or her area of control.
  - Ensure compliance with this program.
  - Conduct immediate corrective action for deficiencies found in the program.
  - Maintain an effective Hazard Communication training program.
  - Make this plan available to employees or their designated representative

- **Shipping and Receiving**
  - Ensure all received containers are properly labeled and that labels are not removed or defaced.
  - Ensure all shipped containers are properly labeled
  - Ensure shipping department employees are properly trained in spill response
  - Ensure received Material Safety Data Sheets (MSDS) are properly distributed

- **Purchasing Agent**
  - Obtain, from the manufacturer, MSDS for chemicals purchased from retail sources

- **Safety Manager**
  - Manager of HS&E has full authority and responsibility for the implementation and execution of this Hazard Communication and Chemical Safety Program, company wide.
  - Develop and maintain a list of hazardous chemicals using the identity that is referenced on the MSDS
  - Monitor the effectiveness of the program
  - Conduct annual audit of the program
  - Monitor employee training to ensure effectiveness
  - Keep management informed of necessary changes
  - Ensure MSDSs are available as required
  - Monitor jobsites for proper use, storage and labeling of chemicals

- **Supervisors**
  - The senior site supervisor has full authority and responsibility for the implementation and execution of this Hazard Communication and Chemical Safety Program, within his or her area of control.
  - Comply with all specific requirements of the program
  - Provide specific chemical safety training for assigned employees
  - Ensure chemicals are properly used stored and labeled
  - Ensure only the minimum amount necessary is kept at work stations
  - Ensure up to date MSDS are readily accessible to all employees on all shifts

- **Employees**
  - Comply with chemical safety requirements of this program
  - Report any problems with storage or use of chemicals
  - Immediately report spills of suspected spills of chemicals
  - Use only those chemicals for which they have been trained

- Use chemicals only for specific assigned tasks in the proper manner

- **Subcontractors**
  - Comply with all aspects of this program
  - Coordinate information with the Project Supervisor
  - Ensure Subcontractor employees are properly trained
  - Notify the Project Supervisor before bringing any chemicals into client's property of facilities
  - Monitor and ensure proper storage and use of chemicals by subcontractor employees

Section 6 - HAZCOM Definitions

TERM	DEFINITION
Chemical	Any element, chemical compound, or mixture of elements or compounds.
Combustible liquid	Any liquid having a flash point at or above 100 deg. F (37.8 deg. C), but below 200 deg. F (93.3 deg. C), except any mixture having components with flash points of 200 deg. F (93.3 deg. C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.
Compressed gas	Any compound that exhibits: • A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psig at 70 deg. F. • A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psig at 130 deg. F. regardless of the pressure at 70 deg. F. • A liquid having a vapor pressure exceeding 40 psig at 100 deg. F.
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, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.
Employee	A worker who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies. Workers such as office workers or bank tellers who encounter hazardous chemicals only in non-routine, isolated instances are not covered.
Explosive	A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.
Exposure or exposed	An employee is subjected in the course of employment to a chemical that is a physical or health hazard, and includes potential (incidental or possible) exposure. Subjected in terms of health hazards includes any route of entry (for example, inhalation or ingestion)

TERM	DEFINITION
Flammable	A chemical that falls into one of the following categories: • Aerosol, flammable means an aerosol that yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening, • Gas, flammable means: –) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of thirteen (13) percent by volume or less, or – A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than twelve (12) percent by volume, regardless of the lower limit. • Liquid, flammable means any liquid having a flash point below 100 deg. F., except any mixture having components with flash points of 100 deg. F. or higher, the total of which make up 99 percent or more of the total volume of the mixture. • Solid, flammable means a solid, other than a blasting agent or explosive as defined in 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.
Flash point	The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite.
Hazardous chemical	Any chemical this is a physical hazard or a health hazard.
Hazard warning	Any words, pictures, symbols, or combination appearing on a label or other appropriate form of warning which convey the specific physical and health hazard(s), including target organ effects, of the chemical(s) in the container(s). (See the definitions for *physical hazard* and *health hazard* to determine the hazards which must be covered.)
Health hazard	A chemical for which there is evidence that acute or chronic health effects may occur in exposed employees. The term *health hazard* includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, and neurotoxins, agents which act on the hematopoietic system and agents which damage the lungs, skin, eyes, or mucous membranes.
Identity	Any chemical or common name which is indicated on the material safety data sheet (MSDS) for the chemical. The identity used shall permit cross-references to be made among the required list of hazardous chemicals, the label and the MSDS.
Immediate use	The hazardous chemical shall be 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.

TERM	DEFINITION
Label	Any written, printed, or graphic material displayed on or affixed to containers of hazardous chemicals.
Material Safety Data Sheet (MSDS)	Written or printed material concerning a hazardous chemical which is prepared in accordance with OSHA Standard 1910.1200 requirements.
Mixture	Any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction.
Oxidizer	A chemical other than a blasting agent or explosive as defined in 1910.109(a) that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.
Physical hazard	A chemical that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.
Pyrophoric	A chemical that will ignite spontaneously in air at a temperature of 130 deg. F. or below.
Specific chemical identity	The chemical name, Chemical Abstracts Service (CAS) Registry Number, or any other information that reveals the precise chemical designation of the substance.
Unstable (reactive)	A chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, or temperature.
Use	To package, handle, react, emit, extract, generate as a byproduct, or transfer.
Water-reactive	A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.
Work area	A room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.
Workplace	An establishment, job site, or project, at one geographical location containing one or more work areas.

Section 7 - Hazard Recognition

This Hazard Communication and Chemical Safety Program is primarily a hazard recognition program. Elements such as, product warning labels and material safety data sheets, detailed in the sections that follow provide useful tools and knowledge enabling employees to identify hazardous chemicals in the work place.

7.1 - General Chemical Safety

Assume all chemicals are hazardous. The number of hazardous chemicals and the number of reactions between them is so large that prior knowledge of all potential hazards cannot be assumed. Use chemicals in as small quantities as possible to minimize exposure and reduce possible harmful effects. The following general safety rules shall be observed when working with chemicals:

Read and understand the Material Safety Data Sheets.
Keep the work area clean and orderly.
Use the necessary safety equipment.
Carefully label every container with the identity of its contents and appropriate hazard warnings.
Store incompatible chemicals in separate areas.
Substitute less toxic materials whenever possible.
Limit the volume of volatile or flammable material to the minimum needed for short operation periods.
Provide means of containing the material if equipment or containers should break or spill their contents.

Task Evaluation

Each task that requires the use of chemicals should be evaluated to determine the potential hazards associated with the work. This hazard evaluation or JSA must include the chemical or combination of chemicals that will be used in the work, as well as other materials that will be used near the work.

Chemical Storage

The separation of chemicals (solids or liquids) during storage is necessary to reduce the possibility of unwanted chemical reactions caused by incidental mixing. Explosives should be stored separately outdoors. Use either distance or barriers (trays) to isolate chemicals into the following groups:

- Flammable Liquids - store in approved flammable storage lockers.
- Acids - treat as flammable liquids
- Bases - do not store bases with acids or any other material
- Other liquids - ensure other liquids are not incompatible with any other chemical in the same storage location.
- Restraints and Containment - Lips, strips, or bars are to be installed across the width of storage shelves to restrain the chemicals in case of earthquake or unexpected shock.
- Chemicals shall not be stored in the same refrigerator used for food storage. Refrigerators used for storing chemicals must be appropriately identified by a label on the door.

Container Labels

It is extremely important that all containers of chemicals are properly labeled. This includes every type of container from a 5000 gallon storage tank to a spray bottle of degreaser. The following requirements apply:

- All containers shall have the appropriate label, tag or marking prominently displayed that indicates the identity, safety, and health hazards. The name and address of the manufacturer or importer must also be provided.
- Portable containers which contain a small amount of chemical need not be labeled if they are used immediately that shift, but must be under the strict control of the employee using the product.
- All warning labels, tags, and markings must be maintained in a legible condition and not be defaced or removed. Facility weekly supervisor inspections shall check for compliance of this rule.

- Incoming chemicals are to be checked for proper labeling. The symbol below is an example of labeling used to rate the hazard of products in storage tanks. It is a National Fire Protection Association (NFPA) standard. Each square contains a number based upon the accompanying table.

7.2 - Rating Summary

Chemical (Blue)
4 - **Danger** - May be fatal on short exposure. Specialized protective equipment required
3 - **Warning** - Corrosive or toxic. Avoid skin contact or inhalation
2 - **Warning** - May be harmful if inhaled or absorbed
1 - **Caution** - May be irritating
0 - No unusual hazard

Flammability (Red)
4 - **Danger** Flammable gas or extremely flammable liquid
3 - **Warning** Flammable liquid flash point below 100° F
2 - **Caution** Combustible liquid flash point of 100° to 200° F
1 - Combustible if heated
0 - Not combustible

Reactivity (Yellow)
4 - **Danger** Explosive material at room temperature
3 - **Danger** May be explosive if shocked, heated under confinement or mixed with water
2 - **Warning** Unstable or may react violently if mixed with water
1 - **Caution** May react if heated or mixed with water but not violently
0 - **Stable** Not reactive when mixed with water

Special Notice Key (White)
W - Water Reactive
Oxy - Oxidizing Agent

Section 8 - Emergencies and Spills

Each operation and job-site shall establish emergency response and evacuation plans per company Emergency Preparedness Program. The required emergency response and evacuation plans shall include the following elements:

8.1 - Environmental Response Plan

Each location shall have an Environmental Response Plan that includes the following:

- Instructions on how to report an environmental spill.
- Location and phone number of the local company approved spill response contractor.
- In case of an emergency, implement the proper Emergency Action Plan:
    - Evacuate people from the area.
    - Isolate the area.
- If the material is flammable, turn off ignition and heat sources.
- Only personnel specifically trained in emergency response are permitted to participate in chemical emergency procedures beyond those required to evacuate the area.
- Call for Emergency Response Team assistance if required.

8.2 - Emergency Evacuation Plan (Fires and Other Emergencies)

Each location where personnel occupy a building shall have a Building Emergency Evacuation Plan that indicates the following:

- Instructions on how to report a fire or other emergency.
- A floor plan indicting each room, the available exits, fire extinguisher locations, fire alarms, evacuation route(s).
- A designated assembly point.
- Main electrical disconnects, main gas supply and water shut off valves, and hazardous material storage locations (for solvents, paints, fuels, pesticides - indicate quantities).

Each location where personnel are assigned to a client's facility shall have a Job Site Evacuation Plan that includes the following:

- Instructions on how to report a fire or other emergency.
- The alarm signal(s) and the all clear signal for the facility and the immediate work area.
- A site plan that indicates a primary and a secondary evacuation route, an assembly point, the location of fire alarms, fire extinguishers, and safety showers.
- Communication network to keep employees and supervising business unit appraised of job site status.
- Spills - Chemical spill or release reporting criteria varies by agency and type of spill.

Section 9 - Housekeeping

Housekeeping is a fundamental part of all safety programs but caution must be exercised not to create additional or more serious hazards by improperly handling, storing, and disposing of chemicals in the interest of housekeeping. The following housekeeping rules shall apply with regard to hazardous chemicals:

Maintain the smallest possible inventory of chemicals to meet immediate needs.
Periodically review stock of chemicals on hand.
Ensure that storage areas, or equipment containing large quantities of chemicals, are secure from incidental spills.
Rinse emptied bottles that contain acids or inflammable solvents before disposal.
Recycle unused laboratory chemicals wherever possible.
DO NOT Place hazardous chemicals in salvage or garbage receptacles.
DO NOT Pour chemicals onto the ground.
DO NOT Dispose of chemicals through the storm drain system.
DO NOT Dispose of highly toxic, malodorous chemicals down sinks or sewer drains.

Section 10 - Hazard Communication Program and Procedure

10.1 - Hazard Communication Plan

This written Hazard Communication Plan (HAZCOM) has been developed based on the OSHA Hazard Communication Standard and consists of the following elements:

Written Hazard Communication Program
Identification of Hazardous Materials
Product Warning Labels
Material Safety Data Sheets (MSDS)
Effective Employee Training

Multiple Jobsites

Each jobsite shall have a copy of the Hazard Communication Program, a list of all hazardous chemicals in company possession and a MSDS for each of those chemicals. In the event that crews are working in various locations, a primary location shall be designated for the location of the hazardous chemical information. In the event multiple jobsites are too remote to designate a primary location and still have timely and effective access to the information, a copy shall be carried with the crew. The onsite supervisor is responsible for notifying the client and other contractors of the particular hazardous chemicals used in our company's scope of work and obtaining the information from the client and other contractors regarding the hazardous chemicals that may be encountered in the work area.

Non-Routine Tasks are defined as working on, near, or with unlabeled piping, unlabeled containers of an unknown substance, confined space entry where a hazardous substance may be present and a one-time task using a hazardous substance differently than intended (example: using a solvent to remove stains from tile floors).

Steps for Non-Routine Tasks

Step 1: Hazard Determination
Step 2: Determine Precautions
Step 3: Specific Training and Documentation
Step 4: Perform Task

All non-routine tasks shall be evaluated by the Project Supervisor before the task commences, to determine all hazards present. Once the hazard determination is made, the Project Supervisor shall determine the necessary precautions needed to either remove the hazard, change to a non-hazard, or protect from the hazard (use of personal protective equipment) to safeguard the Employees present. In addition, the Project Supervisor shall provide specific safety training for Employees present or affected.

Subcontractors

All subcontractors working under our companies control are required to follow the requirements of this program. We shall provide subcontractors information concerning:

Location of MSDS
Precautions to be taken to protect subcontractor employees
Potential exposure to hazardous substances
Chemicals used in or stored in areas where they will be working
Location and availability of Material Safety Data Sheets
Recommended Personal Protective Equipment
Labeling system for chemicals

Multiple Employer Worksites

As industrial contractor company employees will often be assigned to jobsites where employees from multiple companies are working together or in close proximity. Many of these jobsites may have hazardous materials present, either being used by other employers, stored or transported through the area. In these facilities, jobsites or work areas where this company is a subcontractor or does not have total control of the procedures being used, company supervision shall identify and communicate to all employees in his or her area of control the following:

Methods of supplying or locations of MSDS provided by the primary employer or organization in control of the facility or worksite.
Methods the primary employer or organization in control of the facility or worksite will use to inform other employers and their employees of any precautionary measures required to protect employees during normal operations and emergencies.
Methods of notification, labeling, or warnings used by the primary employer or organization in control of the facility or worksite to inform other employers and their employees of material hazards in the work area.

Non-English Speaking Employees

Where non-English speaking employees are exposed to material hazards, a method, or methods shall be employed to communicate hazardous material information to these employees in their own language.

10.2 - Identification of Hazardous Materials

Some chemicals are explosive, corrosive, flammable, or toxic. Other chemicals are relatively safe to use and store but may become dangerous when they interact with other substances. To avoid injury and property damage, persons who handle chemicals in any area must understand the hazardous properties of the chemicals. Before using a specific chemical, safe handling methods and health hazards must always be reviewed. Supervisors are responsible for ensuring that the equipment needed to work safely with chemicals is accessible and maintained for all employees on all shifts.

10.3 - Product Warning Labels

In addition to the National Fire Protection Association (NFPA) standard illustrated in section 8.4 above, there are numerous other types of labeling schemes in use. Most combine symbols with text to communicate the hazards involved. Some even identify specific PPE requirements, body organs at risk if exposed, and emergency procedures.

10.4 - Chemical Information List and Material Safety Data Sheets

Chemical information List (CIL) is the list of all hazardous substances in a specific location. Every substance on the CIL shall have a Material Safety Data Sheet (MSDS) on file at the jobsite or local project/business unit office. Each supervisor is required to maintain a list such as this and forward copies of the added product MSDS to the Safety Manager for addition to the master Chemical Information List.

Chemical Information List by Product Name (*partial example*)

PRODUCT NAME	COMMON NAME	MANUFACTURER	MSDS CODE
2-26 Aerosol	2-26	CRC Industries	# 36001
40-600 Moisture Displacer	Moisture Displacer	Ideal Industries Lab	# 36660
40-620 HD Electric Motor Cleaner	Motor Cleaner	Ideal Industries Lab	# 36544
40-625 Red Insulating Varnish,	Varnish Ideal	Industries Lab	# 43145
40-630 Zinc Cold Galvanize	Cold Galv	Ideal Industries Lab	# 42282
40-680 All Purpose Cutting Oil	Cutting Oil	Ideal Industries Lab	# 38207
40-685 Penetrating Oil	Penetrating Oil	Ideal Industries Lab	# 26438
40-690 Gray Electric Equipment Paint	Gray Paint	Ideal Industries Lab	# 47720
40-695 Hand Cleaner	Hand Cleaner	Ideal Industries Lab	# 47237
40-700 Hornet/ Wasp Spray	Wasp Spray	Ideal Industries Lab	# 43821
40-705 Switch and Contact Cleaner	Contact Cleaner	Ideal Industries Lab	# 32850
40-705 Switch and Contact Cleaner With Lubricant	Contact Cleaner	Ideal Industries Lab	# 46498
40-720 Fluorescent Orange Marking Paint	Orange Paint	Ideal Industries Lab	# 45790
40-725 Cable Cleaner	Cable Cleaner	Ideal Industries Lab	# 36363

Material Safety Data Sheet (MSDS) Information

Each job-site shall have a copy of the Material Safety Data Sheet (MSDS) for each hazardous chemical present. A Material Safety Data Sheet, often referred to by its acronym MSDS, is a detailed informational document prepared by the manufacturer or importer of a hazardous chemical which describes the physical and chemical properties of the product. Information included in a Material Safety Data Sheet aids in the selection of safe products, helps employers and employees understand the potential health and physical hazards of a chemical and describes how to respond effectively to exposure situations. The employee responsible for the purchase of all hazardous chemicals is also responsible for obtaining the MSDS for those chemicals from the supplier and forwarding a copy to the Safety Manager. The Safety Manager shall add the chemical to the hazardous chemical list and forward copies to the onsite supervisors to update the worksite MSDS binder. The format of a Material Safety Data Sheet may vary but there is specific information that must be included in each sheet. It is useful to review this information to increase your ability to use a Material Safety Data Sheet. All Material Safety Data Sheets should include the following information:

Section 1: Chemical Product and Company Information - provides the chemical name on the label to the MSDS. Also listed is the name, address and the phone number of the company, manufacturer, or distributor who provides the chemical.

Section 2: Composition and Ingredients - identifies all hazardous ingredients, OSHA permissible exposure limits (PEL) and ACGIH (American Conference of Governmental Industrial Hygienists) Threshold Limit Values (TLV).

Section 3: Hazard Identification - information about the health effects of exposure. Description of the material appearance, potential symptoms and health effects, routes of entry and target organs.

Section 4: First Aid - Provides first aid procedures for each route of entry.

Section 5: Fire-Fighting - information on the explosive and fire properties, extinguishing agents and items and general fire-fighting information.

Section 6: Accidental Release - information on material spill response, containment and required spill response PPE.

Section 7: Handling and Storage - information about chemical storage and handling and measures to prevent over-exposure.

Section 8: Exposure Controls and Personal Protection - engineering controls and personal protective equipment to reduce chemical exposure.

Section 9: Physical and Chemical Properties - this section tells about the physical and chemical properties of the chemical. Characteristics include appearance, odor, physical state, pH, vapor pressure, vapor density, boiling point, freezing point, melting point, solubility in water and specific gravity or density.

Section 10: Stability and Reactivity - all potentially hazardous chemical reactions are identified in this section, including information on chemical stability, conditions to avoid, incompatibility, hazardous decomposition and hazardous polymerization.

Section 11: Toxicological Information - provides information such as acute data, carcinogen potential, reproductive effects, target organ effects, and other physiological aspects.

Section 12: Ecological Information - information concerning the environmental impact if a chemical is released into the environment.

Section 13: Disposal Considerations - information concerning proper chemical disposal, recycling and reclamation.

Section 14: Transport Information - shipping information includes the hazardous materials description, hazard class and the identification number (UN or NA numbers).

Section 15: Regulatory Information - provides information about applicable federal regulations. Examples include OSHA, TSCA (Toxic Substance Control Act), CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act), SARA Title III (Superfund Amendments and Reauthorization Act).

Section 16: Additional Information - provides other information about the chemical such as hazard ratings, preparation, and revisions of the MSDS, and label information. Manufacturers may withhold certain information as proprietary (such as hazardous ingredients) on a Material Safety Data Sheet if the information is considered a trade secret.

10.5 - Effective Training

All affected employees shall receive Hazard Communication and Chemical Safety Program training. In addition, employees shall receive training and information regarding hazardous chemicals and safety precautions specific to their assigned work sites.

Training Content

All new and affected employees shall receive safety orientation training covering the elements of the HAZCOM and Chemical Safety Program. This training shall consist of the following:

- Requirements of OSHA's standard 29 CFR 1910.1200.
- Detailed review of the Hazard Communication and Chemical Safety Program
- Location and availability of the written Hazard Communication Program
- Location and availability of the List of Chemicals used in the workplace
- Methods and observation used to detect the presence or release of a hazardous chemical in the workplace.
- The specific physical and health hazard of all chemicals in the workplace
- Specific control measures for protection from physical or health hazards
- Explanation of the chemical labeling system
- Location and use of MSDS
- Locations and operations in their work area where hazardous chemicals are present

Job Specific Training

Employees shall receive on the job training from their supervisor. This training shall cover the proper use, inspection, and storage of necessary personal protective equipment and chemical safety training for the specific chemicals they will be using or will be working around.

Personnel Training

All company personnel shall be trained in Hazard Communication and Chemical Safety Awareness.

Training Frequency

Hazard Communication and Chemical Safety Program training and re-training shall be provided as follows:

- **Initially** - on hire or upon assignment to tasks or locations where hazardous chemicals are used, stored or may present in some manner. Hazard Communication and Chemical Safety Awareness training shall be included in the Short Service Employee Program and shall be covered in first 180 days of service or prior to new employees assignment to locations where hazardous chemicals are used.
- **Annually** - prior to anniversary of pervious training. Hazard Communication and Chemical Safety Awareness training shall also be refreshed annually as part of the Toolbox Safety Meeting Program
- **Upon changes** - in the Hazard Communication and Chemical Safety Program.
- **Introduction of new hazards** - Whenever a new chemical, physical, or health hazard is introduced to the work site that has not been effectively covered by previous training.
- **Immediate On-the-Spot Training** - This training shall be conducted by supervisors for any employee that requests additional information or exhibits a lack of understanding of the safety requirements.

Section 11 - Reporting and Recordkeeping

Training - All training shall be recorded.

Reports

- All exposure incidents shall be reported.
  - Incident/Accident Report
  - All exposure events resulting in injury, illness or loss of consciousness of an employee shall be recorded as Incidents on an Incident/Accident Report.
- Spills
  - Spills or releases that meet the following criteria shall be recorded as Incidents on an Incident/Accident Report
  - Oil based fluids spilled on land or water in excess of five (5) gallons
  - Chemical based fluids or products spilled on land or water in excess of (5) gallons or five (50) pounds whichever is less.
- Near Miss Reports
  - Failures in containment, control methods, or isolation, not resulting in employee injury, illness, or exposure, shall be recorded as near miss events on a Near Miss Report.

Record Control and Retention

Records associated with this program shall be handled in the following manner:

Custodian - Manager of HS&E shall be the custodian of the Master Chemical Information List (CIL) required by OSHA's 29 CFR 1910.1200.

Incident/Accident records - shall be handled per the Incident Reporting and Record Keeping Program.

Availability - A copy of this plan shall be made available, upon request, to all by the employee, and the required OSHA officials.

END

Attachment 4.B - Drill/Direct Push Type Rig Inspection Checklist

SITE/PROJECT NAME: _____
RIG INSPECTOR (NAME/CO.): _____
RIG INFORMATION:

Rig Type: Rotary/Auger Drilling Rig ☐ Direct Push Type (DPT) ☐
Owner: _____
Yr/Make: _____
Model: _____
VIN #: _____
Mileage: _____
Drill Hrs: _____

Inspector to initial columns below as appropriate

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
Emergency Switches	Kill switches are located and accessible to workers on both sides of the rotating stem. **NOTE:** Location and number of switches depend on the rig manufacturer, please refer to owner's manual (DPT typically has one switch on control panel).				
	Kill switches installed by the manufacturer are verified to be in operable condition and all workers are familiar with the location and operation of these switches. **NEVER BYPASS, DISABLE, OR REMOVE KILL DEVICES.**				
Protective Guards	Drive shafts, belts, chain drives, and universal joints are guarded to prevent accidental insertion of hands, fingers, or tools.				
Cables	Cables on drill rig are free of kinks, frayed wires, birdcages, flat spots, grease, and worn or missing sections.				
	Cables are terminated at the working end with a proper eye splice; either swaged, coupled, or using cable clamps.				
	Cable clamps are installed with the saddle on the live or load side. Clamps are not alternated and are of the correct size and number for the cable size.				
	Wire ropes are not allowed to bend around sharp edges without cushion material.				
Pulleys	Pulleys are not to be bent, cracked, or broken.				
	Pulleys operate smoothly and freely, without resistance.				
Cable Winches	Motor is mounted in correct location and tightly secured to drill rig.				
	Winch is capable of being placed in the free spool (unwind smoothly) and locked position correctly, demonstrating that the cable is suitable for lifting during drilling operations.				
Safety Latches	Hooks installed on hoist cables are the safety type with a functional latch to prevent accidental separation.				
	Safety latches are functional and completely span the entire throat of the hook and have positive action to close the throat except when manually displaced for connecting or disconnecting a load.				
Flights/Augers	Flights/Augers should not be bent, cracked, or broken. **NOTE:** Flights/Augers failing inspection must be removed from jobsite.				
	Flights should be blunt to prevent the risks of cuts.				
	Auger keys should not be bent, have any cracks/fractures, be excessively worn, or otherwise damaged.				
	Auger bolt holes and threads should not be damaged.				

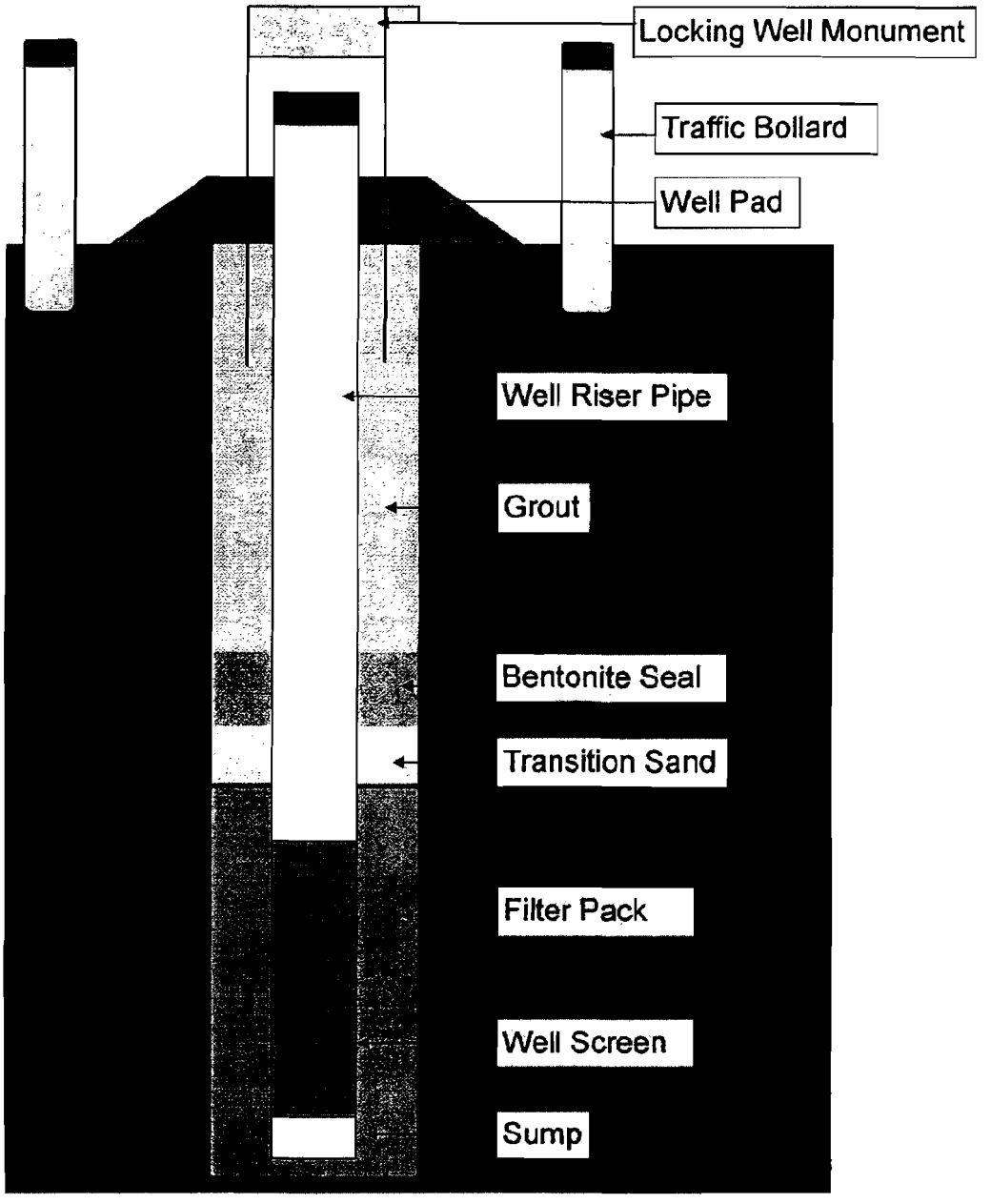
CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
Flights/Augers (cont.)	Inspect flights/augers for metal burrs. **NOTE:** Burrs must be filed to flat surface.				
	Avoid stacking augers; all should lay flat on ground.				
	Avoid manually lifting/moving augers. Should be lifted/moved with cable lines, or, at a minimum, by two persons.				
Drill String	Drill string should not be bent or have any cracks/fractures.				
	Drill string connecting pins should not be bent, have any cracks/fractures, or be excessively worn.				
Mast	Mast is free of bends, cracks, or broken sections.				
	All mounting hardware (pins, bolts, etc.) should be in place.				
	No moving of drill rig while mast is in vertical position.				
	Maintenance/repairs to be performed on mast only in horizontal position.				
Hammering Device	Hammer free of cracks, fatigue, or other signs of excessive wear.				
	Hammer connections are secure.				
Leveling Devices	Outriggers move in/out and up/down smoothly and freely while using controls on drill rig, with no hydraulic leaks.				
	Outriggers are extended prior to and whenever the mast is raised off its cradle. Outriggers must maintain pressure to continuously support and stabilize the drill rig (even while unattended).				
	Outriggers are properly supported on the ground surface to prevent settling into the soil (use of outrigger support pads).				
Controls	Controls are intact, properly labeled, have freedom of movement, and have no loose wiring or connections.				
	Controls are not blocked or locked into an operating position.				
	Installed lights, signals, gauges, and alarms operate properly.				
Lifting Devices	Slings, chokers, and lifting devices are inspected before using and are in proper working order. **NOTE:** Damaged units are to be labeled and removed from jobsite.				
	Shackles/Clevises are in proper working order with pins/ screws in place that is to be used while lifting.				
	Cables and lifting devices are not operated erratically or with a jerking action to overcome resistance.				
Hydraulic System	Hydraulic lines are secure, in good condition with no signs of excessive wear, and not leaking. **NOTE:** Check while pressurized.				
	Hydraulic lines are not in a bent or pinched position causing additional fluid restrictions/pressures.				
	Hydraulic oil reservoir has appropriate amount of oil and not leaking.				
	Documentation available to confirm that pressure relief valve was checked during shop maintenance activity and noted on maintenance log.				
Pump Lines (water, grout, etc.)	Suction/Discharge hoses, pipes, valves, and fittings are secured and not leaking.				
	High pressure hoses have a safety chain, cable, or strap at each end to prevent whipping in the event of a failure.				
Fire Prevention	A fire extinguisher of appropriate size is located on drill rig and readily available/accessible for drilling crew (recommended 20 lb.).				
	Documentation available to confirm that the drilling crew has received training on proper use of fire extinguishers.				
Ladders	Drill rig has a permanently attached or proper portable ladder to be used for access to drilling platform.				
Tracks	Tracks on rig are not excessively worn and free of any debris or foreign material.				

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
General	Drill rig meets regulations for transport on state/federal highways (inspection sticker, license plate, etc.).				
	Documentation available to verify that rig was inspected prior to arriving at ExxonMobil job sites.				
	Does the rig size meet job requirements?				
	Maintenance log available for previous 3 months to confirm proper maintenance/inspection.				
Exhaust	Exhaust system should be free from defect and routes engine exhaust away from drill rig workers.				
Fuels	Fuel stored in an approved and properly labeled container.				
	Fuel transfer lines free from signs of excessive wear and not leaking.				
	Refueling and transferring of fuel is performed in an approved area with sufficient containment to prevent spillage.				
Exclusion/ Work Zones	The exclusion/work zone is centered over the borehole and the radius equal to or greater than the height of the mast (measured from ground level).				
	The exclusion/work zone should be clear of tripping hazards.				
Overhead Obstructions	Except where electrical distribution and transmission lines have been de-energized and visibly grounded, drill rigs will be operated proximate to under, by, or near power lines in accordance with the following: * 50 KV or less - minimum clearance of 10 feet * 50 KV or greater - add 0.4 inches for every KV over 50 KV * If voltage is unknown, maintain at least 20 feet of clearance.				
	While the rig is in transit, clearance from energized power lines will be maintained as follows: * Less than 50 KV - 4 feet * 50 thru 365 KV - 10 feet * 366 thru 720 KV - 16 feet				
Rig Repairs	Repairs, when possible, are conducted offsite to reduce the risk of any onsite incidents.				
Specialized PPE	When working at elevated heights, workers are to wear a fall restraining device attached in a manner to restrict fall to less than six feet.				
	When working in wet/slippery conditions, all workers have a lug-type sole or similar slip resistant sole, on their safety footwear to prevent slipping.				

RECOMMENDED SPARE PARTS OR ITEMS TO BE SENT WITH DRILL CREW

DRILL RIG	DPT RIG
Emergency Switch	Emergency Switch
Drive Coupling	Drive Caps
Shear pins/keys (for drive coupling)	Cutter Head
Pump Packing	Pull Cap
Pump Hoses	Liner Cutter
Auger Bolts	Rod to Cap Pins
Rod to cap pins	Liner Holder (used while cutting)
Cutter Head	Spill Kit (5 gal. Bucket with oil dry and absorbent pads)
Safety Latches, Hooks, Clamps	
Split Spoon Cutter Head	
Spill Kit (5 gal. bucket with oil dry and absorbent pads)	

Attachment 5.A - Simplified Well Construction Diagram



Attachment 5.B - Typical Job Safety Analysis for Equipment Loading and Unloading

Job Being Analyzed:	LOADING AND UNLOADING BACKHOE/FORKLIFT	Date Started:	

Instructions: load and unload in dry even area. Watch for lift sliding on ramps, to close to the side, lift in right gear

FLAT AND LEVEL WORK

STEPS	HAZARDS	PREVENTION
1. Check area for hazards	Uneven ground, wet obstruction	Park on dry flat area with nothing in the way
2. Try to have a spotter	Vision not being able to see where you are	Spotter - to check closeness to sides and ramp
3. Verify truck is in gear with brake on and wheels chalked	Truck and trailer could move when loading or unloading	Leave in gear, brake on and wheels chalked
4. Check hitch	Hitch coming loose when loading	Check hitch, verify it is locked with pin and safety chain is attached
5. Loading	Weather can make lift slide on ramps and trailer	Load in dry, level area - use 4-wheel drive, low gear: watch and be aware
6. Ramps	Not even, pins loose: raise and lower properly	Check ramps before lowering and when raising lift properly
7. Tying down	Mast too high, not enough chains, in gear with brake on and wheels chalked	Check mast height: use 4 chains tying down, chalk wheels, check load after driving a few miles
8. Unloading - same steps in reverse, check lift, verify it is in good condition		
9. Check forklift	Brakes out of adjustment popping out of gearing, shutting off emergency brake	Check out before loading and driving off lift, oil levels
10.		
11.		

Comments:
If off unloading with forks, fwd insure forks are high enough for fork clearance
Complete forklift inspection
Do not load/unload equipment with engine running

OPERATOR SAFETY COMMITTEE:		
Operator 1:	**Operator 2:**	**Operator 3:**
Management 1:	Safety Director:	Guest: